4.0 Chapter 4: Environmental Consequences

Chapter 4: Environmental Consequences and Chapter 3: Affected Environment forms the **scientific and analytic** basis for the summary comparisons presented in Chapter 2. Chapter 4 presents the predicted effects of Alternatives 1, 2, 3, 4 and 5, focuses on the objectives of the project, and the issues listed in Section 1.3 and 1.4.3. Specialist Reports, which provide a detailed discussion of the analysis for each resource, were prepared and filed in the Cayuga Project file. These reports are available upon request. Any direct, indirect, and cumulative effects for each issue and resource were summarized from the Specialist Reports and disclosed in Sections 4.2.

4.1 Predicted Attainment of Project Objectives of All Alternatives

4.1.1 Objective #1-Maintain Aspen Component and Age Class Distribution

Alternative 1: No Action

Under Alternative 1, Objective #1 would be met relative to maintaining the aspen component within the range of the Forest Plan Desired Future Condition (DFC). However, it would not meet Objective #1 in terms of maintaining the 1-20 year aspen age class at the 30% level within Goal Area (GA) 1. Following implementation, the percentage of aspen on the landscape within GA 1, would remain at the existing condition level of approximately 38% (see Table 4.1.1a). The aspen component in the 1-20 year age class would decrease by 50% (see Table 4.1.1b).

Alternative 2

Under this alternative, Objective # 1 would be met relative to maintaining the aspen component within the range of the Forest Plan DFC. However, it would not meet Objective #1 in terms of maintaining the 1-20 year aspen age class at the 30% level within Goal Area 1. Following implementation, the percentage of the aspen component on the landscape within Goal Area 1 would be at a level of 37%. If Alternative 2 were implemented, the amount of aspen in the 1 to 20 year age class would decrease by 5% (see Tables 4.1.1a and 4.1.1b).

Alternative 3

If Alternative 3 were implemented, the percentage of the aspen component remaining on the landscape in Goal Area 1 would be the same as Alternative #2 and the 1-20 age class distribution would be maintained at the Existing Condition level of 29% (see Tables 4.1.1a and 4.1.1b).

Alternative 4

If Alternative 4 were implemented, the percentage of the aspen component remaining on the landscape in Goal Area 1 would be the same as described under Alternative 2 and 3. However, the percentage of aspen in the 1-20 year age class would decrease by 9% from the Existing Condition level (see Tables 4.1.1a and 4.1.1b).

Alternative 5

If Alternative 5 were implemented, the percentage of the aspen component remaining on the landscape in Goal Area 1 would be the same as described under Alternative 2, 3 and 4. However, the percentage of aspen in the 1-20 year age class would decrease by 2% from the Existing Condition level (see Tables 4.1.1a and 4.1.1b).

Table 4.1.1a: Effects of Alternative implementation on the aspen component within the Project Area

Goal Area	Forest Desired Future Condition Percent	Forest-wide Existing Condition Percent	Project Area Existing Condition Percent	Alternative 1 Aspen Remaining		Alternative 2 Aspen Remaining		Alternative 3 Aspen Remaining		Alternative 4 Aspen Remaining		Alternative 5 Aspen Remaining	
				Total percent	Total Acres	Total percent	Total Acres	Total percent	Total Acres	Total Percent	Total Acres	Total Percent	Total Acres
1	35-65%	38%	38%	38 %	6,314 Acres	37%	6,080 Acres	37%	6,119 Acres	37%	6,179 Acres	37%	6,108 Acres
2	10-20%	21%	21%	20 %	2,732 Acres	17%	2,320 Acres	18%	2,490 Acres	17%	2,327 Acres	18%	2,359 Acres

Table 4.1.1b: Comparison of aspen in the 1-20 year age class within the Project Area

Goal Area	Forest Desired Future Condition Percent	Project Area Existing Condition Percent	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
			Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Acres
1	30 %	29 %	15 %	926 Acres	24 %	1,438 Acres	29 %	1,802 Acres	20 %	1,245 Acres	27%	1652 Acres
2	N/A	31%	18 %	501 Acres	31 %	726 Acres	40 %	1,006 Acres	25 %	580 Acres	33%	785 Acres

4.1.2 Objective #2- Maintain Three Or More Age Classes of Hardwood Forests Through Uneven-aged Management In Goal Area 2

Alternative 1: No Action

If Alternative 1 were selected the age class distribution of hardwoods in GA 2 would remain the same. The amount of hardwood stands that are uneven-aged within GA 2 is 18% (see Table 4.1.2a and Figure 4.1.2a). Leaving these hardwood stands in their current state would not move them toward the desired future condition (DFC) prescribed in the Forest Plan.

Alternative 2

If Alternative 2 were implemented, the age class distribution of hardwoods in GA 2 would be moved toward the desired future condition prescribed in the Forest Plan. As a result of uneven-aged and even-aged hardwood treatments, the uneven-aged hardwood component would be 37% (see Table 4.1.2a and Figure 4.1.2a)

Alternative 3

If Alternative 3 were selected, the age class distribution of hardwoods in GA 2 would also move toward the desired future condition prescribed in the Forest Plan. As a result of uneven-aged and even-aged hardwood treatments, the uneven-aged hardwood component would be 49% (see Table 4.1.2a and Figure 4.1.2a).

Alternative 4

If Alternative 4 were selected the age class distribution of hardwoods in GA 2 would be the same as Alternative 3. As a result of uneven-aged and even-aged hardwood treatments, the uneven-aged hardwood component would be 49% (see Table 4.1.2a and Figure 4.1.2a).

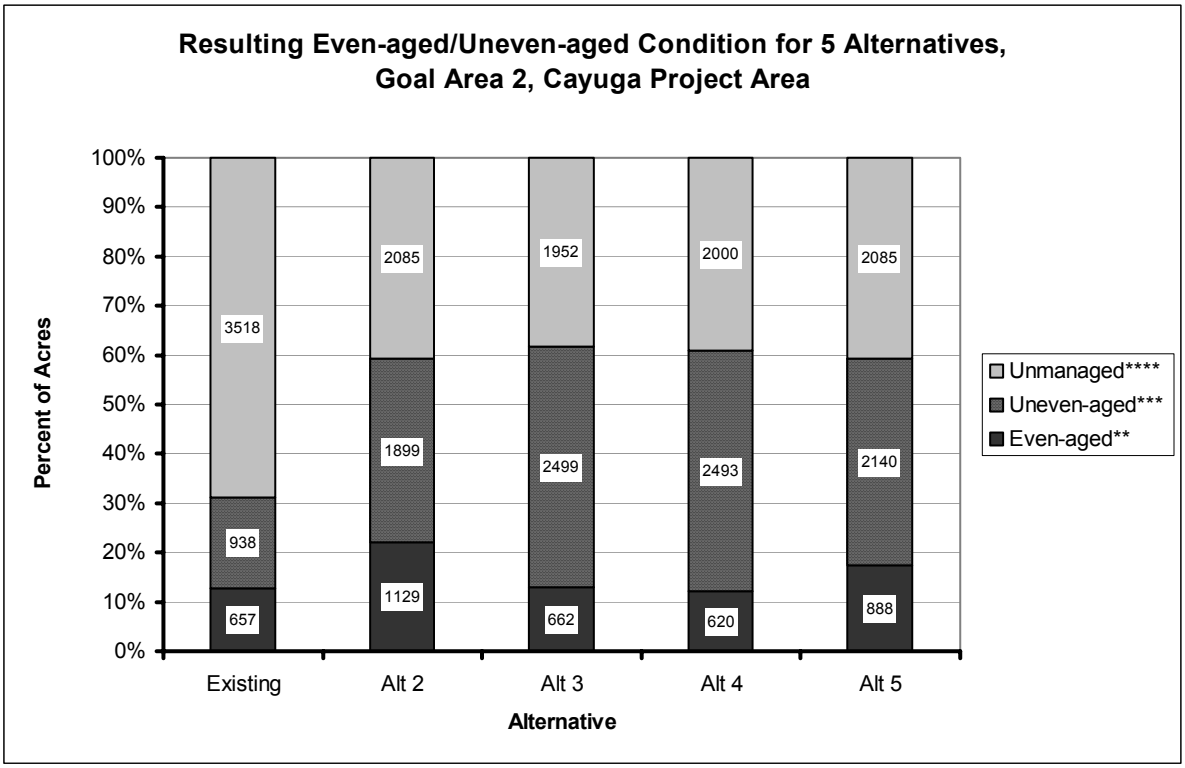
Alternative 5

If Alternative 5 were selected the age class distribution of hardwoods in GA 2 would be higher than Alternative 2, but less than Alternatives 3 and 4. As a result of uneven-aged and even-aged hardwood treatments, the uneven-aged hardwood component would be 42% (see Table 4.1.2a and Figure 4.1.2a).

Table 4.1.2a: Comparison Of Uneven-Aged Hardwoods In Goal Area 2

Forest-Desired Future Condition Percent Uneven Aged	Project Area Existing Condition Percent	Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
		Percent Uneven-aged condition	Acres of Uneven-aged condition	Percent Uneven-aged condition	Acres of Uneven-aged condition	Percent Uneven-aged condition	Acres of Uneven-aged condition	Percent Uneven-aged condition	Acres of Uneven-aged condition	Percent Uneven-aged condition	Acres of Uneven-aged condition
30-65 %	18 %	18 %	938 Acres	37 %	1,899 Acres	49 %	2,499 Acres	49 %	2,493 Acres	42 %	2140 Acres

Figure 4.1.2a: Even-aged and uneven-aged conditions for all alternatives



Note: 1/ ** Resulting even-aged acres = even-aged prescriptions + "no cut"" prescriptions which have even-aged history; *** Resulting uneven-aged acres = uneven-aged prescriptions + "no cut" prescriptions which have uneven-aged history; **** Resulting unmanaged acres = "no cut" prescriptions with no record of cut since acquisition by USFS.

4.1.3 Objective #3-Management of Large Blocks of Hardwoods

Alternative 1: No Action

If Alternative 1 were implemented, stands identified for management as large blocks of hardwoods would not be treated to encourage interior forest conditions. Existing areas of interior forest would remain in their current condition. In addition, existing young-age stands of aspen within hardwood blocks would gradually mature, resulting in a long-term increase in the amount of interior hardwood habitat.

Alternative 2

If Alternative 2 were implemented, approximately 93 acres of aspen would be converted to hardwood within larger areas of existing hardwood types. This would promote continuous blocks of interior forest conditions (see Table 4.1.3a). This would result in 5,209 acres of interior hardwood conditions.

This amount represents a temporary reduction from the existing condition, since some clearcutting would still occur adjacent to, or within, areas of smaller interior hardwood blocks. However, existing large blocks of northern hardwood would be preserved and enhanced. In addition, existing young-age stands of aspen within

hardwood blocks would gradually mature, resulting in a long-term increase in the amount of interior hardwood habitat.

Alternative 3

If Alternative 3 were implemented, approximately 44 acres of aspen would be converted to hardwood within larger areas of existing hardwood types (see Table 4.1.3a). Other activities to promote hardwood conditions would also occur. This would result in 4,933 acres of interior hardwood conditions.

Alternative 4

If Alternative 4 were selected approximately 81 acres of aspen would be converted to hardwood within larger areas of existing hardwood types. This would promote continuous blocks of interior forest conditions (see Table 4.1.3a). This would result in approximately 5,259 acres of interior forest conditions. This amount represents a temporary reduction from the existing condition, since some clearcutting would still occur adjacent to or within areas of smaller interior hardwood blocks. However, existing large blocks of northern hardwood would be preserved and enhanced. In addition, existing young-age stands of aspen within hardwood blocks would gradually mature, resulting in a long-term increase in the amount of interior hardwood habitat.

Alternative 5

If Alternative 5 were implemented, approximately 93 acres of aspen would be converted to hardwood within larger areas of existing hardwood type. This would result in interior forest conditions similar to that described for Alternative 2.

Table 4.1.3a: Comparison of predicted effects on landscape pattern

Acres	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt 5
Acres interior habitat (hardwood type)	5,301 acres	5,209 acres	4,933 acres	5,259 acres	5,142
Average interior patch size-acres	29 acres	28.8 acres	27.7 acres	28.7 acres	28.1
Acres of aspen converted through partial cuts	0 acres	93 acres	44 acres	81 acres	93 acres

4.1.4 Objective #4- Convert Stands To Promote The Development Of Long-lived Species Where Visual Quality Objectives Are Important

Alternative 1: No Action

If Alternative 1 were implemented, the visual quality objectives along County Highway GG (north) and the shorelines of Day Lake and Spillerberg Lake would continue to be met through natural succession.

Alternative 2

If Alternative 2 were implemented, approximately 326 acres of mature aspen would be treated to meet the long-term visual quality objectives along County Highway GG (north), Day Lake and East Twin Lake. Treatment of the mature aspen would enhance visual quality by converting towards longer-lived species. Under planting of approximately 53 acres of white pine would be implemented to improve visual quality along the shorelines of Day Lake and Spillerberg Lake. Within Day Lake Campground visual quality would decline for about a one-year period immediately following harvest, but would return to acceptable levels after that.

Alternative 3

If Alternative 3 were implemented, approximately 279 acres of mature aspen would be treated to meet the long-term visual quality objectives along County Highway GG (north), Day, Spillerberg and East Twin Lake. Treatment of the mature aspen would enhance visual quality by converting towards longer-lived species. In addition, about 29 acres of white pine would be underplanted in two shore land stands adjacent to Day Lake. The effects on visual quality within Day Lake Campground would be similar to alternative 2.

Alternative 4

If Alternative 4 were implemented, approximately 265 acres of mature aspen would be treated to meet the visual quality objectives along County Highway GG (north), Day Lake, and East Twin Lake. Treatment of the mature aspen would enhance visual quality by converting towards longer-lived species. In addition, about 39 acres of white pine would be underplanted on three shoreline stands at Day Lake. The effects on visual quality within Day Lake Campground would be similar to alternative 2.

Alternative 5

If Alternative 5 were implemented, approximately 287 acres of mature aspen would be treated to meet the visual quality objectives along County Highway GG (north), Day Lake, and East Twin Lake. Treatment of the mature aspen would enhance visual quality by converting towards longer-lived species. White pine underplanting and effects on Day Lake Campground would be the same as in Alternative 2.

4.1.5 Objective #5- Restore and Maintain Permanent Openings

Alternative 1: No Action

If Alternative 1 were implemented, there would be no construction or maintenance of upland openings within the Cayuga Project area. The amount of upland openings within the project area would gradually be reduced through natural succession.

Alternative 2

If Alternative 2 were implemented, approximately 85 acres of existing upland openings would be maintained for long-term grass/forb/shrub cover type. Maintenance of these openings would not increase the amount of upland openings. Maintenance of these openings, along with gradual conversion of remaining openings, would eventually result in an upland opening acreage of about 0.3% of project area. No new openings would be constructed (see Table 4.1.5a).

Alternative 3

If Alternative 3 were implemented, approximately 126 acres of existing upland openings would be maintained for long-term grass/forb/shrub cover type. Approximately 16 acres of new openings would be constructed. This construction, along with maintenance of some openings, and gradual conversion of remaining openings, would eventually result in an upland opening acreage of about 0.4% of project area. Maintenance and construction of upland openings would not increase the amount of upland openings (see Table 4.1.5a).

Alternative 4

If Alternative 4 were implemented, approximately 27 acres of existing upland openings would be maintained for long-term grass/forb/shrub cover type. Maintenance of these openings would not increase the amount openings. Maintenance of these openings, along with gradual conversion of remaining openings, would eventually result in an upland opening acreage of about 0.1% of project area. No new openings would be constructed (see Table 4.1.5a).

Alternative 5

If Alternative 5 were implemented, opening maintenance and eventual upland opening percentage would be the same as in Alternative 2.

Table 4.1.5a: Acres of upland openings per alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt 5
Acres of maintenance (Managed openings as percentage of project area)	0 acres (0%)	85 acres (0.3%)	126 acres (0.4%)	27 acres (0.1%)	85 acres (0.3%)
Acres of new construction	0	0	16 acres	0	0

4.1.6 Objective #6: Restore The Vegetative Composition Of Transition Areas From Aspen Back To Long-Lived Conifer Types Through A Shelterwood Seed tree Harvest Method and Under planting

Alternative 1: No Action and Alternative 3

If Alternative 1or 3 were selected the proposed under planting and harvest methods to convert aspen in transition areas toward long-lived hardwoods and conifers would not be implemented.

Alternative 2

If Alternative 2 were implemented, approximately 38 acres of aspen in transition areas would be harvested through shelterwood seedtree methods to move stands towards upland hardwoods (see Table 4.1.6a). Under planting of conifers in concert with the harvest treatment would also be implemented. The combination of the under planting and treatment of aspen would result in a mixed stand of hardwoods and conifers.

Alternative 4

If Alternative 4 were implemented, approximately 58 acres of aspen in transition areas would be harvested through shelterwood seedtree methods to move stands towards upland hardwoods (see Table 4.1.6a). Under planting of conifers in concert with the harvest treatment would also be implemented. The combination of the under planting and treatment of aspen would result in a mixed stand of hardwoods and conifers.

Alternative 5

If Alternative 5 were implemented, approximately 26 acres of aspen in transition areas would be harvested through shelterwood seedtree methods to move stands towards upland hardwoods (see Table 4.1.6a). Under planting of conifers in concert with the harvest treatment would also be implemented. The combination of the under planting and treatment of aspen would result in a mixed stand of hardwoods and conifers.

Table 4.1.6a: Acres of aspen conversion per alternative

	Alt. 1	Alt. 2	Alt. 3	Alt.4	Alt 5
Acres of aspen conversion	0	38	0	58	26

4.1.7 Objective #7- Provide Safe Quality Recreation Experiences And Facilities

Alternative 1: No Action

If Alternative 1 were selected, no management of the mature red pine and jack pine would occur within Day Lake Campground, and the safety objectives would not be met.

Alternatives 2, 3, and 5

If Alternative 2, 3, or 5 were selected, 25 acres of jack pine would be thinned in the Day Lake Campground to address safety issues. An additional 88 acres of red pine would be thinned to enhance recreational experiences.

Alternative 4

If Alternative 4 were selected, 25 acres of jack pine would be thinned in Day Lake Campground to address safety issues.

4.1.8 Objective #8- Modify Forest Management Practices In Adjacent Timber Types To Reduce Negative Impacts On The Conifer Swamp And Bog Within The McCarthy Lake and Cedars Research Natural Area

Alternative 1: No Action

If Alternative 1 were selected, no aspen adjacent to the McCarthy Lake and Cedars Research Natural Area (RNA) would be converted. In addition, the proposed under planting of approximately 25 acres of hemlock adjacent to FR 183 and the RNA would not be accomplished.

Alternative 2

If Alternative 2 were selected, approximately 48 acres of aspen adjacent to the McCarthy Lake and Cedars RNA would be converted toward long-lived species through shelterwood seedtree harvest methods. Approximately 25 acres of hemlock would be underplanted adjacent to FR 183 and the RNA.

Alternative 3

If Alternative 3 were selected, approximately 57 acres of aspen adjacent to the McCarthy Lake and Cedars RNA would be converted toward long-lived species through shelterwood seedtree harvest methods. Approximately 25 acres of hemlock would be underplanted adjacent to FR 183 and the RNA.

Alternatives 4 and 5

If Alternatives 4 or 5 were selected, no aspen adjacent to the McCarthy Lake and Cedars RNA would be converted by harvest methods. Approximately 25 acres of hemlock would be underplanted adjacent to FR 183 and the RNA.

4.1.9 Objective #9- Close Motorized Access To Research Natural Areas (RNA) That Do Not Contribute To Objectives Or Protection Of The Area

Alternative 1: No Action

If Alternative 1 were implemented, the spur road off of FR 1333, which accesses the McCarthy Lake and Cedars RNA, would not be closed to public motorized access.

Alternatives 2, 3, 4, and 5

If Alternatives 2, 3, 4, or 5 were selected the spur road off FR 1333 would be closed to public motorized vehicle use.

4.1.10 Objective #10- Control Leafy Spurge

Alternatives 1: No Action and Alternative 3

If Alternatives 1 or 3 were selected, the proposed action to release a biological control agent on three leafy spurge sites that cumulatively total less than 1 acre in size would not be implemented.

Alternatives 2, 4, and 5

If Alternative 2, 4, or 5 were selected, a biological control agent would be released on three leafy spurge sites that cumulatively total less than 1 acre.

4.1.11 Objective #11- Restore Streams To Conditions Prior To Beaver Activities

Alternative 1: No Action

If Alternative 1 were selected stream restoration activities would not occur on McCarthy Creek, Brush Creek, or other streams within the project area.

Alternatives 2, 3, 4, and 5

If Alternatives 2, 3, 4, or 5 were selected, brush piles would be placed along 1,000 feet of McCarthy Creek to help flush away sediment, stabilize sediment into newly created streambanks, and help narrow and deepen the stream channel. In addition, fine debris and tag alder would be selectively removed along 1.5 miles of McCarthy Creek to assist in the restoration of the health of this stream.

4.1.12 Objective #12- Protect, Restore, And Improve The Quality of Watersheds

Alternative 1: No Action

If Alternative 1 were selected, the proposed replacement of existing culverts to improve water quality and fish passage would not be implemented.

Alternative 2

If Alternative 2 were selected, existing culverts at 7 sites would be replaced to improve water quality and fish passage. This would include the replacement of twin culverts located within an unnamed tributary of the Bad River and FR 355.

Alternatives 3, 4, and 5

If Alternative 3, 4, or 5 were selected, existing culverts at 6 sites would be replaced to improve water quality and fish passage. In addition, twin corrugated metal culverts would be removed from an unnamed tributary to the Bad River to restore it to the original floodplain.

4.1.13 Objective #13- Manage For Long-Lived Species Adjacent To Trout Streams To Reduce The Loss Of Cold Water Habitat

Alternative 1: No Action

If Alternative 1 were selected, the aspen conversion to long-lived hardwoods proposed within the stream corridor of McCarthy Creek or Brush Creek would not occur.

Alternatives 2 and 5

If Alternatives 2 or 5 were implemented, approximately 35 acres of aspen would be converted through harvest towards long-lived hardwood species within the stream corridor of McCarthy Creek and Brush Creek.

Alternative 3

If Alternative 3 were implemented, approximately 13 acres of aspen would be converted through harvest towards long-lived species within the stream corridor of McCarthy Creek.

Alternative 4

If Alternative 4 were implemented approximately 22 acres of aspen would be converted through harvest towards long-lived species within the stream corridor of Brush Creek.

4.1.14 Objective #14- Design Trails And Trailheads That Minimize User Conflicts While Protecting Resources

Alternative 1: No Action

If Alternative 1 were selected, Snowmobile Trail 8 would remain on a plowed road (Forest Road 1296). A special use authorization would continue to be issued for the use of an existing sand pit for snowmobile parking.

Alternatives 2, 3, 4, and 5

If Alternative 2, 3, 4, or 5 were selected 0.4 miles of Snowmobile Trail 8 would be re-routed off of FR 1296 onto National Forest lands. A 1-acre parking area for snowmobile and ATV users would be constructed off FR 1296 for easy trail access. This would eliminate mixed vehicle traffic on FR 1296.

4.1.15 Objective #15- Identify Roads For Decommissioning That Are No Longer Needed On Landscape For Resource Management Within Goal Areas 1 and 2

Alternative 1: No Action

If Alternative 1 were selected, the total road densities would not change. The current Forest Plan direction for system roads only is 3.6 miles/square mile. The existing road densities for system roads in Goal Area (GA) 1 is 2.2 miles/square mile and 1.8 miles/square mile in GA 2. The road density for system and non-system roads within the project area would remain at 2.8 miles/square mile.

Alternative 2

If Alternative 2 were implemented, approximately 6.5 miles of system and non-system roads would be decommissioned.

Alternative 3

If Alternative 3 were implemented, approximately 5.7 miles of system and non-system roads would be decommissioned.

Alternative 4

If Alternative 4 were implemented, approximately 11.4 miles of system and non-system roads would be decommissioned.

Alternative 5

If Alternative 5 were implemented, approximately 11.4 miles of system and non-system roads would be decommissioned.

4.1.16 Objective #16- Construct Temporary Roads And Maintain Existing Roads To Provide Access For Resource Management Activities

Alternative 1: No Action

The Alternative 1 were selected no construction or maintenance of temporary roads to provide access to conduct management activities would not occur.

Alternative 2

If Alternative 2 were implemented, approximately 12.2 miles of temporary roads would be constructed to conduct timber management activities. Approximately 22.80 miles of road maintenance work on existing roads would occur.

Alternative 3

If Alternative 3 were implemented, approximately 16.3 miles of temporary roads would be constructed to conduct timber management activities. Approximately 23.3 miles of road maintenance work on existing roads would occur.

Alternative 4

If Alternative 4 were implemented, approximately 10.5 miles of temporary roads would be constructed to conduct timber management activities. Approximately 19.70 miles of road maintenance work on existing roads would occur.

Alternative 5

If Alternative 5 were implemented, approximately 14.0 miles of temporary roads would be constructed to conduct timber management activities. Approximately 23.1 miles of road maintenance work on existing roads would occur.

4.2 Predicted Effects on Relevant Affected Resources of All Alternatives

4.2.1 Predicted Effects of Early Successional Management (Issue 1)

Alternative 1: No Action

Thirty-eight percent (38%) of Goal Area 1 within the project area is dominated by the aspen component (all age classes). Twenty-one percent (21%) of Goal Area 2 within the project area, is dominated by aspen (see Table 4.1.1a in Section 4.1.1). The Forest Plan Desired Future Condition for the amount of aspen on the landscape ranges from 35%-65% in Goal Area 1 and 10%-20% in Goal Area 2. The percent of aspen, as a component on the landscape, would not change appreciably over the life of this project under the No Action alternative.

If Alternative 1 were selected, the proposed timber harvests designed to maintain aspen in the 1-20 year age class would not be implemented. The Forest Plan desired future condition (DFC) prescribes maintaining 30% of the aspen component within Goal Area 1 in the 1-20 year age class, (Forest Plan, pp. IV-114). There is no Forest Plan standard for aspen in the 1-20 year age class in Goal Area 2. Without harvest treatments, the amount of aspen in the 1-20 year age class would decline from the existing level of 29% in Goal Area 1 and 31% in Goal Area 2, to 15% and 18% respectively, over a 5-year period. As stands age naturally, the amount of aspen in the 1-20 year age class would move away from the DFC prescribed for Goal Area 1. An indirect effect of Alternative 1 would be a decrease of aspen in the 1-20 year age class by approximately 50% from the existing condition in Goal Area 1 (see Table 4.1.1b in Section 4.1.1.)

There would also be an indirect effect on the older stands of aspen under Alternative 1. Approximately 46% of the aspen stands within the entire project area are greater than 50 years of age with an average site index of 65 (see Figure 3.3.1a, Section 3.3.1). This is beyond the recommended rotation age (Forest Plan, pp. IV –42, Perala, 1977). The amount of aspen greater than 50-years of age in Goal Area 1 is approximately 2,819 acres. The amount of aspen greater than 50 years of age is due to a number of factors including limited access to some stands, forty-acre regeneration cut limitations and other resource concerns that limited their availability for timber harvest and regeneration.

An indirect effect of not treating mature aspen through harvesting during the life of this analysis would be that the older aspen stands would become more decadent. Those stands older than 50 years of age would have stable mortality rates for the next five years, at which point decay pathogens would start to become a concern. After age 50, these aspen stands would begin to deteriorate. Once these stands reach the range of 60 to 80 years of age, the level of deterioration would increase rapidly. Many of the aspen trees would eventually die and succession to more shade tolerant species would begin (Katovich, McDougall and Chavez, 1998). An indirect effect would be that natural succession would move these stands toward a mixed hardwood type with smaller amounts of shade tolerant conifers.

Stands with a considerable component of other species would gradually convert to the longer lived species as the short lived aspen continues to die out of the stands. Even stands that are now primarily aspen would begin to regenerate other species such as red maple as mortality of aspen begins to occur. Through natural processes, mortality of aspen would likely be spread out over time. The aspen component would be substantially reduced from the plant community, as adjacent vegetation would occupy canopy space.

Table 4.2.1a displays the amount of aspen acreage remaining in the 50-year plus age class (over the five year life of the project) after either no action (Alternative 1), or following regeneration and conversion activities proposed in Alternatives 2, 3, 4, and 5.

Table 4.2.1a: Aspen acres remaining in the 50 year plus age class*

Goal Areas	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
1	3,248	2,693	2,384	2,920	2534
2	1,347	710	600	863	690

*Note: Acres remaining in the 50-year plus age class over the five year life of the project.

The Iron River IPWA totals approximately 8,503 acres or 26 % of the total Cayuga Project Area where no activities are proposed pending completion of the Forest Plan Revision. As stated in Section 1.4.4.6, none of the alternatives propose management activities within the Iron River IPWA. The cumulative effects of not managing the mature aspen in this area will be disclosed under the cumulative effects for this issue (see Section 4.2.1.5).

Since none of the project-related clearcut harvests or other early-successional management would be implemented under Alternative 1, there would not be any direct effects, such as disturbance or displacement, on the wildlife or fish resource. The dying and deteriorating aspen trees would contribute to structural diversity as snags, cavity trees, and dead and down logs. This would provide an increase of habitat features for cavity nesters, such as the pileated woodpecker, barred owl, black-capped chickadee, and flying squirrel. Small burrowing mammals and amphibians would benefit from increased downed woody material. There could be development of canopy gaps as large aspen fell over, creating increased understory development preferred by some Neotropical Migratory Birds (NTMB), including shrub nesters and foliage gleaners.

There are several Management Indicator Species (MIS) that could benefit in the short term through the selection of Alternative 1. The pileated woodpecker, a cavity excavator that requires large trees and snags for nest and roost sites, could benefit from an increase in dead and dying aspen. Although this species seems to prefer mature hardwood and conifer forests, it can also be seen in mature mixed aspen woods. Pileated woodpeckers usually excavate new nest cavities every year. Therefore, preferred habitat consists of forest stands with more than occasional snag trees. Dead and dying trees also provide good foraging sites for these insect eaters.

Another MIS species that would benefit in the short term is the brown creeper. This bird is a bark gleaner that

forages for insects on large hardwood and conifer trees, and nests in holes and in cavities under loose bark. Large dead or dying trees provide suitable sites for both foraging and nesting. The brown creeper would most likely be found in mixed forest stands, rather than pure aspen.

The barred owl, another MIS species, utilizes large unbroken hardwood forests, including aspen. It nests in large abandoned tree cavities or stick nests. Like the pileated woodpecker, this bird benefits from large diameter dead and dying trees.

The long-term indirect effects on wildlife and fisheries habitat under this alternative will not be discussed here, since the selection of this alternative would not govern actions into the future (greater than ten years from now). Within the short term, there would not be noticeable effects on the amount of browse available for deer and elk. There would also not be noticeable effects on deer populations, although other non-project related factors could easily cause yearly population fluctuations.

The effects of aspen management on the Forest landscape will be discussed in Section 4.2.3, Vegetation Composition.

Alternative 2

Thirty-eight percent (38%) of Goal Area 1 within the project area is dominated by the aspen component (all age classes). Twenty-one percent (21%) of Goal Area 2 within the project area, is dominated by aspen (see Table 4.1.1a). The Forest Plan DFC for the amount of aspen on the landscape ranges from 35%-65% in Goal Area 1 and 10%-20% in Goal Area 2. Following implementation of Alternative 2, 37% of Goal Area 1, and 17% of Goal Area 2 would be dominated by aspen.

Approximately 646 acres of aspen would be converted (see Table 4.2.1b) to long-lived species to address a variety of resource concerns such as long term visual quality objectives and management for long-lived species adjacent to trout streams. Approximately 234 acres of aspen would be converted in Goal Area 1 and 412 acres would be converted in Goal Area 2 (see Table 4.2.1b). These conversions would be implemented to meet a variety of resource objectives (see Section 1.3, Objectives #2, #3, #4, #7, #8, and #13.). Those conversions would be facilitated through various methods, which include:

- shelterwood, commercial thinning and improvement harvest techniques
- natural conversion to hardwoods or conifer
- shelterwood harvesting with under planting to conifers
- under planting of conifers with no harvesting

A direct effect of converting stands from aspen to other types would be a reduction of the aspen component with a corresponding increase in the acreage in other forest types, such as hardwoods and conifers. Following implementation, the amount of aspen on the landscape would be within the Forest Plan DFC in both Goal Areas.

Twenty-nine percent (29%) of the aspen in Goal Area 1 is currently in the 1-20 year age class. Thirty-one percent (31%) of the aspen in Goal Area 2 is currently in the 1-20 year age class. The Forest Plan desired future condition (DFC) prescribes maintaining 30% of the aspen component within Goal Area 1 in the 1-20 year age class across the Forest, (Forest Plan, pp. IV-114). There is no Forest Plan standard for aspen in the 1-20 year age class in Goal Area 2

If Alternative 2 were implemented, 737 acres of aspen would be harvested through regeneration cuts to maintain aspen in the 1-20 year age class in Goal Areas 1 and 2. The age of the aspen component, following implementation, is displayed on figure 3.3.1a and Table 4.1.1b to reflect the aging of all aspen at the end of a 5 year period. For instance, aspen stands currently in a 15-20 year age class will be in the 20-25 year age class at the end of a 5-year period. As a result of the implementation of Alternative 2 the percentage of aspen in the 1-20 year age class in the project area would decline by 5% from the existing condition in Goal Area 1. The percentage of aspen in the 1-20 year age class over a 5-year period would be 24% in GA 1 and 31% in GA 2.

Approximately 31% of the aspen in Goal Area 1 across the entire Chequamegon side of the Forest is currently within the 1-20 year age class. Forest-wide, some of these stands will also move into an older age class by the end of a 5-year period. In addition, future proposals across the Forest will likely identify opportunities to manage aspen to contribute to compositional goals, but those projects have not been identified at this point in time.

Table 4.2.1b: Comparison of regeneration and conversion acres by alternative

Acres	Alternative 2			Alternative 3			Alternative 4			Alternative 5		
	Goal Area 1	Goal Area 2	Total Acres	Goal Area 1	Goal Area 2	Total Acres	Goal Area 1	Goal Area 2	Total Acres	Goal Area 1	Goal Area 2	Total Acres
Regeneration Acres	512	225	737	876	505	1,381	319	79	389	726	284	1010
Conversion acres	234	412	646	195	242	437	135	405	540	146	373	519

Clearcut harvest treatments designed to regenerate aspen would be conducted in specific aspen stands under Alternative 2. The indirect effects of clear-cutting aspen would be strong and vigorous regeneration of aspen through suckering. Some nutrient loss would occur from the removal of the tree bole, however the majority of the nutrient rich biomass consisting of the root system, branches, and leaves would be left on site.

The amount of aspen remaining in the 50-year old and greater age class would be approximately 2,693 acres in

Goal Area 1, and approximately 710 acres in Goal Area 2 (Table 4.2.1a). As described previously, some of these stands are inaccessible due to wetlands, access across private lands or due to their adjacency to other harvest units. Approximately 1,598 acres of aspen 50 years of age or older in Goal Area 1 are located within the Forest Plan Revision Inventoried Potential Wilderness Area. The effects of not harvesting older stands of aspen are the same as those described under Alternative 1 (Chapter 4.2.1.1).

If Alternative 2 were implemented, the direct effects of the proposed aspen management activities could cause actual disruption of some wildlife populations, or of activities such as nesting. These effects would vary depending on the season that the clearcutting occurred at any site. Since there is substantial disturbance involved with early successional harvest activities, such as clearcutting, (mechanized vehicle use, felling and moving of trees) there is always the potential for mortality of individual animals by these activities. This would be a possibility mainly with small, relatively immobile animals such as amphibians, nestling birds, or mammalian young. Most animals, including adults of most species, would simply vacate an area during such disturbance. In addition to direct mortality, disturbance during the nesting or birthing season could cause indirect mortality if nests or young were abandoned due to the disturbance. As mentioned, these effects would vary by season. Harvesting that occurred during winter would not have substantial direct effects as defined here. With the application of mitigation measures (see Appendix C) to address wildlife and fisheries concerns, the effects would be minimized.

The change in stand structure resulting from early successional management can be an important benefit for many wildlife species. The dense cover provided by regenerating stands provides important habitat for game species such as ruffed grouse, woodcock, and snowshoe hare. There are also a number of non-game species that inhabit young, brushy forests. These types of forest can result in a high species diversity of songbirds, including species of management concern such as golden-winged warbler, Eastern towhee, and brown thrasher.

Another important effect of early successional management is the increase in woody and herbaceous forage. The rapid regeneration of aspen, shrubs, and other hardwood species results in a large volume of woody browse. The increased sunlight also results in a flush of herbaceous growth, compared to what is available in a mature, closed canopy stand. Species that benefit from these changes include deer, elk, and beaver.

Overall project area deer populations could be influenced by the amount of available forage, although there are a number of other factors that could cancel or add to the effects of food availability. Deer populations are a controversial topic in forest management, affecting (or suspected of affecting) a number of other animal and plant species. They have been termed a keystone species, influencing abundance and distribution of other vertebrate species by directly competing for limited resources, and by altering features that determine distribution of other species (McShea et al., 1992 - p. 177). The bird species community is strongly tied to understory structure and density, therefore high deer densities may affect the diversity and abundance of bird species. In one study, McShea et al. (1992 - p. 181) was able to find a positive correlation between understory

density and number of bird species and individuals. In the same study, they found that small mammal populations are correlated with the mast crop from the previous autumn. High deer populations can alter both of these habitat features. High deer densities have also been a concern due to overbrowsing on species such as northern white cedar, Canada yew, and eastern hemlock, to the point where these species might not successfully regenerate. Browsing has also been documented on a wide variety of herbaceous plant species, including a number of Regional Forester Sensitive Species.

The increased sunlight can also greatly increase the production of soft mast (berries) such as raspberry, blueberry, and cherry species. Species that benefit from these changes include black bear, small mammals, and many songbirds. The effects of aspen management on the forest landscape will be discussed in Section 4.2.3, Vegetation Composition.

Alternative 3

Thirty-eight percent (38%) of Goal Area 1 within the project area is dominated by the aspen component (all age classes). Twenty-one percent (21%) of Goal Area 2 within the project area is dominated by aspen, (see Table 4.1.1a). The Forest Plan DFC for the amount of aspen on the landscape ranges from 35%-65% in Goal Area 1 and 10%-20% in Goal Area 2. Following implementation of Alternative 3, 37% of Goal Area 1, and 18% of Goal Area 2 would be dominated by aspen.

With implementation of Alternative 3, approximately 195 acres of aspen would be converted in Goal Area 1 and 242 acres would be converted in Goal Area 2. (see Table 4.2.1b). These conversions would be implemented to meet a variety of resource objectives (see Section 1.3, Objectives #2, #3, #4, #7, #8, and #13.). Those conversions would be facilitated through various methods, which include:

- shelterwood, commercial thinning and improvement harvest techniques
- natural conversion to hardwoods or conifer
- shelterwood harvesting with under planting to conifers
- under planting of conifers with no harvesting

A direct effect of converting stands from aspen to other types would be a reduction of the aspen component with a corresponding increase in the acreage in other forest types, such as hardwoods and conifers. Following implementation, the amount of aspen on the landscape would be within the Forest Plan DFC in both Goal Areas.

If Alternative 3 were implemented, approximately 1,381 acres of aspen would be regenerated through timber harvest, an increase of 47% over the level of aspen harvest proposed in Alternative 2. This increase is due to higher levels of aspen harvest and lower levels of aspen conversion to long-lived species.

The Forest Plan desired future condition (DFC) prescribes maintaining 30% of the aspen component within Goal Area 1 in the 1-20 year age class, (Forest Plan, pp. IV-114). There is no Forest Plan standard for aspen in the 1-

20 year age class in Goal Area 2. If Alternative 3 were implemented, the percentage of aspen in the 1-20 year age class within Goal Area 1 over a 5-year period, would remain the same as the current, existing condition level (29%). The percentage of aspen in the 1-20 year age class in Goal Area 2 would increase from 31% to 40% (see Table 4.1.1b, Section 4.1.1).

Clearcut harvests to regenerate aspen would predominantly be conducted in aspen stands under Alternative 3. The indirect effects of clear cutting aspen would be strong and vigorous regeneration of aspen through suckering. Some nutrient loss would occur from the removal of the tree bole, however the majority of the nutrient rich biomass consisting of the root system, branches, and leaves would be left on site. The direct effects of clearcutting jack pine would be the removal of overmature, decadent trees and disturbance of the site for eventual hand planting of red pine. Some jack pine would also regenerate naturally, however, mechanical site-preparation would create a improved seedbed for the red pine seedlings. Subsequent follow-up Timber Stand Improvement (TSI) would help eliminate competition and to aid in establishment the longer-lived red pine.

The amount of aspen remaining in the 50-year old plus age class would be approximately 2,384 acres in Goal Area 1 and 600 acres in Goal Area 2 (see Table 4.2.1a). The discussion of accessibility to those stands is described in Alternative 2 and applies here as well. The indirect effects of not harvesting or converting these stands would be the same as those described under Alternatives 1 and 2.

If Alternative 3 were implemented, the result would be greater direct effects on individual animals and populations due to increased disturbance and habitat changes as compared to Alternative 2. Effects described under Alternative 2 from structural changes would be substantially increased, to the benefit of some species and to the detriment of others. One difference would be increased habitat created for species such as golden-winged warbler, ruffed grouse, and woodcock, but there would be decreased habitat for species such as pine marten, pileated woodpecker, and brown creeper. There would be larger areas of increased forage, benefiting species such as elk, deer, and beaver. There would be an increased potential compared to Alternative 2 for indirect effects from browsing by deer and elk, and by beaver activity (trout streams would be protected however by buffer areas where no clearcutting would occur).

If Alternative 3 were selected, a number of stands would be proposed for harvest in isolated wetland areas (nine stands, or approximately 191 acres). Access to these stands would involve temporary, frozen winter roads rather than permanent road construction, however this type of access still requires some clearing of corridors in wetland areas, much of it in the lowland conifer type.

This would represent some habitat loss and disturbance beyond the upland areas affected by harvest. The actual acreage directly affected would be minimal; however there could be additional indirect effects on habitat in these situations. The availability of browse adjacent to winter cover (lowland conifer) would represent a beneficial situation for deer. If deer were drawn to the sites, there could be additional browsing pressure on the adjacent stands.

This alternative was developed in part to address concerns over a regional decline in the aspen type, due to the value of this type for some wildlife species. Clearcutting of these stands, in addition to the long-term effect of perpetuating more of the aspen type within the project area, would have the direct effect of producing the early successional shrub/sapling/forb habitat considered crucial to many wildlife species as described earlier in this document.

The effects of aspen management on the forest landscape will be discussed in Section 4.2.3, Vegetation Composition.

Alternative 4

Thirty-eight percent (38%) of Goal Area 1 within the project area is dominated by the aspen component (all age classes). Twenty-one percent (21%) of Goal Area 2 within the project area is dominated by aspen, (see Table 4.1.1a). The Forest Plan DFC for the amount of aspen on the landscape ranges from 35%-65% in Goal Area 1 and 10%-20% in Goal Area 2 Following implementation of Alternative 4, 37% of Goal Area 1, and 17% of Goal Area 2 would be dominated by aspen.

Approximately 135 acres of aspen would be converted in Goal Area 1 and 405 acres would be converted in Goal Area 2 (see Table 4.2.1b). These conversions would be implemented to meet a variety of resource objectives (see Section 1.3, Objectives #2, #3, #4, #7, #8, and #13.). Those conversions would be facilitated through various methods, which include:

- shelterwood, commercial thinning and improvement harvest techniques
- natural conversion to hardwoods or conifer
- shelterwood harvesting with under planting to conifers
- under planting of conifers with no harvesting

A direct effect of converting stands from aspen to other types would be a reduction of the aspen component with a corresponding increase in the acreage in other forest types, such as hardwoods and conifers. Following implementation, the amount of aspen on the landscape would be within the Forest Plan DFC in both Goal Areas.

If Alternative 4 were implemented, approximately 398 acres of aspen would be harvested through regeneration cuts (see Table 4.2.1b). The Forest Plan desired future condition (DFC) prescribes maintaining 30% of the aspen component within Goal Area 1 in the 1-20 year age class, (Forest Plan, pp. IV-114).

There is no Forest Plan standard for aspen in the 1-20 year age class in Goal Area 2. If Alternative 4 were implemented, the percentage of aspen in the 1-20 year age class within Goal Area 1 over a 5-year period would be 20%; a decrease of approximately 9% from the existing condition level. The percentage of aspen in the 1-20 year age class in Goal Area 2 would be 25% (see Table 4.1.1b, Section 4.1.1).

Clearcut harvest treatments would predominantly be conducted in aspen stands under Alternative 4. The indirect

effects of clearcutting aspen would be the strong and vigorous regeneration through suckering of the stand back to aspen. Some nutrient loss would occur from the removal of the tree bole, however the majority of the nutrient rich biomass consisting of the root system, branches, and leaves would be left on site. The indirect effects of clearcutting the jack pine would be to remove overmature decadent trees for hand planting the site to red pine. Some jack pine would be regenerated naturally, however, mechanical site-prep would create a sufficient seedbed for the red pine seedlings and subsequent follow-up Timber Stand Improvement (TSI) would help eliminate competition and help establish the red pine

After treatment, the amount of aspen remaining in the 50-year old plus age class would be approximately 2,920 acres within GA 1 and 863 acres in GA 2 (see Table 4.2.1a). The discussion regarding accessibility to some of these stands described in Alternative 2 applies to this Alternative as well. The indirect effects of not harvesting or converting these stands would be the same as those described under Alternatives 1, 2 and 3.

The amount of clearcut harvest proposed in Alternative 4 (approximately 398 acres) is less than the amount proposed under action Alternatives 2 , 3, and 5 (approximately 737, 1,381, and 1,010 acres respectively). Under this alternative, there would be fewer direct effects on individual animals and populations from disturbance and habitat changes. Effects that were described under Alternative 2 for structural changes would be substantially reduced in Alternative 4. This would benefit some populations and would represent a gradual loss of habitat for other species, as the aspen gradually matured, or was actively managed to convert to other species. There would be less open, shrub, and sapling habitat created for certain NTMB's and game birds, but there would be more mature and over-mature habitat for other species, favoring bark foragers and cavity nesters, as well as species requiring quantities of large woody debris, such as pine marten, amphibians, and small mammals. Forage, in the form of herbaceous cover, woody twigs, and soft mast would be available in reduced quantities compared to Alternative 2 and especially Alternative 3, potentially affecting habitat quality for species such as elk, bear, grouse, and some songbirds and small mammals.

Alternative 5

Thirty-eight percent (38%) of Goal Area 1 within the project area is dominated by the aspen component (all age classes). Twenty-one percent (21%) of Goal Area 2, within the project area, is dominated by aspen (see Table 4.1.1a). The Forest Plan DFC for the amount of aspen on the landscape ranges from 35%-65% in Goal Area 1 and 10%-20% in Goal Area 2. Following implementation of Alternative 5, 37% of Goal Area 1, and 18% of Goal Area 2 would be dominated by aspen.

Approximately 519 acres of aspen would be converted (see Table 4.2.1b) to long-lived species to address a variety of resource concerns such as long term visual quality objectives and management for long-lived species adjacent to trout streams. Approximately 146 acres of aspen would be converted in Goal Area 1 and 373 acres would be converted in Goal Area 2 (see Table 4.2.1b). These conversions would be implemented to meet a variety of resource objectives (see Section 1.3, Objectives #2, #3, #4, #7, #8, and #13.). Those conversions would

be facilitated through various methods, which include:

- shelterwood, commercial thinning and improvement harvest techniques
- natural conversion to hardwoods or conifer
- shelterwood harvesting with under planting to conifers
- under planting of conifers with no harvesting

A direct effect of converting stands from aspen to other types would be a reduction of the aspen component with a corresponding increase in the acreage in other forest types, such as hardwoods and conifers. Following implementation, the amount of aspen on the landscape would be within the Forest Plan DFC in both Goal Areas.

Twenty-nine percent (29%) of the aspen in Goal Area 1 is currently in the 1-20 year age class. Thirty-one percent (31%) of the aspen in Goal Area 2 is currently in the 1-20 year age class. The Forest Plan desired future condition (DFC) prescribes maintaining 30% of the aspen component within Goal Area 1 in the 1-20 year age class across the Forest, (Forest Plan, pp. IV-114). There is no Forest Plan standard for aspen in the 1-20 year age class in Goal Area 2

If Alternative 5 were implemented, approximately 1,010 acres of aspen would be harvested through regeneration cuts to maintain aspen in the 1-20 year age class in Goal Areas 1 and 2. As a result of the implementation of Alternative 5 the percentage of aspen in the 1-20 year age class in the project area would decline by only 2% from the existing condition in Goal Area 1. The percentage of aspen in the 1-20 year age class over a 5-year period would be 27% in GA 1 and 33% in GA 2.

Approximately 31% of the aspen in Goal Area 1 across the entire Chequamegon side of the Forest is currently within the 1-20 year age class. Forest-wide, some of these stands will also move into an older age class by the end of a 5 year period. In addition, future proposals across the Forest will likely identify opportunities to manage aspen to contribute to compositional goals, but those projects have not been identified at this point in time.

Clearcut harvest treatments designed to regenerate aspen would be conducted in specific aspen stands under Alternative 5. The indirect effects of clear-cutting aspen would be the same as described in Alternatives 2, 3 and 4.

The amount of aspen remaining in the 50-year old and greater age class would be approximately 2,524 acres in Goal Area 1, and approximately 690 acres in Goal Area 2 (Table 4.2.1a).

As described previously, some of these stands are inaccessible due to wetlands, access across private lands or due to their adjacency to other harvest units. Approximately 1,598 acres of aspen 50 years of age or older in Goal Area 1 are located within the Forest Plan Revision Inventoried Potential Wilderness Area. The effects of not harvesting older stands of aspen are the same as those described under Alternative 1 (Chapter 4.2.1.1).

The variety of direct and indirect effects of early successional management on wildlife species would be similar

to those described for Alternatives 2-4. The scope and intensity of effects for Alternative 5 would be intermediate between those for Alternatives 2 and 3. Beneficial effects (for some species) and detrimental effects (for other species) would be increased compared to Alternative 2, and decreased compared to Alternative 3, due to the acreage of forest stands regenerated through clearcutting.

Cumulative Effects

All Alternatives

If the Forest Plan Revision Inventoried Potential Wilderness Area (IPWA) located within the Project Area were recommended for wilderness designation through the Forest Plan Revision, and later designated by Congress as Wilderness, it would be reasonably foreseeable to conclude there would be an eventual reduction in the aspen forest type in this area. The most notable decline would be in those aspen stands in the 50 plus age class (see Figure 3.2.1b). As a result, aspen would be less dominate on the landscape over time.

Past activities in and near the project area have resulted in a fairly patchy landscape, with areas of young-age aspen interspersed throughout most of the area. The proposed activities, when combined with past, future, and other present activities, would basically represent a continuation of the existing condition over the short term, with some exceptions. Alternative 1 could be considered a departure from current management. It would represent a decision to not implement the proposed activities at this time. Other proposals could be made and implemented at some point in the near or long term. Within a ten-year period however, there could be some changes evident in continued maturing of some aspen stands, with increased mortality and succession to other more shade tolerant species. Alternative 4 could also be considered a departure from current management, representing a stronger trend towards less edge, less early successional management, and more interior forest.

There have been concerns expressed about trends of early successional species as well as mature, interior forest species, with national, regional, and local trends being part of the discussion. In terms of regional trends, the Northeast U.S. has perhaps seen greater and more long-term declines in early successional species. This is likely due to the fact that the Northeast has been in a longer process of forest maturation and abandonment of agricultural fields. There are also declining trends in the Lake States, both in terms of habitat and populations. For example, since 1935, the area of aspen/birch in Wisconsin has declined by as much as 40% (Lorimer, 2001 - p. 434). To some extent however, these recent declines can be interpreted as a recovery of regional forests from an unprecedented level of disturbance in the late 1800's and early 1900's.

Declines during the last 50 years may have occurred after a 100-300 year expansion of suitable habitat following European exploration and settlement (Hunter et al., 2001 - p. 441).

Cumulative effects of Alternatives 2, 3, 4, and 5 over the long term would represent a continuation of these trends towards less early successional forest, more mature, shade tolerant forest types, and less fragmentation. This would be less pronounced with Alternative 3, however even in this alternative, there are some stands

proposed for eventual conversion to longer-lived species. There could be some subsequent declines in wildlife species using early successional habitats, however it is unlikely that any species would be at risk of extirpation from this scenario, assuming some level of even-age management in the future, combined with continued natural disturbance. It is also unlikely that populations of most early successional wildlife species would drop to levels found prior to the period of European settlement.

The Sunken Moose Project (Washburn Ranger District) and the Hoffman-Sailor Project (Park Falls/Medford Ranger District) are both proposing early successional regeneration cuts. The Sunken Moose Project would maintain the aspen component within Goal Area 1 at its existing condition and the Hoffman-Sailor Project would increase the aspen component within Goal Area 1 from its existing condition. Cumulatively from a forest-wide perspective the aspen component would be either maintained or slightly increasing within Goal Area 1, as a result of implementing these three projects.

4.2.2 Predicted Effects of Wildlife Openings (Issue 2)

Alternative 1: No Action

If Alternative 1 were selected, the project related maintenance or construction of upland openings would not be implemented. Over the short term, there would be little change in project area openings due the lack of maintenance. Many of the sites could eventually return to forest cover, but that change would generally not happen within a 10-year period. An exception could be openings that haven't been maintained recently, or were small and partially forested to begin with. Some of these could become more or less forested in a short additional period of time. Most openings however would remain in a similar condition without maintenance, over the short term. Some openings in the project area have stayed open without maintenance for several decades, due to natural factors such as frost action, browsing, and sod competition.

Even though Alternative 1 would not involve any opening maintenance over the short term, it would not represent a long-term commitment to a similar approach as future project analysis could consider maintenance of openings. Since there would be only an incremental change in amount of upland opening acreage under this alternative, there would not be noticeable short-term effects (such as loss of habitat or reduction in edge) on fish and wildlife species, including Management Indicator Species (MIS).

Alternative 2

If Alternative 2 were implemented, maintenance of approximately 85 acres of existing openings would be implemented. Maintenance would concentrate on openings within early successional habitats, primarily the aspen type, as well as maintenance of administrative and recreation sites. In spite of this maintenance, there would still be a gradual reduction in acreage of upland openings. Assuming openings not proposed for maintenance under this project were abandoned, openings could eventually make up only 0.3% of the project area. Some people feel that even this amount is not a natural part of the landscape, however literature is cited in

the specialist report that indicates openings in some form were likely in existence prior to European settlement.

Upland openings provide a wide variety of food sources, due to the abundant sunlight available, including grasses, forbs, and fruit producing shrubs and trees. Use has been documented by a wide variety of species; animals using openings are typically generalist species, including edge species (openings in the project area are not large enough to attract true grassland species). Examples of species using upland openings are black bear, white-tailed deer (MIS), thirteen-lined ground squirrel (MIS), butterfly species, voles, indigo bunting, and common yellowthroat (MIS; would use primarily shrub openings).

Short term and long term indirect effects of opening maintenance can include edge effects on adjacent stands. It is generally accepted that even small openings can have the potential for effects beyond the immediate site, with predators and generalist competitors being attracted to the edge. Effects can vary depending on the structural features of the edge, and the forest type the opening is located in. For example, an opening located in a young aspen stand would affect fewer forest interior species than one located in a mature hardwood stand. For more description of edge effects, see Section 4.2.4, Predicted Effects on Fragmentation (Issue 4).

Alternative 3

If Alternative 3 were implemented, approximately 126 acres of upland openings would be maintained. Approximately 16 acres of additional openings would be constructed. This alternative would stress upland opening habitat more than the other alternatives, since the current percentage of this type in the project area is well below that called for in the current Forest Plan.

In spite of the construction and maintenance proposed, Alternative 3 would still result in a decrease in acreage typed as open, to approximately 0.4% of the total project area. There would be some additional direct effects on wildlife, including some MIS, by the construction of openings. The sites used for construction would be young-age aspen. The conversion of this type to a grassy opening could affect any wildlife inhabiting the areas, due to equipment use and ground disturbance. These effects would be minimized by implementing construction later in summer, after the nesting season. There would be indirect effects due to the type conversion, with a small decrease in habitat for the common yellowthroat, ruffed grouse, and other shrub/early successional species, and a slight increase in habitat for the thirteen-lined ground squirrel, and the suite of species using more open grassy areas.

Habitat for the white-tailed deer would be essentially unchanged since both upland openings and young aspen are preferred habitats for this species.

Other indirect effects would be similar to that as described for Alternative 2, since there would not be a substantial change in overall percentage of upland openings within the project area.

Alternative 4

If Alternative 4 were implemented, maintenance of approximately 27 acres of upland openings would occur.

There would be no new construction of openings. Openings that are part of administrative sites (recreation areas, ELF sites) would be maintained, generally by mowing. In addition, there are five existing openings proposed for maintenance by prescribed fire (a disturbance agent that would have typically helped to maintain natural openings). Assuming the openings not maintained would revert to forest cover, this would result in a long-term upland opening percentage of 0.1% for the project area.

There would be few short-term effects from this alternative, however long-term effects would include a reduction in grass/forb habitat for thirteen-lined ground squirrel; a temporary increase in shrub habitat for common yellowthroat and ruffed grouse; and a reduction in potential indirect effects on species of adjacent forests, including pine warbler and blackburnian warbler. Over the long term there could be a slight decrease in foraging habitat for deer, however the loss of such a relatively small amount of habitat over a 32,000-acre project area would not have any appreciable effect.

Alternative 5

Opening maintenance, and direct and indirect effects, would be the same as described for Alternative 2.

Cumulative Effects

All Alternatives

Cumulative effects to wildlife habitat and populations caused by fragmentation and maintenance of edge habitat would be minor. This is due to the small amount of area affected, and the overall reduction of this cover type over the years. Even in Alternative 3, there would be a further reduction in percentage of upland opening acreage in addition to what has occurred in the recent past. In addition, Alternatives 2, 4 and 5 would not involve maintenance within larger blocks of interior habitat, to further reduce potential effects of fragmentation and edge. For more information on cumulative effects, see the section in the specialist report on cumulative effects, vegetation management.

4.2.3 Predicted Effects on Vegetation Composition (Issue 3)

Alternative 1: No Action

If Alternative 1 were selected, the proposed management activities would not be implemented.

An indirect effect of not conducting management activities would result in very little, to no change, in the age class distribution in the northern hardwoods in both Goal Areas 1 and 2. In many of the northern hardwood stands, this would result in growth being equal to mortality. Therefore, there would be no net growth. Without treatment, stands would not be expected to convert from another forest type to northern hardwoods in the next 10 years, although some aspen stands with large amounts of hardwood trees would eventually convert to hardwood dominated stands over the longer term (beyond 10 years).

Many of the hardwood stands (including northern hardwoods and mixed hardwood types) have components of

aspen and white birch. Because of age (50 + years), drought, and heavy defoliation during the late 1980's, some of the aspen and white birch have died over the last five years and additional trees would die due to their age. An indirect effect of not treating these stands would be the creation of snag trees and coarse woody debris on the forest floor, which would benefit certain wildlife species. It would also create gaps in the tree canopy that would allow light to penetrate to the forest floor and stimulate brush and tree regeneration in the under story. The effect would be short term, as the gaps would be closed by the growth of adjacent trees.

If Alternative 1 were selected, those stands with low amounts of aspen and white birch would experience little mortality in the short term. With no harvesting, high growth rates on better quality, future crop trees would be lost, as growth would be spread out over more trees. A direct effect of not managing these stands would be the heavy shading of the understory vegetation, which would limit regeneration and development of the vertical vegetation structure. A long-term effect would be that the canopy would be opened due to the mortality of individual trees. In addition, these dead and dying trees would result in more snag and den trees and more large woody debris on the forest floor.

There would essentially be a continuation of the existing condition in terms of landscape pattern if Alternative 1 were chosen. This is represented by a fairly even distribution of younger-age and regenerating patches of aspen in the southern portion of the project area, interspersed with areas of northern hardwood, lowland conifer, and small areas of other types, with a fairly high amount of edge. The areas of regenerating aspen could eventually mature and merge into blocks of interior forest, but not within the short term (under 10 years). Substantial areas of interior forest habitat are confined to the area north of FR 184, and several other smaller areas, such as the area northwest of Spillerberg Lake, and within the Iron River IPWA (see Table 4.2.3a and maps in Appendix A). These would be maintained under Alternative 1, unless affected by natural disturbance. Wind continues to be an important factor within and near the project area, with several extensive areas of wind throw just from the past several years. Insect and disease agents also continue to be a factor in landscape pattern development, with mortality evident in the project area from spruce budworm. Beaver activity could affect additional areas of riparian or lowland forest by flooding.

The dense canopy and more or less even-age condition provides habitat for various species that prefer mature closed-canopy forests, such as many Neotropical Migratory Birds and pine marten.

Many wildlife species would benefit from the lack of disturbance resulting from Alternative 1. The relatively low level of structural diversity could be limiting for some species. Natural canopy gaps would occur as individual trees blew down in windstorms or they collapsed due to natural mortality. This would create some diversity in stand structure. However, overall the stands would mature slowly, with little change over a ten-year period. Pileated woodpecker, brown creeper, and barred owl could benefit indirectly from Alternative 1 as the stands gradually matured, and more snags, cavity trees, and dying trees developed. Since the changes within the stands would be minimal however, habitat conditions would not be very different from the existing condition

(see summary of effects to MIS in the specialist reports).

Alternative 2

If Alternative 2 were implemented, northern hardwood stands proposed for treatment would be treated to move toward a balanced amount of age classes and structure within the project area. Harvest activities would be conducted on approximately 1,331 acres of northern hardwoods through even-aged methods and 2,140 acres of northern hardwoods through uneven-aged methods (see Table 4.2.3a).

In uneven-aged management, the direct effect of selection harvesting would be to develop and maintain stands of trees over a large land area that contain a range of tree sizes or age classes from seedlings to larger diameter sawtimber size trees. Many of the short-lived species such as paper birch and aspen would be removed before they are lost to natural mortality. Many of the shorter-lived tree species would be removed before they die. Harvest activities would improve growth and quality on residual trees and would reduce the probability of insect and disease losses because healthier trees would be left to grow. Some existing and potential snag and cavity trees would be left to provide structural habitat for wildlife species. Species diversity would be encouraged through harvesting to create canopy gaps that would allow enough sunlight to reach the forest floor to promote regeneration of less shade tolerant species, such as green ash, basswood and red oak. These gaps would be similar to those naturally occurring in older, unmanaged stands and would generally not exceed 66 feet in diameter. This type of treatment would maintain the continuous forest canopy.

Table 4.2.3a: Summary of timber harvest activity by acres for each alternative

Harvest Activity	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Even-aged Thinning				
Northern Hardwood	**1,331**	**865**	**179**	**722**
Conifer	**383**	**383**	**295**	**383**
Aspen	**220**	**351**	**142**	**247**
Paper Birch	**7**	**28**	**0**	**7**
Total	**1,941**	**1,627**	**616**	**1,359**
Uneven-aged Management				
Selection	**2,140**	**2,836**	**2,710**	**2,448**
Improvement	**0**	**56**	**966**	**313**
Total	**2,140**	**2,892**	**3,676**	**2,761**

Shelterwood				
Seed Cut	**543**	**197**	**111**	**437**
Overstory Removal	**53**	**53**	**53**	**53**
Total	**596**	**250**	**164**	**490**
Clearcut				
Aspen	**737**	**1,381**	**398**	**1,010**
Conifer	**0**	**26**	**26**	**0**
Total	**737**	**1,407**	**424**	**1,010**
Grand Total	**5,414**	**6,176**	**4,880**	**5,610**

Under Alternative 2, approximately 646 acres of aspen would be converted to other species, through a variety of techniques. Those include shelterwood, thinnings, and improvement harvesting with natural conversion to hardwoods or conifers, shelterwood harvesting with under planting to conifers, or straight under planting of conifers with no harvesting.

A direct effect of the aspen conversions within the project area would be a decrease of aspen acres with an increase of acreage in other forest types. Table 4.1.1b displays, by alternative, the changes in the percentage of aspen as a component on the landscape and the remaining aspen acreage within the Goal Areas following any conversions within the project area.

If Alternative 2 were implemented, Alternative Management Area (AMA) prescriptions would be applied to stands roughly corresponding to the area north of Forest Road 184. The AMA prescriptions would be applied to approximately 998 acres of northern hardwood stands. These prescriptions differ from standard prescriptions and are described in Appendix C under Design Feature T7 (Appendix C, p. 13).

As a result of these practices conditions would move towards a continuous canopy of interior forest habitat in this area. This would benefit forest interior birds, pine marten, forest raptors, and other wildlife using continuous closed-canopy, mature forest. Species diversity of the overstory would be increased. Timber volumes of about 850 cubic feet per acre would be harvested at 15-year intervals. The residual stand would be fully stocked. Logging would be conducted during winter months to minimize soil disturbance. The small canopy gaps created by the removal of mature trees would allow natural regeneration to become established (Management Options for Northern Hardwoods, Project Paper for Silviculturist Certification, Jerry Van Cleve).

Photo 4.2.3a Hardwood thinnings

The practice of hardwood thinnings, improvement cutting, and selection harvesting were considered together as selection cutting to evaluate the effects to wildlife species. Alternatives 2-5 (also referred to as the action alternatives) will be discussed together under this section since effects do not vary substantially between them. The acreage affected varies by approximately 10% between Alternatives 2, 3, and 5, but there are few site-specific differences. One main difference between Alternative 4 and the other alternatives is the use of improvement harvest for 966 acres (compared to 313 acres in Alternative 5, 56 acres in Alternative 3, and none in Alternative 2). Improvement cutting is a type of selective harvest with the goal of promoting uneven-age conditions. It was proposed in Alternative 4 as a way of further reducing the eventual regeneration harvest that could result from even-age management.

For this project analysis however, the effects of improvement cutting as opposed to other selection cutting would be essentially the same.

One of the factors included in the larger issue of vegetation composition is the effect on biodiversity due to the management of large hardwood blocks. This is strongly correlated with the level of clearcutting and other early successional management, which is covered in the following sections of the effects analysis: Section 4.2.1 and Section 4.2.4. A detailed description of effects on animal populations from hardwood selection cutting can be found in the specialist report.

Direct effects of selection cutting are reduced compared to clearcutting or other even-age management, since only a portion of the trees would be removed from a stand. Indirect effects are also greatly reduced compared to clearcutting, since a partial tree canopy is maintained, along with a distribution of various tree sizes. Since there is less change in vegetation structure resulting from the activity, there is less change in wildlife communities compared to clearcut areas. In terms of bird communities, harvested stands typically retain much of the mature forest bird community, in addition to providing habitat for those using the shrub/sapling layer (Thompson et al. 1995 - p. 212).

If one of the action alternatives were implemented, there could be a loss of some structural complexity from

selection cutting, due to a loss of at least some poorer quality trees, including cavity trees and potential snags. However there can also be improvements in some aspects of structural diversity, primarily from the creation of gaps, and the establishment of a more diverse shrub layer. Several studies are cited in the specialist report, documenting the improvements in bird species diversity in stands with these structural features. A study by Goodburn and Lorimer (WDNR, 1997 - p. 10) is cited, that found "even-age forests are often notable for the concentration of foliage in the main canopy layer and lack of vertical stratification, a trait that can depress biological diversity".

Table 4.2.3b: Landscape pattern analysis by alternative

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt 5
Total acres interior habitat *	10,272	9,817	9,157	10,047	9445
Avg. interior block size	63.4	59.5	54.2	61.6	55.9
Total miles of edge	456.6	455.5	463.4	455.3	462.2

*includes both mature and immature forest stands.

One of the main effects of implementation of all action alternatives would be an increase in the amount of early successional patches, resulting in increased amount of edge within portions of the project area (see Table 4.2.3b) and maps in Appendix A), although a GIS analysis indicates the project area total would increase for Alternative 3 only.

Alternatives 2, 4, and 5 would concentrate the proposed clearcuts within the southern 1/3 of the project area. Alternatives 2 and 5 would involve more acreage of clearcutting than Alternative 4, and would result in some reduction in area of interior habitat due to the placement of some of the harvest areas. Alternative 4, in addition to involving the least amount of clearcutting, would avoid placement of clearcut units within larger areas of contiguous hardwood blocks, and therefore would not result in a substantial decrease of interior habitat compared to Alternative 1. Alternative 3 would have the greatest effect on the existing pattern, since it involves the greatest acreage of clearcutting. In addition, this alternative would include the placement of harvest units throughout a greater portion of the project area, including the area north of FR 184 that is currently dominated by relatively continuous hardwoods. None of the action alternatives would result in harvest activities within the Iron River IPWA, therefore there would be no project-related changes to landscape pattern within that area.

Most of the proposed clearcuts in the action alternatives would be of fairly similar size, ranging from approximately 5 acres to 40 acres. There would be several exceptions in Alternatives 2, 4, and 5 however, with several larger clearcuts being proposed, to reduce edge and to produce slightly larger areas of contiguous habitat. Alternatives 2, 4 and 5 propose a 60 acre and 95 acre clearcut; Alternative 4 also proposes a 47 acre and 60 acre clearcut.

Photo 4.2.3b Shelterwood Cuts

Shelterwood cuts create open stands that are conducive to the establishment of young trees.

The various types of hardwood partial removal harvest proposed in these alternatives would not have substantial short-term effects on landscape pattern. The harvest would involve small regularly spaced canopy gaps, which would grow back into a closed canopy within a fairly short period of time. Components of long-lived upland conifer within the hardwood stands would be essentially unaltered, since these types are generally reserved from cutting. There would be some long-term differences between the alternatives however, since Alternatives 2, 3, and 5 propose much more even-age hardwood management than Alternative 4. The short-term effects of even-age thinning are similar to uneven-age selection and improvement cutting, however eventually an even-age management would involve a regeneration cut, which would create patches of young forest on the landscape, together with associated edge. The long-term management and regeneration of these stands will not be determined by this project analysis and decision however.

The majority of the conifer planting proposed under these alternatives would be under planting of long-lived conifers (primarily white pine), aimed at restoring some of the conifer component lost due to cutting and burning around the turn of the century. This under planting would help provide more within-stand conifer, as well as management for conifers in wetland transition areas. There would be approximately 26 additional acres of red pine planted following a jack pine clearcut under Alternatives 3, 4, and 5. The stand that would be replaced by plantation red pine also has plantation-origins rather than a natural-origin stand. See the table 4.2.3b, for comparisons of interior habitat acres, average interior block size, and total miles of edge, by alternative.

Alternative 3

If Alternative 3 were selected, approximately 1,244 acres of northern hardwoods would be treated through even-aged methods and 2,892 acres of northern hardwoods would be treated through uneven-aged methods (see Table 4.1.2a). The effects of conducting the proposed management activities for hardwood management would be the same as described for Alternative 2, except the AMA prescriptions identified for alternatives 2, 4, and 5 would not be applied to the area north of FR 184. Standard prescriptions would be used instead.

The use of standard practices would result in smaller maximum tree diameters, potentially smaller and fewer numbers of snags and reserve trees, and a potential for less species diversity. In the event of a substantial natural disturbance, there would be a greater chance for salvage harvests than with the other alternatives. The residual stand would be fully stocked. Logging would be conducted during winter months to minimize soil disturbance. The small canopy gaps created by the removal of mature trees would allow natural regeneration to become established.

The effects to wildlife species would be the same as that discussed for Alternative 2. A more detailed discussion of effects to wildlife can be found in the specialists report, in the Project Record.

Under Alternative 3, approximately 437 acres of aspen would be converted to other species, through shelterwood, thinnings, and improvement harvesting with natural conversion to hardwoods or conifers, shelterwood harvesting with under planting to conifers, or straight under planting of conifers with no harvesting. The effects of converting these aspen acres would be the same as those described for Alternative 2.

Alternative 4

If Alternative 4 were selected, approximately 321 acres of hardwood would be harvested through even-aged treatment methods, and approximately 3,676 acres of hardwoods would be treated through uneven-aged treatment methods (see Table 4.1.2a). The effects of conducting the proposed management activities for hardwood management would be the same as described in Alternative 2.

Alternative 4 would apply the same type of management prescriptions listed in Appendix C under Design Feature T7, in the Alternative Management Area (AMA). The AMA prescriptions would be applied to approximately 1,213 acres northern hardwood stands. The effects of this type of hardwood management would be the same as described for Alternative 2.

The effects to wildlife species are the same as disclosed in Alternative 2. A more detailed discussion of effects to wildlife can be found in the specialists report, in the Project Record.

Under Alternative 4, approximately 540 acres of aspen would be converted to other species, through shelterwood, thinnings, and improvement harvesting with natural conversion to hardwoods or conifers, shelterwood harvesting with under planting to conifers, or straight under planting of conifers with no harvesting. The effects of converting these aspen acres would be the same as those described for Alternative 2.

Alternative 5

If Alternative 5 were selected, approximately 969 acres of hardwood would be harvested through even-aged treatment methods, and approximately 2,761 acres of hardwoods would be treated through uneven-aged treatment methods (see Table 4.1.2a). The effects of conducting the proposed management activities for hardwood management would be the same as described for Alternative 2.

Alternative 5 would apply the same type of management prescriptions listed in Appendix C1 under mitigation measures T7, in the Alternative Management Area (AMA). The AMA prescriptions would be applied to approximately 1,213 acres northern hardwood stands. The effects of this type of hardwood management would be the same as described for Alternative 2.

The effects to wildlife species would be the same as those discussed for Alternative 2. A more detailed discussion of effects to wildlife can be found in the specialists report.

Under Alternative 5, approximately 519 acres of aspen would be converted to other species (146 acres in Goal Area 1 and 373 acres in Goal Area 2). These conversions would be accomplished through shelterwood, thinnings, improvement harvesting with natural conversion to hardwoods or conifers, shelterwood harvesting with under planting to conifers, or straight under planting of conifers with no harvesting. The effects of converting these aspen acres would be the same as those described for Alternative 2.

Cumulative Effects

All Alternatives

The contemporary landscape pattern would be a result of the interaction between natural and human forces (Dunn and Stearns, 1993 - p. 202). As mentioned previously, natural forces continue to affect the project area. At the same time, there have been numerous management activities similar to those proposed in the recent past, and would likely continue to be similar activities in the future, although the overall balance is difficult to predict. The cumulative effects of these activities, combined with the proposed project activities, would continue to have a substantial effect on the landscape pattern within the project area. Management of vegetation would likely result in a higher percentage of early successional species, a higher percentage of young-age forest, less structural diversity, and a less complex landscape pattern than that found during pre-settlement.

There is some potential for change in the current trend. In addition to the proposed aspen clearcutting, there are some aspen stands in all alternatives that would be actively or passively converted to longer-lived species. This would gradually reduce the amount of early-successional management in the project area, and could therefore gradually reduce the amount of edge and overall patchiness.

There are some portions of the project area that currently have fairly continuous close-canopy hardwood conditions. The most notable is the area of hardwoods north of FR 184, where recent management has purposely encouraged this condition. With the exception of Alternative 3, all alternatives would maintain this condition.

This large area of hardwood management would be complemented, at least in the short term, by the Iron River IPWA to the south, and by a large area of corporate lands to the north that are managed primarily for hardwoods. All alternatives propose activities that would help to restore some aspects of landscape pattern that have been lost, including increasing long-lived conifer types, and providing for some representation of old-growth communities (a designated Ecological Reference Area (ERA), is included within the project area and would be protected from management activities until a decision is reached about a permanent designation).

4.2.4 Predicted Effects of Fragmentation (Issue 4)

Alternative 1: No Action

If Alternative 1 were selected, there would be no direct effects from this alternative on fragmentation, since no project-related activity would occur (there would be no increase in amount of edge habitat, or reduction of interior forest habitat). There could be indirect effects from reduction of existing edge, combined with the lack of new edge. The total amount of edge habitat in the project area would gradually be reduced as existing young age stands matured, and the transitional edge with adjacent stands became less distinct. There could gradually be less edge-related activity, including nest predation, nest parasitism, and herbivory. It should be noted that at least one study indicated that edge effects on forest songbird assemblages may persist up to 35-40 years after an aspen stand is clearcut, or at least until the aspen is 14m tall (Mason, 1992 - pp. 11, 19-20). There could also be a gradual reduction in edge created by upland openings, since some of the openings would continue to revert to forest or shrub cover if there was no maintenance.

Alternative 2

If Alternative 2 were selected proposed timber management activities that were described in Section 4.2.1.2 would be implemented. The effects of managing for 1-20 year aspen would be the same as disclosed under Section 4.2.1.2.

Fragmentation is a primary concern associated with habitat manipulation, and can cause or exacerbate other effects such as predation, parasitism, dispersal, and area sensitivity. Fragmentation has been defined as a disruption in the continuity of habitat (Robinson, 1996 - p. 2). Fragmentation can include the extreme cases where large areas of forest are broken into small patches of woodland by agriculture or urban development, as well as more subtle fragmentation that occurs when forest management (such as clearcutting) creates a mosaic of successional stages within a large forest matrix. The first type is felt to be more damaging to wildlife populations, and can result in permanent losses of habitat. The second type represents the situation in the Cayuga project proposal.

This type of fragmentation can cause temporary reductions in quantity or quality of habitat.

As habitat fragmentation increases within a given area, the amount of edge increases, and the amount of interior forest decreases (see table 4.2.4.3a for amount of interior forest habitat by alternative, determined by GIS

analysis). There is general consensus that increased edge leads to increases in brood parasitism and predation, two of the main causes of lower reproductive success in bird species in fragmented forests (Rosenberg et al., 1999 - p. 8). Brood parasitism occurs when brown-headed cowbirds lay their eggs in other bird's nests, causing displacement or competition with the other nestlings. Cowbirds are generally found in agricultural areas in Wisconsin, but can be active in fragmented forests. Nest predation occurs by species such as red fox, skunk, crow, eastern chipmunk, and blue jay, species which tend to be more active at forest edges.

Parasitism appears to be less of a concern in the extensively forested Chequamegon-Nicolet National Forest, with both low incidences of cowbirds and low parasitism rates being reported. Predation is likely a more important effect, with several studies cited in the Wildlife specialist report that show greater predation rates and lower nest success close to clearcut edges. Ground nesting birds appear to be the most vulnerable.

Fragmentation is also a concern for some of the species listed as Regional Forester Sensitive Species, including American marten, northern goshawk, red-shouldered hawk, and cerulean warbler. For more information on these species, see the Biological Evaluation (Appendix D).

Most clearcut units proposed in Alternative 2 are 40 acres in size or smaller. There can be exceptions to this restriction however, to meet specific management goals. Alternative 2 proposes two blocks of aspen harvest larger than 40 acres: Compartment 157, stands 7 and 8 (60 acres total); and Compartment 158, stand 1, and Compartment 161, stand 14 (95 acres total). These two larger blocks of aspen would be harvested as single units rather than being broken into smaller units, to meet two goals. First, overall habitat fragmentation would be reduced in the local area, since the amount of edge produced by one large unit is less than that produced by several smaller units. In addition, these larger units would also help represent a greater variation in overall patch size on the landscape, which would be closer to the situation caused by natural disturbance patterns. Both of these concerns would address recommendations of the Scientific Roundtable on Biological Diversity (Crow et al., 1994 - pp. 17, 31). The long-term effects of less edge would be a reduction in the potential for impacts to interior forest species such as red-eyed vireo and ovenbird, while still providing habitat for MIS such as ruffed grouse and common yellowthroat.

Alternatives 2-5 would involve varying levels of upland opening maintenance, however all of these alternatives would also involve the gradual conversion of some existing openings. Alternative 3 proposes the construction of 16 acres of small upland openings, together with the highest level of maintenance. Even in this alternative however, the long-term result would be fewer acres of upland openings on the landscape, eventually reducing edge.

Alternative 3

Alternative 3 proposes the greatest amount of clearcutting and opening maintenance, as well as some opening construction, and would therefore create the greatest degree of fragmentation within the project area (greatest amount of edge, greatest reduction in interior habitat). There are some areas of relatively continuous northern

hardwood that would be affected by harvest of aspen stands, due to the emphasis on aspen in this alternative. There would also be some large areas of lowland conifer fragmented by the clearcutting of aspen "islands".

Another specific difference in the design of this alternative is that there would be no areas of aspen managed in larger blocks; there would be no clearcutting of any units larger than 40 acres. In terms of the project area as a whole, there would be fairly minor changes in total edge produced as a result of this change, but there would be local differences by splitting aspen blocks into smaller clearcut units (several smaller clearcuts create more edge than one large clearcut with the same total acreage).

Alternative 4

Alternative 4 proposes the least amount of clearcutting. The objective of the alternative is to more closely follow new information concerning sustainable ecosystem management, using sources such as the Scientific Roundtable on Bidiversity Report, public comment, and information used in the Forest Plan revision effort. The alternative reduces fragmentation and habitat patchiness compared to Alternatives 2 and 3 by reducing aspen clearcutting, particularly within or near large hardwood blocks, or where adjacent to large wetland areas.

This alternative would manage two additional large blocks of aspen (over 40 acres) through clearcutting, one in Compartment 161 involving 47 acres, and one in Compartment 127 involving 60 acres. Effects and reasoning concerning large block management were discussed earlier under Effects of Alternative 2.

Alternative 5

Alternative 5 proposes a level of clearcutting intermediate between Alternatives 2 and 3; therefore the effects of fragmentation would also be intermediate between the two. Alternative 5 would not include clearcut units within the large area of hardwoods north of FR 184, therefore levels of fragmentation within that area would be similar to that resulting from Alternative 2. There would be additional clearcutting however in the southern portion of the project area (compared to Alternative 2), resulting in increased edge habitat in that area.

Alternative 5 would involve the same two areas of large (over 40 acre) clearcut blocks as Alternative 2.

Cumulative Effects (All Alternatives)

Past activities in and near the project area have resulted in a relatively high level of heterogeneity (variety) in forest types and ages in the southern portion of the project area, resulting in temporary fragmentation and edge effects. The northern portion of the project area has been managed with more emphasis on northern hardwoods, resulting in fewer areas of young forest types, and less temporary fragmentation. There have been relatively few areas of permanent edge created within the project area (edge caused by long-term maintenance of open areas, such as roads or upland openings).

Proposed project area activities would maintain these conditions to a certain degree, and could even increase fragmentation and edge in the short term. Analysis using GIS has shown that all alternatives would result in a

slight increase in edge, and a slight decrease in interior habitat compared to the no action alternative. This would be primarily due to proposed clearcutting of aspen and aspen/fir stands. Over the long term however, assuming similar management occurred, there could be a gradual reduction in edge and fragmentation. Edge within the project area, and within the Forest as a whole, is created by features such as early successional management, roads, upland openings, private in-holdings, and open wetlands. Only the first three features are within Forest Service control; open areas in private ownership, and open wetland types, can be assumed to stay fairly constant. If current trends continue in the project area over the long term, particularly within the northern portion, there would be fewer areas of aspen management, lower road densities, and fewer upland openings, resulting in less edge and fragmentation. Alternative 3 produces more temporary edge than the other alternatives, however even Alternative 3 involves reductions in road densities and upland openings, and gradual conversion of some aspen stands.

Studies are cited in the wildlife specialist report that show the potential for effects from fragmentation and associated concerns even in extensively forested areas such as northern Wisconsin. Studies are less clear however on whether these effects are actually causing reduced populations or productivity. Results from various bird surveys are described, including both the Nicolet and Chequamegon Breeding Bird Surveys. Analyses of population trends show both significant increases and decreases for various species, but with no common patterns of habitat associations shown for the declining species. Habitats of declining species include hardwood forest, conifer forest, and both mature and regenerating forest.

A study by Robinson et al. (1995 - pp. 1988-1989) analyzed fragmentation at a regional scale, comparing predation and parasitism rates in areas with varying percentages of forest cover. Both nest predation and cowbird parasitism declined with increasing levels of forest cover, even though local effects could still be detected. From a regional perspective, they felt that the extensive forests of northern Wisconsin, the Missouri Ozarks, and south-central Indiana could provide a surplus of birds to maintain populations in more fragmented forest areas.

In summary, project area activities will continue to create and maintain some edge and fragmentation. In the long term however there is the potential for reduction of fragmentation within the project area. Studies show continued concern for effects of fragmentation, however results do not show clear connections between temporary fragmentation in heavily forested areas and consistent declines in wildlife species.

Table 4.2.4.3a: Comparison of interior habitat by forest type (mature forest stands only)

Forest type	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Aspen/birch/balsam fir	2141	1887	1603	1988	1651
Northern/swamp hardwood	5301	5209	4933	5259	5142
Jack pine	11	11	11	11	11
Red pine	45	44	44	45	44
White spruce	94	93	93	93	69
Lowland conifer	2296	2228	2168	2273	2195
Other	139	139	122	122	122
Total Acres	**10027**	**9611**	**8974**	**9791**	**9234**

Note: In performing the GIS analysis to determine edge and areas of interior habitat, the following features were considered to create edge, and therefore to produce edge effects:

- All sapling and poorly stocked pole size stands (size/density class 0,1,2,3,4)
- All non-forest vegetation types: type 97 (lowland shrub), type 99 (upland open)
- All traffic service level roads A, B, and C
- All adjacent privately owned parcels, regardless of current forest cover

In order to determine areas of interior habitat, all edge producing types were buffered by 100 meters; the areas remaining were considered to be interior habitat.

4.2.5 Predicted Effects on Roads (Issue 5)

Alternative 1: No Action

If Alternative 1 were selected, the existing roads within the Cayuga Project Area would be maintained in their present condition. The total road mileage for the project area would remain at approximately 141 miles of system and non-system roads. This results in an average road density of 2.8miles/sq. mile.

The Forest Plan direction for Management Area 1.1 prescribes a density of open system roads at a maximum level of 3.6 miles of road per square mile.

There are currently 2.2 miles of open system road per square mile within the Management Area 1.1 portion of the project area.

The Forest Plan direction for Management Area 2.2 prescribes a maximum density of 2.0 miles of open system road per square mile. Under Alternative 1, there would be 1.8 miles of open system road per square mile. The density of open system roads within the project area is within the levels described in the Forest Plan desired future condition.

Under this alternative there would be no new temporary road construction. Road maintenance would occur primarily on traffic service level (TSL) C and higher roads to maintain the existing condition. Some low standard roads (below TSL C) would experience minor additional rutting and pothole development through continued public use. This would make it more difficult for passenger cars to drive on them and may increase opportunities for people who desire to drive 4-wheel drive vehicles on roads in a lower standard condition.

The types of activities discussed in the wildlife specialist report relative to access management include: construction of new temporary roads; maintenance of existing roads; decommissioning of existing roads that are no longer needed or desired; relocation of Snowmobile Trail 8; and watershed restoration activities.

The opportunities identified for closures and decommissioning of system and non-system roads in the Roads Analysis would not be implemented under Alternative 1. Maintenance of existing road closure devices (i.e. berms, gates, rocks, etc.) would continue. There could be some routine maintenance of existing roads through grading and spot graveling. The level of public motorized access would remain the same.

The closure of the spur road off of Forest Road 1333 that provides access into the McCarthy Lake and Cedars Research Natural Area (RNA) would not occur. All terrain vehicles (ATV's) and four-wheel drive vehicles could potentially access the interior of the RNA and create user-developed trails.

If Alternative 1 were implemented, there would be no project related activity in terms of access management.

Alternative 2

If Alternative 2 were implemented, the amount of temporary road construction and maintenance of existing roads maintenance would primarily be related to the level of timber harvest proposed (see Table 4.2.3a). This alternative would involve 12.6 miles of temporary road construction and 22.8 miles of road maintenance. Alternative 2 includes the decommissioning of 6.5 miles of road no longer needed on the landscape.

The wildlife specialist report (project record) describes various effects of road construction, involving both direct disturbance and indirect effects from factors such as fragmentation and increased human access. The effects of road construction as proposed in the project area are reduced however, since only low-standard, temporary roads are proposed for construction in Alternative 2. These roads would be decommissioned following timber sale needs.

If Alternative 2 were implemented, a minor portion of the road maintenance activities would result in similar effects as road construction when a corridor previously grown over and not driveable becomes a road usable by at least a four-wheel drive vehicle. Generally, roads that were not previously being used by the public would be

closed following maintenance, to prevent an increase in public vehicle use. In addition to protecting wildlife populations, this would protect the investment in the road maintenance.

The addition of new temporary road corridors, and the improvement of others, would be offset somewhat by the decommissioning of other existing roads that are no longer considered necessary for project area management. The act of decommissioning a road would involve more than just placing a berm or other closure at the entrance to the road. It would involve activities such as restoring contours, removing culverts, and replanting vegetation over sections of the road corridor. As a result, there could be some short-term impacts from ground disturbance and equipment use, but the long-term result would be the removal of both the public use and the physical corridor from the landscape, and an overall reduction in road densities in the project area.

A Biological Evaluation has been completed to assess project impacts on species listed as sensitive; a Biological Assessment has been completed for the selected alternative to assess project impacts on federally listed species. Both of these documents consider potential effects from access management, as well as effects from other project activities. These analyses documented potential effects on the following species summarized here with proposed mitigation measures pertaining to access:

- Gray wolf (federally threatened)
- Northern goshawk (Regional Forester Sensitive Species)
- Spruce grouse (Regional Forester Sensitive Species)
- Calypso orchid, Ram's head lady's-slipper, White adder's mouth (Regional Forester Sensitive Species) considered together as "lowland conifer plant species".

The current Wisconsin Wolf Management Plan (1999) lists Access Management as one of the wolf management strategies, under Habitat Management (Wolf Management Plan, pp. 22). Studies are cited that suggest wolves exist primarily in areas with less than, or up to, one mile of open improved road per square mile of land area, although the expanding wolf population in recent years indicates tolerance for higher densities ("improved road" in this case is similar to Forest Service traffic service level A, B, and C level roads). Currently the density of this type of road in the Cayuga project area is 0.97 miles per square mile.

Currently the project area is used by up to three separate wolf packs that have exhibited stable populations. No additional "improved" roads are proposed for construction, although there are project area proposals for temporary road construction. All temporary roads would be decommissioned at the conclusion of activities for which they are authorized. In addition, the proposal to decommission a number of existing roads would result in a long-term decrease in overall road densities within the project area.

Therefore, access management within the project area is predicted to have no adverse long-term effects on the wolf.

There is one known active goshawk territory within the project area at this time. The project proposal includes road maintenance on an existing poor quality road (currently usable only by ATV's) that is in the immediate vicinity of the nest. Mitigation measures in Appendix C would prevent adverse impacts to nesting goshawks from project activities.

There are several known locations of spruce grouse in the project area from recent years. One of the factors affecting spruce grouse populations is incidental hunting mortality. Any expansion of road networks can increase accidental or intentional shooting by increasing public hunting use of an area. Proposed temporary road construction could have short-term impacts if there was increased public use and hunting. All temporary roads would be decommissioned following use for timber harvest. In addition, decommissioning of some existing roads would gradually reduce the road density and public vehicle access within the project area.

Potential habitat exists for a number of Regional Forester Sensitive plant species within cool, shaded swamp conifer stands in the project area. These areas of potential habitat could be affected primarily through the construction of temporary roads to access timber harvest areas. Effects would result from direct disturbance from vegetation removal, ground disturbance, and possibly from increased deer herbivory. Recommended mitigation is to survey all proposed temporary road locations that would pass through potential habitat, prior to any disturbance. If any listed plant species are found, road location and/or design should be modified to protect the plant sites.

More information on effects of access and road density can also be found in the Biological Evaluation in Appendix D.

If Alternative 2 were implemented, no detrimental erosion or sedimentation would be expected to occur from temporary road construction and maintenance on the project sites due to existing site conditions and the implementation of mitigating measures (see Appendix C).

Alternative 3

Alternative 3 would require the most temporary road construction in lowland sites. The predicted effects of alternative 3 are similar to those described under Alternative 2, however specific quantities of construction, maintenance, and decommissioning vary by alternative. This alternative would involve 16.3 miles of temporary road construction and 23.3 miles of road maintenance. Alternative 3 includes the decommissioning of 5.7 miles of road no longer needed on the landscape.

Alternative 4

The predicted effects of Alternative 4 are similar to those described under Alternative 2, however specific quantities of construction, maintenance, and decommissioning vary by alternative.

This alternative would involve 10.5 miles of temporary road construction and 19.7 miles of road maintenance. Alternative 4 includes the decommissioning of 11.4 miles of road no longer needed on the landscape.

Alternative 5

The predicted effects of Alternative 5 are similar to those described under Alternative 2, however specific quantities of construction, maintenance, and decommissioning vary by alternative. This alternative would involve 14.0 miles of temporary road construction and 23.1 miles of road maintenance. Alternative 5 includes the decommissioning of 11.4 miles of road no longer needed on the landscape.

Cumulative Effects

All Alternatives

The proposed access management activities, when combined with other past, present, and future activities, would result in a gradual reduction of road densities in the project area, and approximately the same density of motorized trails. Road densities would increase for short time periods, as temporary roads are constructed for sale activity, but they would be decommissioned after use. It is not likely that there would be any other need for permanent road construction for other activities in the foreseeable future, with the exception of special use permits to access private land. The implementation of road decommissioning would therefore gradually decrease the amount of road corridors, and the amount of public motor vehicle use. This could have the effect of decreasing impacts on wildlife populations sensitive to human disturbance, as described in the direct and indirect effects analysis.

4.2.6 Predicted Effects on Water Quality (Issue 6)

Five types of resources within the three watersheds in the project area were identified as having the potential to be impacted by Cayuga alternative actions from a water quality standpoint. They include lakes, streams, riparian areas, floodplains, and wetlands.

No detrimental erosion or sedimentation would be expected to occur from stand treatment, temporary road construction, culvert replacements, stream habitat improvement, trail relocation, or parking area construction, because of the location of the projects, project design features, and mitigation measures identified. The majority of the activities proposed are not near enough to water resources identified above, to pose a threat to water quality. Treatments in all alternatives that are in the vicinity of streams, lakes, riparian areas, wetlands, or floodplains would be designed and conducted in ways that are sensitive to fish habitat, stream and lake quality, and would follow Best Management Practices for water and wetland quality, as well as Forest Plan standards and guidelines for wildlife, fish, soil and water resources. Therefore, negative impacts to the three watersheds as a result of project activities are also not expected to occur.

Introduction

The water quality of lakes and streams could be negatively affected as a result of forest management activities if sedimentation were to occur.

Erosion is the process by which soil particles are detached and transported. Erosion resulting from natural causes is referred to as geologic erosion, while that caused by human activities is commonly known as accelerated erosion (Hewlett and Nutter 1969). Erosion can be caused from water, wind, and gravity. In Wisconsin, water is the most common erosive agent, particularly in forested areas. When eroded material is transported and then deposited by water or wind, it is referred to as sediment and the process as sedimentation. Sediment yield is the amount of sediment transported from an area, usually from a watershed via a stream.

Accelerated erosion and sediment yield from timber harvest areas are typically minimal because good ground cover is maintained by residual vegetation and logging slash and because areas where soil is exposed tend to rapidly re-vegetate. Exceptions to this general rule include roads, skid trails, landings, and recreational trails (Hewlett and Nutter 1969).

Sediment yields in Wisconsin range from a high of 100-500 tons/sq mi/yr to a low of less than 10 tons/sq mi/yr (Hindall 1976; Hindall 1972; Hindall and Flint 1970). The highest sediment yields occur in the hilly terrain with mixed forest and agriculture in the southwestern part of the state and the red clay region near Lake Superior. The lowest yields occur in the forested areas of northern Wisconsin including the Chequamegon-Nicolet NF. These low yields occur for three reasons. First, erosion and sediment yield from timber harvest areas is usually low because ground cover is often provided by residual vegetation, logging slash and rapid re-growth of vegetation (Verry 1972; Spangenberg and McLennan 1983). Second, timber harvest and other forest management activities typically only impact a small portion of the area in any given year. For example, on the Chequamegon-Nicolet NF, timber harvest has occurred on 1.6 percent of the land each year over the last decade (U.S.D.A. Forest Service 1998). Third, even when erosion does occur, it frequently is not delivered to streams because of the low relief and undulating terrain (Verry 1972).

Sediment is recognized as the most important water pollutant in the United States in terms of total quantity (Oschwald 1972; Ritchie 1972), miles of stream affected (US EPA 1990), and adverse effects on aquatic communities (Judy et. al. 1984). Surface erosion from roads can introduce fine sediment to streams. Fine sediment is a particular water quality problem in streams because it can reduce: (1) available habitat by filling pools; (2) survival of fish eggs and fry; and (3) survival, composition and abundance of aquatic invertebrates (Waters 1995; Cordone and Kelly 1961). Sedimentation can also affect channel morphology by increasing width/depth ratio and reducing sinuosity (Rosgen 1994). Sand sediments in particular are associated with increased width and reduced depth (Heede 1980).

Section 208 of the 1977 Clean Water Act required states to develop plans and procedures to control non-point sources of pollution, including silvicultural sources, to the extent feasible. Additionally, Section 319 of the 1987 Clean Water Act requires each state to develop and implement a program to reduce non-point source pollution to the “maximum extent practicable.” The act requires that best management practices (BMPs) be used to control non-point sources of water pollution.

Most Forest Service policy regarding water quality is contained in Forest Service Manuals 2532 (Water Quality Management) and 2522 (Watershed Improvement). The primary objective for water quality management is to protect, and where necessary, improve the quality of the water resource consistent with the purposes of the National Forests and national water quality goals. The policy includes promoting and applying approved Best Management Practices to all management activities as the method for control of non-point sources of water pollution and for compliance with state and national water quality goals; establishing goals and objectives for managing the quality of the water resource in land and resource management plans; and producing water of a quality suitable for the beneficial uses identified in the land and resources management planning process. Forest Service policy also calls for restoring degraded watershed conditions; improving soil and water quality; and implementing watershed improvement projects when feasible.

The current Land and Resource Management Plans for the Chequamegon-Nicolet National Forest, 1986, include standards and guidelines that are intended to serve as best management practices for the protection of water quality in compliance with the Clean Water Act. During the mid-1990s, the Forests also participated in the development of "Wisconsin's Forestry Best Management Practices for Water Quality" (WDNR 1995) and support their use to minimize sediment and other non-point sources of water pollutants. The use and effectiveness of Best Management Practices (BMP's) for Water Quality, were monitored by interdisciplinary and interagency teams across all land ownerships in Wisconsin, including the National Forest, during the years of 1995, 1996, 1997, and 2002. The field evaluations for monitoring conducted from 1995 to 1997, indicated that ninety-nine percent of the time no adverse impact to water quality occurred when a BMP was applied correctly where needed. They also indicated that the one percent of time that there was an impact, it was minor (WDNR PUB-FR-145-99). The sales on the Great Divide Ranger District that were monitored were found to have followed BMPs and had no adverse effect on water quality.

This water resource effects analysis utilized all available Aquatic Ecological Classification and Inventory, water resource inventory information, current research, and professional judgment of resource specialists. The effects of the alternatives proposed for this project area were assessed on a site-specific basis and mitigation measures were recommended to ensure the quality of the water resources within and adjacent to the analysis area are maintained. Additionally, many stands were deferred early in the analysis due to a variety of reasons, one of which related to their location relative to various water resources. In many cases, stand boundaries were adjusted to exclude wetlands, streams, lakes, and ponds from the treatment area. Many stands were deferred because access would involve complicated wetland or stream crossings. Each stand has been looked at closely on the ground. Lakes, streams, ponds, riparian areas, and wetlands within and adjacent to proposed treatment areas have been identified.

Treatment areas with boundaries within 200 feet of the water resources listed above were considered in this analysis. The water resources within the project area were also looked at from a watershed scale to assess potential cumulative effects. Portions of three 5th level watersheds encompass the Cayuga project area and were

described in section 3.3.6. The potential for short and long-term effects was also addressed. Long-term effects are those expected to last longer than 1 year after treatment or mitigation is completed, while those expected to last less than 1 year were considered short-term. Boundary distances and long verses short term effects criteria were chosen to be consistent with the criteria used for the on-going Wisconsin's Forestry BMP's for Water Quality Monitoring program.

Alternative 1: No Action

If Alternative 1 were implemented, the stream sedimentation that is currently occurring from road surface run-off, ditch erosion, or frequent culvert washouts would continue to occur. A direct effect of not implementing the proposed road/stream crossing, stream restoration, or road improvement projects could be an addition of approximately 123 tons of sediment per year into McCarthy Creek, Brush Creek, and un-named tributaries within the project area. Barriers to fish passage would also continue to occur in the tributary to Clam Lake and in Brush Creek.

Since none of the proposed water quality improvement projects would be implemented, there would not be any direct benefits to wildlife species. Sedimentation degrades habitat for wetland and aquatic species, including fish species, insect larvae, and frog and salamander species. In the case of the crossings of Brush Creek and a Brush Creek tributary, the brook trout, a Management Indicator Species (MIS), could be directly affected. Without these projects, there could be long-term effects on brook trout and other cold-water fish species.

If Alternative 1 were selected, the conversion of up to 35 acres of aspen along McCarthy and Brush Creeks would not be implemented. Habitat along these streams would remain favorable for beaver and increase the potential for flooding. As a direct effect the flooding could destroy riparian vegetation in these areas and deposit sediment. Removal of fine debris and alder along McCarthy Creek to reduce sedimentation deposition and stabilize the streambanks would not occur. There could be some gradual improvements in habitat under Alternative 1 due to natural changes, however the low gradient of the stream, together with the existing sediment load and heavy alder growth, would limit recovery.

Alternative 2

The stream sedimentation that is currently occurring from road surface run-off, ditch erosion, or frequent culvert washouts would be corrected by the proposed water quality improvement projects. If Alternative 2 were chosen, seven culvert replacements and road reconstruction projects would be implemented. An estimated 62.25 tons would be deposited if the culverts located within an unnamed tributary to the Bad River and Forest Road 355 failed. An additional 46.73 tons are estimated to come from the imminent failure of culverts where Forest Road 354 crosses Brush Creek.

A direct effect of implementing these seven projects could be a reduction of stream sediment by an estimated 123 tons per year.

There would be potential for some direct effects from the proposed restoration activities under this alternative. The removal of old culverts involves disturbance directly in stream channels. In addition, any project that involves ground disturbance near wetlands or water bodies can potentially result in short-term erosion and sedimentation from the exposed earth. Project design features and mitigation measures W20-W43 address culvert replacements (see Appendix C). Depending on site and weather conditions at the time of project work, some short-term erosion or sedimentation due to project activities could still occur. This could have temporary impacts on aquatic species within the immediate area, including amphibians, insects, and forage and game fish. The long-term effects of such projects would be an improvement in water quality due to reduction of erosion and reduced chances for culvert failure. Since the projects would occur on previously disturbed sites (roadsides) there would not be noticeable effects on terrestrial wildlife species. A direct effect of replacing these culverts would be the elimination of two fish passage barriers. The existing stream fragmentation of the unnamed tributary to Clam Lake and Brush Creek would be eliminated.

Alternatives 2, 3, 4, and 5

Riparian ecosystems and coarse woody debris inputs would not be negatively impacted by harvest activities with the application and adherence to specified mitigation measures (see Appendix C, measures W10-W19). The application of a shelterwood cut and an even-aged thinning along 0.5 miles of McCarthy Creek would improve riparian area conditions. To ensure adequate shading of the streams, at least 60 basal area would be required to be left within 100 feet of the high water mark of lakes and perennial streams, and within 35 feet of navigable intermittent streams. Therefore, there would be no increase in water temperatures as a result of the proposed treatments.

If Alternatives 2-5 were implemented conversion of 35 acres of aspen within the stream corridors of McCarthy and Brush Creeks to address beaver problems would occur. These streams are Class II, cold-water streams that support trout and other cold-water aquatic species. An indirect effect of converting the aspen would be a lower potential for sedimentation and increased water temperature problems due to beaver activity.

No long-term detrimental water quality effects are expected to occur from sedimentation, coarse woody debris removal, water temperature increases, or lateral sub-surface flow in wetlands due to the nature of the project locations and the application of mitigation measures (W1-W43 in Appendix C).

If Alternatives 2-5 were implemented the proposed aquatic habitat improvement activities on up to 1.5 miles of McCarthy Creek would occur. The removal of fine debris and placement of brush bundles along 1,000 feet of McCarthy Creek would improve streamflow, reduce accumulations of sediment deposits, scour deeper pools and expose gravel bottom in some areas. Use of brush bundles would also help to restore the stream channel, with higher sinuosity, narrower width, and deeper pools.

The removal of some streamside alder would also help stabilize the streambanks and promote sod growth.

There could be some short-term effects on trout and other fish species due to siltation, since much of the work would require travel and working in the stream. This type of siltation readily disperses however and does not have any long-term consequences. There could also be some temporary effects simply from the disturbance of people working in the stream and riparian areas, affecting both fish and shrub dwelling wildlife species such as the common yellowthroat.

Long-term indirect effects of the project work would include improved habitat for brook trout, due to increased holding and cover pools, increased overhead cover (from overhanging banks and woody structures), more stable stream temperatures, and more potential spawning areas.

The stands proposed for treatment under Alternatives 2-5 primarily occur on nearly level to gently rolling topography. Treatments proposed in these alternatives that are adjacent to streams, lakes, riparian areas, wetlands, or floodplains, would be conducted in ways that are sensitive to fish habitat, stream and lake quality, and follow "Best Management Practices (BMP's) For Water and Wetland Quality" (Wisconsin Department of Natural Resources, 1995), as well as Forest Plan standards and guidelines for wildlife, fish, soil and water resources (Chequamegon Land and Resource Management Plan, pp. IV-66-87) (see Appendix C). The soils analysis (section 4.2.8) determined that there would be a very low potential for soil erosion to occur. There would be an even lower potential for sedimentation to occur because the areas adjacent to water bodies are not disturbed, preventing erosion from occurring, and therefore eliminating the potential for sedimentation. No temporary roads would be constructed over streams. The effects of temporary road construction and maintenance to existing Forest Service roads is discussed in the Roads (4.2.5) and Soils (4.2.8) sections.

Alternatives 3, 4, and 5

If Alternatives 3, 4, or 5 were implemented, the same road/stream crossing projects described above would occur, except that one them would be a culvert removal and stream and floodplain restoration project. The resulting effects of all 7 projects would be the same as those described for Alternative 2, except that there would be an even greater reduction in chance for future culvert failure, due to the complete removal of one crossing.

Cumulative Effects

Streams or lakes with proposed treatments within 200 feet of the high water mark, in any of the alternatives, were considered in this cumulative effects analysis. Other ownerships, past activities, planned activities, and reasonably foreseeable activities occurring adjacent to these streams or lakes were identified. This information was used to analyze the potential for cumulative effects to occur as a result of Forest Service proposed activities.

Alternative 1

If Alternative 1 were implemented, the long-term water quality disturbance effects would continue to occur to the streams undergoing sedimentation.

An estimated 122.62 tons of sediment per year could be deposited into streams if the culverts fail and road and

ditch erosion were allowed to continue.

Alternatives 2, 3, 4, & 5

The project sites are all on National Forest land. There are private, county, and state lands nearby the project sites. Past activities on all these lands have included timber harvest, road building, agriculture, and disturbances from fire, flood, drought, and windstorm events. Disturbance caused by these past practices and events has influenced the existing condition of the water resources. No appreciable long-term water quality disturbance effects have been identified on National Forest or privately owned land in the project area from past activities and events. Long-term effects are those predicted to last more than one year after project completion.

The cumulative effects of project activities, combined with other past, present, and future activities, would be a gradual improvement in watershed health and quality. Past and proposed watershed improvement activities would result in decreased sedimentation in project area streams, benefiting a wide variety of aquatic insect, fish, and amphibian species. Beaver control, combined with proposed stream improvement activities on McCarthy Creek, would improve stream temperatures and habitat structure for brook trout and other cold-water fish species, and would result in more stable riparian areas. The lack of beaver control on other streams will still allow some beaver flooding and resulting wetland habitat maintenance.

There are no known reasonably foreseeable projects that may affect water quality within the project area.

Present actions proposed in Alternatives 2, 3, 4, and 5 include activities associated with timber harvest, such as temporary road improvement and construction in order to maintain forest health. Watershed restoration projects are also proposed in each of the action alternatives to improve water quality. All project activities would be implemented with site-specific measures taken to mitigate potential adverse effects to the water resources (see Appendix C, W1-W43). No appreciable long-term water quality disturbance effects are predicted from implementation of projects in Alternatives 2-5.

4.2.7 Predicted Effects on Noxious weeds (Issue 7)

Alternative 1 No Action

If Alternative 1 were selected there would be a continued chance for the introduction and spread of noxious weeds within the project area due to factors beyond Forest Service control (i.e., introduction by Forest visitors, wildlife, wind dispersal, highway maintenance, etc.). Known populations of noxious weeds within the project area would continue to expand.

Alternatives 2, 4, and 5

Activities associated with use of a biological control, timber management, upland wildlife opening maintenance and/or construction, road and/or recreational trail maintenance and/or construction, or other soil- disturbing

activities in areas that would remain open could have a long-term effect on the noxious weeds currently found in the project area.

If Alternatives 2, 4, or 5 were implemented, use of flea beetles would not fully eliminate leafy spurge from the landscape, but they would help reduce it to a tolerable member of the plant community. This biological control was chosen as the preferred method for treatment of leafy spurge for several reasons. Leafy spurge has an extensive and deep root system (tap roots can reach 20 feet in depth) and un-removed roots will re-grow, making hand removal nearly impossible. Herbicides only offer a short-term solution, needing to be reapplied on a frequent basis making them an expensive long-term choice. It is anticipated that biological control would be self-perpetuating over time if properly established.

Release of biological control agents should have a direct effect on reducing spurge density, patch size, and overall numbers. There is concern that the release of biological control agents could have an effect on the environment. The flea beetle proposed for use within the project area to control leafy spurge has been shown to be host-specific and there is no documented evidence showing it to have an effect on any other species. Based upon this information there would not be any effects to other native plants, agricultural crops or vegetation on private lands.

Forest management, using accepted silvicultural methods would occur. Timber management often includes varying degrees of ground disturbance and opening of the canopy that could provide suitable habitat for noxious weeds known from within the project area. Subsequent growth of trees and closure of the canopy would return managed stands to a state generally unfavorable for habitation by the noxious weeds currently found in the project area.

Equipment used for timber management could pose a threat as a potential vector of infestation by transporting seeds or rootstock material of non-native invasive plant species from one site to another. Temporary road construction or road maintenance associated with timber management that uses off-site fill could pose as a potential vector of infestation by transporting seeds or rootstock material of noxious weeds as well.

The aging jack pine would be removed from a stand of mixed pine within Day Lake Campground, which would result in a lower overall basal area. Timber management activities could create a canopy open enough to allow noxious weeds to become established. Both spotted knapweed and leafy spurge are known to occur in several nearby locations but not known specifically within the campground area.

Upland openings would be restored within the project area. Although there are no documented occurrences of noxious weeds in these openings, maintenance through mowing, burning, and or hand cutting could cause ground disturbance creating favorable habitat for noxious weeds or introduce seeds resulting in infestation of wildlife openings.

Other activities with potential for the inadvertent establishment of noxious weeds include: temporary road

construction, existing road maintenance, road decommissioning, recreational trail construction, watershed restoration, which would include replacement of culverts and reshaping roads at stream crossings, construction of a parking area at a snowmobile trail head, and the relocation of .4 miles of snowmobile trail. Any ground disturbance and/or importation of fill material or gravel associated with these projects could result in the inadvertent establishment of noxious weeds.

The application and enforcement of the mitigating measures described below and in Appendix C would reduce the potential spread of exotic plant species.

N1: Equipment used for timber harvest, wildlife opening construction or maintenance, or road and recreational trail construction on maintenance should either be documented as coming from an area free of noxious weeds or be cleaned prior to use on National Forest lands. Equipment should have all mud, dirt, and plant parts removed before working in the project area.

N2: Equipment used in sites within the project area already documented as containing noxious weeds will be cleaned prior to leaving the contaminated site.

N3: Fill material sources (sand, gravel, etc.) should be inspected before use in the project area for contamination by noxious weeds. Monitor areas where fill is used annually for a minimum of 3 years to ensure that noxious weeds were not inadvertently established by the activity.

N4: Minimize soil disturbance to the extent practical, consistent with the project objectives.

N5: Monitor the effectiveness of biological control methods for leafy spurge on an annual basis for a minimum of 3 years. Monitor both the anticipated reduction of leafy spurge and the numbers of flea beetles present at the release site.

N6: Re-vegetate disturbed soil in a manner that optimizes plant establishment. Use certified weed-free seed and/or mulch where needed.

These mitigating measures have been successfully used across the western United States by numerous federal and state agencies and are generally regarded as standard operating procedure in these areas. Although relatively new to the upper Midwest, there is no known information showing that these measures will not work here.

Alternative 3

If Alternative 3 were selected, no biological controls would be utilized to control leafy spurge. This Alternative would have the same effects as described in Alternative 1, No Action.

Under Alternative 3, the other proposed management activities would be implemented. This would result in similar effects as described in Alternative 2.

Cumulative Effects

Alternative 1

If Alternative 1 were selected, the three patches of leafy spurge would continue to grow in size. It would continue to take over nearby native vegetation. There is a continued chance for introduction and spread of noxious weeds within the project area due to factors beyond Forest Service control (introduction by Forest visitors, wildlife, wind dispersal, highway maintenance, etc.).

All Alternatives

Almost any activity that involves disturbance of the vegetation and soil can increase the chance of non-native invasive plant establishment. There have been increased efforts in past years to identify and treat known locations, but complete elimination of non-native invasive species is unlikely. Because all of the noxious weeds plants currently known from the project area are associated with open canopy areas, there would be no long-term cumulative effects regarding vegetation management. Many of the other proposed activities could have long-term effects on invasive species because these activities often continue to leave the area in some state of disturbance. These activities include recreational trail and road construction and maintenance, culvert replacement, upland wildlife opening construction and maintenance, etc. Monitoring of these areas would provide for the early detection of invasive species.

Alternatives 2, 4, and 5

It is expected that the flea beetles would take several years to fully establish themselves after release before having an impact on the leafy spurge populations. Since the flea beetles feed exclusively on leafy spurge, they should not become a pest in their own right. The cumulative, long-term effect of the use of flea beetles as a biological control should be a significant reduction in the population of leafy spurge within the project area, making this species a more tolerable member of the local plant community.

4.2.8 Predicted Effects on Soils (Issue 8)

Summary

There would be no short or long-term detrimental soil disturbance effects on project sites or adjacent areas for the alternatives analyzed within the Cayuga Project boundary. Adherence to Forest Plan standards and guidelines, site-specific mitigation measures and timber sale contract provisions would eliminate or minimize potential adverse soil resource impacts from erosion, displacement, compaction, rutting, and nutrient removal.

Introduction

The bounds of analysis for determining direct, indirect and cumulative effects of proposed activities on the soil resource are those portions of ecological Landtypes (LT) within the project area, where treatment would take place. These ecological units delimit areas of different biological and physical conditions. Potential effects to the

soil resource are reasonably confined to the soil directly beneath where the activity would take place, such as the operation of machinery to cut and remove trees. These effects may extend to adjacent Landtype phases for some activities, but not to an extent where the effect would transcend LT boundaries. As an example, heavy equipment causing soil compaction that reduces pore space for roots and water within a portion of one LT does not affect pore space on adjacent LTs.

The effects of the alternatives were assessed on a site-specific basis to determine if the degree and extent of potential soil disturbance would cause appreciable change in soil properties to be considered detrimental to the soil resource. Alternatives 2-5 propose actions that have potential to change soil properties through compaction, rutting, erosion, and displacement. Nutrient removal was considered but there are no ELTP's within the Cayuga project area, which are susceptible to it. The magnitude of potential direct, indirect and cumulative effects on the soil resource is estimated based on 1) applicable research; 2) technical information; 3) monitoring of past activities on similar soils; and 4) the professional experience and judgment of certified soil scientists and resource specialists. National and Regional Forest Service policy states the total extent of detrimental disturbance should not exceed 15 percent of an activity area (USDA Forest Service, 1991, 2001). Duration for short-term effects from soil disturbance is considered to be less than 10 years or the shortest amount of time between harvest entries. Duration for long-term effects is considered to be greater than 10 years.

National and Regional soil quality standards set limits of change for specific types of soil disturbance (USDA Forest Service, 1991, 2001). Detrimental soil disturbance is defined as the condition where accepted limits of change for soil properties are exceeded and result in major changes in soil quality and productivity. Forest Service and Natural Resource Conservation Service soil scientists have developed interpretations for use and management of the soil resource. These interpretations are based on soil chemical, biological and physical properties that are specific to ecological unit, soil type and land management activity. Representative sites within this project area that are proposed to have ground disturbing activities, have been field checked by a soil scientist.

Site-specific project design criteria based on this information and on current and proposed Forest plan standards and guidelines are incorporated into this analysis to minimize or avoid effects to the soil resource. Treatment areas would be monitored during project implementation. Selected sites would be monitored by inter-disciplinary teams to evaluate whether activities are within acceptable limits of change for measurable and observable soil properties. Mitigation measures are assigned where appropriate, to ensure the inherent long-term productivity of the land would be maintained and that soils would not be irreversibly damaged. See Appendix C, for a listing of mitigation measures (S1-S18) and where they would be applied.

Alternative 1

Soil Erosion and Displacement

The potential for soil erosion and displacement is very low since no new ground disturbing activities are

proposed in this alternative. Geologic erosion would continue at a minimal rate of less than 0.18 tons/acre/year (Patric, 1976, p572). Sites where soil is eroding from existing road/stream crossings have been identified within the project area and are discussed in the Water Resources sections of Chapters 3 and 4. This alternative would continue to allow these sites to erode and in some cases cause sedimentation in lakes and streams, unless stabilization is accomplished through maintenance or separate proposed actions. A catastrophic wildfire may expose large areas of bare soil or make some soils hydrophobic (water repellant), which could initiate erosion on a few steep slope areas. However, potential for a fire of this magnitude is very low in the Cayuga area.

Soil Compaction and Rutting

The potential for soil compaction and rutting is very low since no activities involving operation of heavy equipment in the forest are proposed. Historical compaction, if any still exists on the old logging trails, would continue to be mitigated through natural soil formation processes, freeze-thaw cycles, and plant root development. Closure or reconstruction of existing woods roads that are un-surfaced and poorly located on fine textured soils would not occur at this time. Public use of some of these roads during wet conditions would continue to cause rutting of the road surface.

Soil Productivity

The potential for impacts to inherent soil productivity is very low since there would be no ground or vegetation disturbing activities proposed. Natural soil formation processes would continue, biomass would accumulate, organic matter would accumulate and be incorporated into the soil surface, and the biological and geo-chemical nutrient cycles would continue. Inputs to the system include atmospheric deposition and weathering of parent materials. Annual nutrient balances based on estimated inputs and outputs would tend to increase as succession progresses (Pritchett, 1979, p199). Potential would increase for high intensity wildfire due to fuel build up on sites where vegetation is not managed. Severe burning may appreciably change soil properties to an extent that would impair short and long-term productivity, however, the probability of such an event is very low.

Alternatives 2, 3, 4, and 5

These are the action alternatives as described in Chapter 2. Proposed activities that have potential to affect the soil resource include:

- Timber harvesting and post-harvest mechanical site preparation
- Construction of new temporary roads
- Decommissioning of roads
- Construction of a trail parking lot
- Trail reconstruction

Table 4.2.8-1 displays the amount of each of these activities by alternative. The type and amount of these

proposed activities are similar enough amongst alternatives to allow direct, indirect and cumulative effects to the soil resource to be summarized together in this section.

Alternatives 2 through 5 were assessed on a site-specific basis for potential effects to the soil resource. This assessment was completed by a soil scientist, as well as by other resource specialists. The purpose was to ensure that the inherent long-term productivity of the land would be maintained, and that soils would not be irreversibly damaged by these proposed actions.

The Stand Treatment Table in Appendix J lists the ELTP, and appropriate design criteria and mitigation measures specific to each treatment area. A listing of soil quality mitigation measures and design features common to all action alternatives and those that are treatment area specific can also be found in Appendix C, features S1-S18.

Of the 32,416 acres of National Forest lands in the project area, from 15 to 19 percent would have potential ground-disturbing activities in alternatives 2-5 across the range of ELTs described in Section 3.3.8 and ELTPs listed in Appendix J. This leaves between 81 to 85 percent of the federal lands in the project area that do not have such activities planned. All of the ELTs receiving treatments in these alternatives are also represented in the untreated portions of the project area.

Table 4.2.8.2 Potential Ground Disturbing Activities by Alternative

Activity	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Harvest acres	5,414 acres	6,176 acres	4,880 acres	5,610 acres
Post-Harvest Mechanical Site Preparation	543 acres	223 acres	137 acres	437 acres
Construct new temporary road	12.6 miles	16.3 miles	10.5 miles	14.0 miles
Decommission road	6.5 miles	5.7 miles	11.4 miles	11.4 miles
Construct trail parking lot	1 acre	1 acre	1 acre	1 acre
Reconstruct trail	2,112 feet	2,112 feet	2,112 feet	2,112 feet

Soil Erosion and Displacement

The potential for soil erosion and displacement is very low within the majority of proposed harvest areas. There

is a low to moderate potential for erosion and displacement to occur on ELTP's SL/LS4C/4v, SL/LS4C/3, and LS4C/3 (Alt. 2, 4%, 212 acres; Alt. 3, 4%, 244 acres; Alt. 4, 2%, 118 acres; Alt.5, 4%, 232 acres). These ELTP's have slopes greater than 15 percent. However, the forest floor cover such as litter, slash and surface rock protects the soil from erosive forces of raindrop impact and runoff. An undisturbed and totally covered forest soil usually yields no surface runoff, thus, it has no sheet and rill erosion (Dissmeyer and Foster, 1980, p7). Tracked harvesting machines (fell, limb and cut to length) and rubber-tired forwarders (haul) are used in 90% of the tree harvest operations on the Great Divide Ranger District land base and the average ground traveled is less than 11% of a sale unit for all harvest types (Schumacher, 2002). The two machines typically operate on the same trails and run on top of slash generated from the harvested trees, surface rock and forest floor litter. Potential to expose mineral soil is minimal. Verry (1972, p283) found no evidence of accelerated erosion after clear-cutting an aspen stand in Minnesota. A few scattered areas (less than several square feet) of exposed soil may occur within harvest areas due to maneuvering machines over uneven ground. These isolated areas would re-vegetate naturally within one or two growing seasons and are not an erosion concern. Operation of this type of harvesting equipment does not remove the surface organic or mineral soil layers, thus, soil displacement rarely occurs. When thinning red pine, full-length trees may be pulled to a landing with a grapple skidder, allowing the limbed treetops to drag on the ground. This would cause some mixing of the organic and mineral soil materials but is not considered detrimental displacement (USDA Forest Service, 2001).

Landings are locations where wood is temporarily stored until it can be trucked away. They are often located on open areas adjacent to woods roads and the wood is placed directly on the undisturbed ground surface. A landing "spur" within or adjacent to a harvest unit, may be approved by the Sale Administrator, when decking wood along the road is not permitted. A spur typically is an area about 40 feet by 100 feet and wood is placed on undisturbed ground, if possible. Some spurs may require clearing of trees, stumps, rocks or other debris. Some soil may be displaced in this process. Potential for soil erosion is very low because level, well drained upland areas are chosen and natural ground cover would be re-established within one growing season. Main skid trails near landing areas would have more exposed mineral soil due to repeated use. These areas would re-vegetate naturally within one growing season.

Mechanical site preparation is necessary on some areas to prepare the ground for regeneration. It may involve Bracke scarification, salmon blade scarification or other similar mechanical scarification equipment. Some mineral soil would be exposed and displaced in the process, however, the project goal is to regenerate these sites and get ground cover within one growing season. Mitigation measures have been identified to minimize further potential for erosion or displacement while these sites are regenerating.

Site-specific design features and mitigation measures were identified to eliminate or further minimize potential for soil erosion and displacement within harvest units. Some of the mitigation measures developed for the Cayuga Project include:

- avoiding steep slope areas (>30%) within sale unit boundaries;
- operating along slope contours rather than perpendicular to the slope
- approving the location of main skid trails and log landings or spurs;
- artificial seeding of exposed soil that does not re-vegetate naturally;
- use of water diversion structures to control potentially erosive runoff, and
- restricting the operating season.

The mitigation measures relating to soil are found in Appendix C, and are labeled S-1, S-2, S-3, etc.

Potential for soil erosion exists when mineral soil is exposed during the temporary road construction process. This potential is eliminated or minimized by following Wisconsin BMPs pages 21-37, Forest Plan Standards and Guidelines pages IV-66-75, and FSH 7709.58 for site-specific road design features (available at any Chequamegon-Nicolet National Forest Office). Soil would be displaced and portions covered with other materials in the temporary road construction process, however these roads would be decommissioned after use. Roads are part of the transportation system necessary to manage the forest and provide public access for recreation. The lands dedicated for use as system roads are not considered as having detrimental soil displacement conditions (USDA Forest Service, 2001).

Permanently closing roads, constructing a trail parking lot, and reconstructing a trail as described in the proposed action, would expose and displace some mineral soil in the process. However, the project goal is to stabilize these sites and eliminate existing erosion potential. Design features would minimize further potential for erosion while these sites are stabilized.

Geologic erosion would continue at a minimal rate of less than 0.18 tons/acre/year (Patric, 1976, p572). Patric (1976, p576) also notes the overwhelming weight of evidence supporting the view that soil losses from responsibly managed forest land are slight compared to those that accompany most other land uses. A catastrophic wildfire may expose large areas of bare soil or make some soils hydrophobic (water repellant), which could initiate erosion on a few steep slope areas. However, potential for a fire of this magnitude is very low.

There would be no short or long-term detrimental soil disturbance effects from erosion on project sites or adjacent areas, when design features and mitigation measures are followed.

Soil Compaction

The potential for soil compaction and rutting from operation of heavy equipment is moderate for project sites on the sandy to loamy textured LS/MCS2A/3, SL2A, SL/LS3-1A/3, and SL/LS3-1B/3 ELTPs. These ELTPs are somewhat poorly to moderately well drained. The potential is high for project sites on the fine sandy loam to silt loam textured M1A, SiL/SL2A/3, SiL/SL3A/3, and Pn1A ELTPs. The percentage and acreage of soils in the areas proposed for harvest with moderate to high potential for compaction and rutting in each alternative are: Alt. 2, 7%, 379 acres; Alt. 3, 9%, 538 acres; Alt. 4, 4%, 207 acres; and Alt. 5, 8%, 437 acres.

These ELTPs hold moisture in surface horizons longer and lose strength when temporarily saturated from spring snowmelt and heavy rainfalls. The fine textured soils that are moderately well drained and sandy textured soils that are somewhat poorly drained are firm and hold up well to use of heavy equipment when moisture in the surface is reduced during dry periods of late spring, summer and fall. The fine textured soils that are somewhat poorly drained hold up well when frozen. Site-specific mitigation measures and design features listed in the Stand Treatment Table of Appendix J and the Mitigating Measures Table of Appendix C limit equipment use to dry seasons or winter (frozen ground) conditions based on soil type, minimizing the potential for compaction or rutting of the soil surface. Five year results of a long-term site productivity study concluded harvesting aspen when soils were frozen had little effect on physical soil properties and produced a fully stocked stand of aspen suckers (Stone and Elioff, 1997, p56-57). Potential for compaction and rutting is also reduced, by operating low ground pressure equipment (tracked harvesters and wide rubber tired forwarders) over snow, forest floor litter, logging slash, and surface rock. A Michigan study intentionally tested the latest harvesting equipment on wet fine sandy loam soil and found no rutting or compaction that exceeded acceptable limits (Miller et al, 2001, p3). On-site inspections performed by sale administrators determine whether contract provisions to shut down operations during intermittent wet periods are enforced.

Main trails nearer the log landings have repeated use by forwarders and have higher potential for compaction, depending on moisture conditions at the time of operation. There would be an increase in soil bulk density on the main haul trails. High use skid trails typically occupy less that 5% of the sale unit area and potential for long-term detrimental compaction or rutting is minimized by limiting operation of equipment to periods when the soil surface is frozen or not saturated. Soil scientists and resource specialists have monitored harvested areas on these ELTPs both within and outside of the Cayuga project area. Findings to date indicate no signs of reduced productivity due to soil compaction or rutting (Great Divide Timber Sale Activity Review, 2001, and End-of-Decade Monitoring Report Che-Nic NF, 1986-1996).

Constructing up to 16.3 miles of new temporary road would compact new soil areas but would not affect soil productivity, as these temporary roads would be decommissioned after use. Additionally, decommissioning of between 5.7 to 11.4 miles of existing woods roads that are unsurfaced and poorly located would reduce rutting and compaction from public use during wet conditions. Natural processes would eventually eliminate existing

compaction and return this land area to productive forest. The overall long-term effect to the soil resource from proposed road activities in the project area would be beneficial, since there are many more miles of road decommissioning than new construction proposed.

There are no known areas of historical compaction (outside of historical roads that still remain in use). However, if any still exists, it would continue to be mitigated through natural soil formation processes, freeze-thaw cycles, and plant root development. There would be some increase in soil bulk density from operation of heavy equipment in high use areas. The extent and intensity of soil compaction would be minimized through design features and mitigation measures and would be within acceptable limits over the treatment areas. Long-term productivity of the land would not be adversely affected.

Soil Productivity

The potential for activities in these alternatives to impact inherent soil productivity in the project area is low.

Soil productivity could be reduced from the proposed activities if excessive organic matter and nutrients were removed through harvesting, erosion or displacement. Productivity could also be reduced if soil physical properties such as structure or porosity, were impaired by compacting or rutting soil beyond acceptable limits for a treatment area (USDA Forest Service, 2001). Potential for soil impacts from erosion, displacement, rutting and compaction are determined to be minimal, as described in the three previous sub-issues, and would not adversely affect the inherent soil productivity of the ELTPs in the project area. Direct evidence is rare that nutrient removals in biomass harvesting trigger declines in soil productivity (Powers et. al., 1998, p 57).

Permanently closing 5.7-11.4 miles of roads that would return to productive forest over time provides a net increase in productive forestland in the project area.

Cutting trees and removing the merchantable bole wood would remove some nutrients from treatment areas.

The ratio and amount of nutrients in the bole and bark of trees varies by species, age, stocking and site quality, but is generally less than one half of nutrients found in the whole tree and accounts for a relatively small portion of total site nutrients. A major portion of the nutrients taken up annually into the above-ground components of trees is returned to the soil in litter fall and canopy wash resulting in a long-term accumulation of nutrients in the surface of mineral soils under forests (Pritchett, 1979, p205). Alternatives 2-5 propose to conduct thinning or selection harvests that remove between 20-40 percent of the existing overstory trees. These harvest methods will not remove excessive amounts of nutrients because a large percentage of the total site nutrients remain in the cut tree tops and limbs (slash), standing trees, shrubs, organic matter, roots, and mineral soil.

Alternatives 2-5 also propose clearcut harvests where all of the merchantable bole wood is removed. Alban and Perala (1990, p389) found that merchantable bole harvesting of mature aspen stands in Minnesota and Michigan did not affect forest floor weight, soil carbon, or nutrients (nitrogen, phosphorus, potassium, calcium, and magnesium). They found that within 5 years the clearcut sites are fully revegetated, litterfall has returned to

normal, and nutrients accumulated in the perennial vegetation tissues are as great as the amounts left in logging slash. Accelerated leaching of nutrients below the rooting zone after harvesting aspen is quite small and short-lived (Silkworth and Grigal 1982, p630; Verry, 1972, p 283). The clearcut acres are on relatively rich ELTPs where nutrient storage is medium to high. This harvest method would not remove excessive amounts of nutrients from these ELTPs because logging slash; non-merchantable trees, shrubs, organic matter and soil retain a high percentage of the total site nutrients. Logging slash contains three to four times more nutrients than annual litterfall and can be considered replacements for litterfall nutrients (Alban and Perala, 1990, p389).

Natural soil formation processes would continue, biomass and organic matter would accumulate and be incorporated into the soil surface, and the biological and geochemical nutrient cycles would continue. Inputs to the system include atmospheric deposition and weathering of parent materials. Annual nutrient balances based on estimated inputs and outputs would tend to increase as succession progresses (Pritchett, 1979, p199). Potential would remain very low for high intensity wildfire because managing the fire prone forest communities in the southern portion of the project area would reduce potential fuel build up.

Recent studies in the Lake States documented the distribution of soil and biomass carbon in red pine and hardwood forests before and after harvest. The conclusion was that in general, tree harvesting activities slightly reduced carbon storage, but the effect was not significant when considering total ecosystem carbon (Rollinger and Strong, 1995, p206; Strong, 1997, p5). Also, there was no difference in total ecosystem carbon between red pine plantations and native hardwood stands (Perala et al., 1995, p242). Alban and Perala (1992, p1109) found that neither whole-tree nor conventional harvesting (tops and limbs left on site) had any effect on soil carbon in aspen ecosystems in the Lake States. They also reported finding no evidence that soil carbon is changing as succession proceeds from an aspen-dominated community to a northern hardwood community. Johnson (1992) reviewed several studies reporting soil carbon changes after harvesting of forests. The majority of the studies reported no effects or only slight decreases in soil carbon.

The overall conclusion was that little (10%) or no change of soil carbon could be expected to occur after forest harvesting alone (Bouwman and Leemans, 1995, p516). Detweiler (1986) concluded that managed forests, currently covering 970 Mha worldwide (WRI, 1992), may have no net global effect on the carbon cycle. Mitigation measures as described in Appendix C would prevent or minimize net removal of soil carbon. This should be underscored when considering the addition of tree leaves, limbs, bark, roots, stumps, and wood not removed from the project sites, and the fact that more than 80 percent of the federal lands within the project area have no proposed activities for Alternatives 2-5.

The harvest activities proposed in Alternatives 2-5 are expected to increase above ground carbon storage as remaining trees increase biomass and understory and ground vegetation respond to increased light. The proposed projects in Alternatives 2-5 would have no direct or indirect adverse effects to total ecosystem carbon storage on the project sites, in the Lake States or to the national or global carbon budget.

Alternatives 2-5 would not negatively impact soil nitrate levels. Soils of the Chequamegon-Nicolet Forest are not nitrogen saturated. Total soil N varies from less than 0.02% in subsoils to greater than 2.5% for some peats. The average N content for most surface soils ranges from 0.03 to 0.4%. Generally, the amount of total N decreases with depth in the soil profile (Bremner, 1967). Soil lab analysis for total nitrogen on 68 sites across the northern Nicolet land base sampled from 1991-1993 showed N levels to be less than 0.25% in the surface and decreasing to less than 0.01 % in the subsurface. Under normal circumstances, 90 to 95% of the soil N occurs in a combined organic form, while only 5 to 10% exists either as ammonium, nitrate or nitrite (Wollum and Davey, 1976).

Forest soils are generally credited with restricting elemental losses through leaching in temperate forest regions. Elements are retained within a cycle between the plant and soil system and a general deficiency of anions exists in a forest soil profile of this region. Removal of trees through thinning or clear cutting would increase nitrification. The accelerated release of elements (including nitrates) from the forest floor is utilized by remaining vegetation on these sites or retained in the root zone, with little if any expected loss from leaching. Johnson (1995, p1351) found that redistribution of soil caused by logging machinery may serve to retain soil nitrogen at least in the first few years after clear-cutting. Hendrickson et al. (1989) reported up to 81% higher nitrogen concentrations in the top 20 cm of mineral soil 3 years after stem only and whole tree clear-cutting in Ontario. Harvesting practices in this project will preserve organic matter on-site, which will also promote nitrogen retention. Practices that encourage rapid re-vegetation will shorten the period in which conditions are favorable to high nitrification rates. National Atmospheric Deposition Program sites located across northern Wisconsin near Spooner, Trout Lake and Popple River have recorded a decreasing annual trend for wet deposition of nitrates and inorganic nitrogen from 1980-1998.

The proposed activities in Alternatives 2-5 would have no long-term direct or indirect detrimental effects to soil productivity.

Cumulative Effects (all alternatives)

Effects of Past, Present, and Reasonably Foreseeable Connected and Cumulative Actions

The analysis boundary for cumulative effects was determined to be those portions of ELTPs, on federal land within the project area, where treatment would take place. Since analysis has indicated negligible erosion potential, cumulative impacts to the soil resource in the project area would not affect surrounding landtypes on federal land or land in other ownerships.

Past Actions

Numerous historic, natural and human caused ground disturbing events, such as, windstorms, exploitive logging and associated fires, road and railroad building, have taken place in and around the area of cumulative effects analysis. While these events have influenced the existing condition of the soil resource, there are no known adverse residual impacts.

Recent activities, such as, timber harvesting and road building, have occurred over the past 15 years and were implemented following Land and Resource Management Plan standards and guidelines, sites specific design features to mitigate soil resource impacts, and contract operating restrictions on Forest Service lands. Site specific field monitoring by resource specialists within the project area and on similar ELTPs outside the project area has shown no short or long-term impairment to the soil resource from recent activities. The Forest has also implemented Wisconsin Forestry Best Management Practices for Water Quality since 1995 and recent field monitoring indicates that 99% of the time there will be no adverse impacts to water quality from soil erosion/sedimentation when BMPs are applied correctly (WDNR, 1999, p62). Current conditions indicate key soil properties affecting ecosystem health and sustainability such as porosity, organic matter content and nutrient availability are representative of the natural range of soil conditions inherent to the landscape of the Chequamegon-Nicolet NF (USDA Forest Service, 1998, p6). Healthy populations of soil microorganisms such as bacteria and fungi exist in the favorable environment of the forest floor litter layer and soil surface organic matter (Pritchett, 1979, p72). Storage of soil and biomass carbon is increasing in the vegetation and soil.

No appreciable long-term effects to the soil resource or long-term productivity of the land from past activities have been identified in the project area.

Present Actions

There are no known actions presently taking place within this cumulative effects analysis area that would have any measurable effects on the soil resource. Alternative 1 does not propose any new actions. Alternatives 2-5 do propose actions that would include potential ground-disturbing activities. Some of these proposed actions would occur over the same acres that have previously had similar treatments, such as a thinning harvest. Alternative 4 has less potential to impact the soil resource than the other action Alternatives, because fewer acres are proposed for harvesting, and temporary road building activities.

Alternative 3 would potentially impact more of the soil resource than Alternatives 2, 4, and 5. Assessment of potential direct and indirect impacts from activities in each action alternative indicates that no appreciable short or long-term detrimental soil disturbance would be expected. Monitoring indicates adherence to current and proposed Land and Resource Management Plan standards and guidelines, site-specific project design features and mitigation measures and contract provisions would eliminate or minimize potential adverse impacts from erosion, displacement, compaction, or rutting. Storage of soil and biomass carbon is projected to increase in the vegetation and soil.

Future Actions

At this time no specific actions are planned within the area of cumulative effects analysis for the soil resource. It is likely that timber harvesting and associated activities would be proposed to some degree, but it is not possible to foresee exactly where or when such actions would occur. All future proposed actions on federal lands would be subject to environmental effects analysis and any project implementation would follow site specific design criteria, applicable research, current Land and Resource Management Plan direction, standards and guidelines, mitigation measures and best management practices to eliminate or minimize potential adverse soil resource impacts from erosion, displacement, compaction, rutting, or nutrient removal. Storage of soil and biomass carbon is projected to increase in the vegetation and soil.

Conclusions

The effects of implementing Alternative 1 or any of the action Alternatives 2-5, when added to the effects of past, present, and reasonably foreseeable actions would not be expected to result in appreciable adverse cumulative effects to the quality of the soil resource or to the total forest ecosystem carbon storage capacity.

4.2.9 Predicted Effects on Floodplains and Wetlands (Issue 9)

Alternative 1

If Alternative 1 were selected, none of the proposed resource management activities would be implemented. Therefore, there would not be any impacts to floodplains and wetlands.

Alternative 2

If Alternative 2 were implemented, temporary access would be located adjacent to, and possibly within wetlands under frozen conditions. Small pothole wetlands or wet spots are located throughout the analysis area. There are also large wetland complexes between uplands and adjacent to most streams. Most streams also have floodplains located on either side or adjacent to them. Wetlands and floodplains would not be negatively impacted because trees would not be removed, slash would not be placed within these areas, and adjacent slopes would be protected so that erosion and sedimentation would not occur. Equipment would not be operated within wetlands or floodplains, except where it can't be avoided to access a stand or portion of a stand.

This would only occur under frozen conditions and when no other reasonable alternative for access exists. Mitigation measures W1-W4 address wetlands and floodplains (see Appendix C).

Due to the nature of the project locations and the application of mitigation measures, no long-term detrimental water quality effects to wetlands or floodplains are expected to occur from sedimentation, or blockage of the lateral subsurface flow, in wetlands.

The indirect and direct effects of the proposed culvert replacements at seven sites are described in Section 4.2.6, Alternative 2. Replacement of the culverts would also reduce sedimentation of the floodplains that lie adjacent to these streams.

Alternatives 3, 4, and 5

If Alternatives 3, 4, or 5 were implemented, the direct and indirect effects would be the same as those described under Alternative 2 with the exception of the restoration of the floodplain located on FR 355. The direct and indirect effects of the culvert replacements are described in Section 4.2.6. The direct effects of the removal of the twin culverts at the FR 355 crossing of an unnamed tributary to the Bad River would be a reduction of 62.25 tons of sediment per year and restoration of 1 acre of floodplain. Without the road crossing, the floodplain would no longer be interrupted, resulting in improved flow of floodwater and increased floodplain habitat for aquatic species. The sediment source (road surface, fill, and embankments) would also be absent, resulting in less sediment inputs over time.

Cumulative Effects

All Alternatives

There are approximately 11,209 acres of wetland located on National Forest lands in the Cayuga Project Area. This accounts for approximately 35% of the analysis area. There are no activities proposed in these 11,209 acres in any of the action alternatives, with the exception of temporary roads under frozen conditions. The effects of the proposed stream restoration projects, when added to the effects of past practices and events, current practices, and future proposed actions, would not be expected to result in any adverse cumulative effects to the quality of the floodplains. The cumulative effects of these projects would cumulatively improve the overall health of the watersheds in the Cayuga Project Area.

4.2.10 Predicted Effects on Visual Quality (Issue 10)

Alternative 1: No Action

If Alternative 1 were implemented, no vegetation management activities would be implemented to improve visual quality along Day, Spillerberg, and East Twin Lakes, or along County Highway GG or M. The mixed aspen and hardwood stands along County Highway GG and M would convert mainly to hardwoods over time.

These stands would convert mostly towards all aged maple stands partially hidden, in some areas along the corridors by a dense conifer strip along the edge of clearing for the highway. In the short term, dead and dying aspen would blow over with their boles elevated above the ground. The Forest Plan Visual Quality Objectives (VQO's) for these areas would still be met, however.

Alternatives 2, 3, 4, and 5

If Alternative 2, 3, 4, or 5 were implemented, approximately 297, 203, 236, and 258 acres respectively, of aspen would be converted to northern hardwoods or conifers along Highway GG. In these stands, aspen would be removed leaving a residual stand of hardwoods or conifers, depending on the stand. Much of the harvest activity would be shielded from view along portions of the corridor, by the dense screen of balsam fir saplings, which have become established at the edge of the clearing along Highway GG over the last 25 years. Application of mitigating measures V1-V3 in Appendix C, would minimize short-term direct effects to visual quality due to these timber harvesting activities, by requiring slash to be removed or compressed within the viewing area of the highway.

Photo 4.2.10: Clearcut along lake screened from view

This shoreline retains its scenic qualities due to a strip along the lake that screens a clearcut from view.

The aesthetics along the shorelines of Day, East Twin, and Spillerberg Lakes would be improved through the gradual conversion of declining aspen and birch stands to longer-lived white pine, through thinning or shelterwood harvests. Within the first few years after harvest, an observer would notice a less dense appearing forest near the lake, but the change would be temporary as the trees within the stands grow to occupy the space around them. The long-term result would be an all age forest of conifer and deciduous trees, with big tree character, a more open, less brushy understory, and denser canopy cover. The application of mitigating measures V5-V7 in Appendix C would minimize short-term direct effects to visual quality due to these timber harvesting activities, by requiring slash to be removed or compressed within the viewing area of the lakes. In Alternatives 2-5, approximately 53, 29, 39, and 53 acres respectively of long-lived conifers, such as white pine, would be underplanted along the shoreline of Day Lake and Spillerberg Lake. In the short-term, the newly planted trees would not be noticeable. Under planting of long-lived species along these shorelines would gradually improve the visual quality in the foreground and middle ground from the water.

In the longer term, long-lived species would become evident along the shore of these lakes as the short-lived species such as balsam fir, aspen, and paper birch die out naturally.

A clearcut is proposed in Alternatives 2, 3, and 5 between East and West Twin Lakes. Mitigation measure V4, in Appendix C, that requires a 200-foot no cut buffer along the shoreline of the lakes, was designed to screen the cut area from viewers on the lake.

The Forest Plan VQO's for Highway GG, Day Lake, Spillerberg Lake, and East Twin Lake would be met under all alternatives.

Cumulative Effects

Alternative 1

Under Alternative 1 the visual quality of the stands along County Highway GG and M would eventually convert to long-lived hardwoods through natural mortality of short-lived species.

Alternatives 2, 3, 4 & 5

Under the action alternatives, the tree species in stands along Highways GG and M would change to long-lived hardwood or conifer species. For the most part, the dense balsam fir screen along portions of the corridors would not be affected. Those areas within the corridors of County Highways GG and M would progress toward a corridor lined by a narrow band of balsam fir.

4.2.11 Predicted Effects on Recreation Facilities and Trails (Issue 11)

Alternative 1: No Action

If Alternative 1 were selected, campsites located on the Jack Pine Circle and Heron Circle at Day Lake Campground would be closed to protect the public from injury. This would be a 5.7 percent reduction in the campsite capacity on the Great Divide Ranger District as a whole.

Under this Alternative, the portion of Snowmobile Trail 8 located on FR 1296 would not be relocated. Mixed traffic during the winter would continue to be a safety concern. The safety issue of parking at the community center, where emergency vehicles and personnel are housed, would continue to be a concern.

Hunting opportunities for grouse would be expected to decrease, as the amount of aspen in the 1-20 year age class declines by 50 percent over the next 5 years.

Alternatives 2, 3, 4, and 5

If Alternative 2, 3, or 5 were implemented approximately 25 acres of jack pine would be removed on the Jack Pine Circle and Heron Circle loops in Day Lake Campground to address safety issues. As a result of the jack pine removal, this stand would appear to be quite open for approximately 3-5 years.

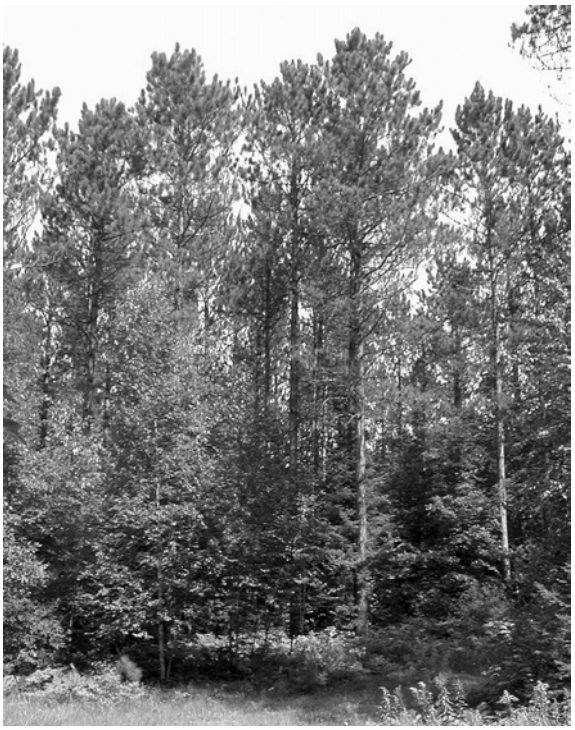


Photo 4.2.11: Thinned red pine stand.

This stand was thinned to a slightly lower stand density than what is proposed in Alternative 2. The red pine trees developed large crowns and small maple and oak trees dominate the lower levels of the stand.

Approximately 88 acres (Compartment 124, Stands 19 and 20) of red pine in Day Lake Campground would be thinned in Alternatives 2, 3, and 5 to promote growth of larger trees within the campground and aid in air movement through the campground. The stands would be thinned to approximately 80 square feet of basal area. The appearance would be similar to the stand of red pine located just east of the entrance to Day Lake Campground. These stands would not be treated under Alternative 4, prolonging the excessively high density of the red pine near the campsites.

To provide a safe and quality recreational experience, Snowmobile Trail 8 would be re-routed off of FR 1296 onto National Forest land. The total length of the reroute would be approximately 1,600 feet. The new section of trail would utilize existing skid trails in the adjacent pine plantation and would require the removal of only about 12 small saw timber size red pine. The rerouted trail would cross Highway GG just north of the campground entrance.

A new parking lot would be constructed adjacent to FR 1296 in a flat open area south of the road. An existing skid trail approximately 550 feet in length would be utilized as a connector to Snowmobile Trail 8. The trail would cross County Highway GG just north of the campground entrance.

The direct effect of the harvest in Day Lake Campground would include the removal of the safety hazard of the old jack pine. The appearance of the pine stands within the campground would change as well, and in the first year the pine stands would appear to be very open. By the second growing season the pine stands would appear to have a more normal stand density and indications of logging would begin to disappear. Within three to four

years the crowns and branches of would expand out to fill in the gap from the trees that were removed.

Indirect effects of harvesting in Day Lake Campground would include the development of larger stand tree diameters and larger crowned trees. Air movement would improve as the result of wider tree spacing within the stand. Visually, the stands within the campground would begin to be dominated by large trees with the removal of smaller trees and increased growth on the remaining trees.

Direct effects of rerouting the snowmobile trail and constructing a parking lot include the reduction in the amount of trails sharing plowed town roads and the establishment of a safe parking place for visitors with snowmobiles and ATV's.

Although hunting opportunities are available in all alternatives, those that regenerate more acres of aspen will in time provide more opportunities for grouse and woodcock hunters. More acres of aspen habitat may equate to increased hunting opportunities over time, as the structure in those stands develops to the point where they provide good habitat. Levels of aspen management and therefore potential effects on hunting vary by alternative. See Tables 4.1.1a and b for a comparison of aspen acreages and percents in the project area by alternative and age class. Many upland bird hunters are attracted to aspen in the 1-20 year age class. Alternative 3 provides for the same amount of aspen in the 1-20 year age class as the existing condition, and would therefore provide similar hunting opportunities as exist right now. Alternative 5 would provide the next highest percentage of hunting opportunities, followed by Alternatives 2 and then 4.

Opportunities for deer hunting would not be likely to change due to varying levels of aspen management. Deer hunting is less focused on the aspen type, with hunters utilizing a wide variety of habitats including northern hardwoods, pine, lowland conifer, and shrub openings.

Approximately 3,064 acres of aspen are currently in the Iron River Forest Plan Revision Inventoried Potential Wilderness Area (IPWA). While some of this aspen may convert passively to other species over time, habitat for grouse and woodcock and therefore hunting opportunities would continue to be available for some time.

Cumulative Effects

Alternative 1

In this alternative the hazardous condition in stand 21 of compartment 124 would continue resulting in a reduction in the amount of open campsites on the district. Campsites at Day Lake would remain shaded and airflow would continue to be restricted.

Alternatives 2, 3, and 5

As a result of the proposed harvest within the campground, Day Lake could conceivably become a more desirable place to camp and campground visitation may increase. The minor snowmobile trail reroute would contribute to the safety of the overall trail system on the district.

Alternative 4

Campsites at Day Lake would remain shaded and airflow would continue to be restricted.

The minor snowmobile trail reroute would contribute to the safety of the overall trail system on the district.

All alternatives

There is potential for long-term impacts to grouse and woodcock populations and therefore hunting opportunities as a result of declines in the amount of aspen, especially 1-20 year old aspen, on the landscape. While grouse populations are known to be cyclic, there have been some long term declines noted for several states, likely due to habitat loss and degradation (Dessecker and McAuley, 2001 - p. 457-459). Woodcock populations have experienced a significant long-term decline in the central U.S., including Wisconsin (Kelley, 2001 - p. 1, 4). White-tailed deer populations in Wisconsin however have been generally increasing in spite of a long-term decline in the aspen resource. Implementation of the No action alternative would result in the highest impact to grouse and woodcock hunting, while Alternative 3 would probably show little impact. Alternative 5 would have the 2nd lowest, followed by Alternative 2, and finally 4. Since deer hunting occurs in a wide variety of habitats, and since deer populations have generally been increasing, it is unlikely that levels of aspen management would have noticeable effects on deer hunting opportunities.

4.2.12 Predicted Effects on Local Economy (Issue 12)

A variety of methods can be used to measure the economic effects associated with natural resource management. Some of these effects are easily quantifiable such as the production of saw timber and pulpwood that result from various management actions. Other values associated with resource management such as ecosystem values, aesthetics, recreation, wildlife viewing and others are more difficult to quantify. This analysis does not attempt to do so and solely addresses the economic effects of managing and harvesting timber. The “Quick Silver” Forestry Investment Analysis program (Vasievich, 1998) was used to address economic efficiency by calculating the present value of costs, the present value of benefits, the present net worth, benefit/cost ratio of implementing each alternative. Commodity production, money to the economy, monies to local and federal governments, and cumulative effects of implementing each alternative were analyzed using volume estimates and the current base rates for timber.

By their nature, economic boundaries are difficult to define. However, for the purposes of this analysis, it is assumed that the majority of the economic impact will be realized in Ashland, Bayfield and Sawyer Counties. This is a convenient way to estimate impacts since much contextual economic information is gathered and reported at the county level. Therefore, the impacts will be estimated for this area and put into the next larger context, the regional level. The timeframe associated with this economic impact analysis will be the present time through the completion of activities proposed in this analysis. The Forest Service is limiting the economic efficiency and impact analyses to those monetary values that are readily available and market-defined.

This analysis is not intended to show every possible tradeoff, but, rather, to consistently and reasonably compare the costs, benefits, and efficiencies between the alternatives.

Alternative 1: No Action

Under this alternative, none of the proposed actions (or alternatives to them) would be implemented within the Cayuga project area. Traditional uses and maintenance activities, such as fire prevention, road maintenance, and recreational use would continue, however. There would be no short or long-term direct or indirect economic costs or benefits realized as a result of this alternative. Selection of Alternative 1 would mean a loss of wood supply for area mills and less revenue for the Federal Treasury as well as for local governments. When comparing dollars returned, this alternative would be fifth. There would not be as large of an increase in the growth and value of the stands in the project area, so future revenues would be less.

If Alternative 1 were implemented, there would be no new timber sales in this project area in the foreseeable future. The total volume harvested would be 0 MMBF for the time period 2003-2008 (For the purposes of comparable calculations it was assumed that these stands would never be thinned during the period analyzed). Not harvesting and hauling these wood products would defer local revenues. In order to address Forest-wide timber volume goals, the shortfall that would occur under Alternative 1 would likely be addressed through proposals to harvest timber in other parts of the Great Divide Ranger District. Although no harvests would occur in the stands proposed for treatment in this project during the period of 2003-2008, much of the timber that is presently available (mainly red pine) would remain available for future years. Other timber, specifically the older jack pine and aspen, would deteriorate and become less available over time.

Alternatives 2, 3, 4, and 5

Harvest of wood products would provide raw materials to local industry and create jobs related to harvesting and processing timber. Growth and value of products from the residual stands would continue to increase as a result of improved vigor with this harvest entry. Timber harvest in the past and anticipated timber harvest in the future has and would continue to be a stable employment and revenue source for local communities and governments.

Local industries have had and would continue to receive raw timber products for processing. Raw timber is a source of considerable income to the local economy. A multiplier of approximately $1,026,000 / MMBF is being used in this analysis to estimate the expected income generated under each alternative. The source of this multiplier is the 1997 TSPIRS Report for the Chequamegon-Nicolet National Forest.

As noted above, the harvest of timber generates income in the local community. It logically follows that employment is also generated. Jobs are created through the harvest, hauling, processing, and manufacturing of

wood products.

Secondary jobs, such as transportation and service-related occupations, are also affected by the processing of wood. The 1997 TSPIRS Report for the Chequamegon-Nicolet National Forest estimates that approximately 14.0 jobs/ million board feet of timber are created/sustained. This is the most recent published report as a source for an employment multiplier.

Through the duration of the timber sale contracts, Alternatives 2, 3, 4 and 5 would help to maintain current employment levels, current saw log and pulpwood supplies to area mills, and revenues to both federal and local governments. Many of the red pine and northern hardwood stands would continue to be available for thinnings on a 10-15 year intervals until the final rotation ages are reached. Aspen and jack pine stands would also be available for future rotation harvests, which would contribute to local revenues. Twenty-five percent of gross receipts from timber sales on the Chequamegon-Nicolet National Forest are collected and paid to the State of Wisconsin. These monies are then distributed to each respective county of origin. Table 4.2.12a displays a Summary of the comparative economic efficiency and economic impacts that would be expected under each alternative

Table 4.2.12a Comparison of effects on Economics by Alternative

	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5
PV-Benefits	$0.00	$904,497	$1,088,145	$772,769	$958,929
PV-Costs	$0.00	$423,675	$450,213	$393,308	$441,536
Present Net Value	$0.00	$480,822	$637,931	$379,461	$517,393
Benefit-Cost Ratio	0	2.13	2.42	1.96	2.17
Commodities Produced a breakdown by product and amount is located in the project file.	0	23.0 MMBF	28.0 MMBF	20.0 MMBF	25.0 MMBF
Income generated	$0.00	$23,600,000	$28,750,000	$20,500,000	$25,650,000
Jobs created	0	325	396	283	354
Payments to Counties *	$0.00	$226,124	$272,036	$193,192	$239,732

*Based on twenty-five percent of gross receipts from timber sales. The DEIS figure used was incorrectly calculated based on present net value and not gross receipts.

Cumulative Effects of All Alternatives

Harvesting dating back to the late 1800's supported several small towns in the area, including large sawmills at Shanagolden , Morse, and Mineral Lake which relied on the pine and hardwood saw timber from this project area. Currently, saw timber goes to mills in Prentice, Park Falls, Hayward, Fifield, and Minocqua, Wisconsin and Grand Marias, Minnesota. Pulpwood goes to mills in Wisconsin Rapids and Hayward, Wisconsin and also to Cloquet, Minnesota.

Employment in the logging industry fluctuates based on market and weather conditions. Selection of Alternative 1 would mean a loss of wood supply for area mills and less revenue for the Federal Treasury as well as local governments. Through the duration of the sale contracts, the action alternatives would help (at varying levels by volume of action alternative) to maintain current employment levels, current saw log and pulpwood supplies to area mills, and revenues to both Federal and local governments.

Over the long term, Silvicultural treatments included in the action alternatives would promote the project area's capacity to produce both a greater quantity and a better quality of wood products. The alternatives would vary in this by the number of acres treated. The alternatives are ranked as follows, by acres treated: Alternative 1 – fifth; Alternative 2 – third; Alternative 3 – first; Alternative 4 – fourth, Alternative 5 – second.

Over the 10-year period from 1992-2001, the average annual Chequamegon-Nicolet National Forest timber output was 133.5 MMBF. The average value during the same period was approximately $6.1 million. In general, the average cut volume has declined slightly and the average cut value has more than doubled. As long as the harvest level continues at or around its current level, area social and economic conditions are not expected to change substantially from the current conditions.

4.2.13 Effects on Threatened, Endangered and Sensitive Species

Biological Assessment

A Biological Assessment (BA) has been prepared as a separate document, for the selected alternative; to analyze effects from project area activities on federally listed threatened and endangered species (See Appendix E).

Contact was initiated with the U.S. Fish and Wildlife Service at the time of project scoping. A reply dated June 5, 2001 stated, "due to the nature and location of the proposed activities, we conclude that the above listed species and critical habitat [bald eagle, gray wolf, Canada lynx, piping plover, piping plover critical habitat] will

not be affected".

The BA also reached the determination of "no effect" for bald eagle, gray wolf, and Canada lynx, based on predicted direct, indirect, and cumulative effects. The piping plover was not evaluated in detail due to a lack of suitable habitat in the project area. The BA was sent to the U.S. Fish and Wildlife Service for their review on April 18, 2003.

Biological Evaluation

A Biological Evaluation (BE), summarized here, was prepared as a separate document for the proposed action and all alternative actions, to determine any effects on species listed as Region 9 Regional Forester Sensitive Species (RFSS). These species were identified in cooperation with the Wisconsin Department of Natural Resources, the state Natural Heritage Program, The Nature Conservancy, USDA Forest Service Region 9 TES staff, and other species experts outside the agency.

The following RFSS were determined to be present in the project area, or to have potential for occurring (potential habitat exists within the project area), and were evaluated in more detail.

Regional Forester Sensitive Species	*Occurrence Potential*
Martes americana – American pine marten	Confirmed
Myotis septentrionalis – Northern (long-eared) myotis**	Minimal
Pipistrellus subflavus – Eastern pipistrelle**	Minimal
Accipiter gentilis – Northern goshawk	Confirmed
Ammodramus leconteii – LeConte's sparrow	Minimal
Buteo lineatus – Red-shouldered hawk	Minimal
Catharus ustulatus – Swainson's thrush	Confirmed
Chlidonia niger – Black tern	Confirmed
Cygnus buccinator – Trumpeter swan	Minimal
Dendroica cerulea – Cerulean warbler	Confirmed
Falcipennis canadensis – Spruce grouse	Minimal
Oporornis agilis – Connecticut warbler	Confirmed
Picoides arcticus – Black-backed woodpecker	Confirmed
Gomphus viridifrons – Green-faced clubtail	Minimal

Incisalia henrici – Henry's elfin butterfly	Minimal
Botrychium oneidense – Blunt-lobed grapefern	Minimal
Calypso bulbosa – Calypso orchid	Minimal
Carex assiniboinensis – Stoloniferous sedge	Minimal
Cypripedium arietinum – Ram's head lady's-slipper	Minimal
Dryopteris expansa – Spreading woodfern	Minimal
Malaxis brachypoda – White adder's mouth	Minimal
Panax quinquefolius – Ginseng	Minimal
Poa paludigena – Bog bluegrass**	Minimal
Polystichum braunii – Braun's holly fern	Minimal
Potamogeton pulcher – Spotted pondweed**	Minimal
Pyrola minor – Lesser wintergreen	Minimal
Ranunculus lapponicus – Lapland buttercup**	Minimal

Species identified by ** are not currently listed as RFSS for the Forest. They are listed as Sensitive for nearby National Forests however, and suitable habitat exists on the Chequamegon-Nicolet, therefore they were considered in the BE.

Direct, Indirect, and Cumulative Effects

The following list summarizes the determination of effects for the above listed species:

No impact

Ammodramus lecontei – LeConte's sparrow

Buteo lineatus – Red-shouldered hawk

Chlidonia niger – Black tern

Dendroica cerulea – Cerulean warbler

Picoides arcticus – Black-backed woodpecker

Botrychium oneidense – Blunt-lobed grapefern

Calypso bulbosa – Calypso orchid

Carex assiniboinensis – Stoloniferous sedge

Cypripedium arietinum – Ram's head lady's-slipper

Dryopteris expansa – Spreading woodfern

Malaxis brachypoda – White adder's mouth

Panax quinquefolius – Ginseng

Poa paludigena – Bog bluegrass

Polystichum braunii – Braun's holly fern

Potamogeton pulcher – Spotted pondweed

Pyrola minor – Lesser wintergreen

Ranunculus lapponicus – Lapland buttercup

May impact individuals but not likely to cause a trend to federal listing or loss of viability

Martes americana – American pine marten

Myotis septentriopnalis - Northern (long-eared) myotis

Pipistrellus subflavus - Eastern pipistrelle

Accipiter gentilis – Northern goshawk

Catharus ustulatus – Swainson's thrush

- *Cygnus buccinator* – Trumpeter swan
- *Falcipennis canadensis* – Spruce grouse
- *Oporornis agilis* – Connecticut warbler
- *Gomphus viridifrons* – Green-faced clubtail
- *Incisalia henrici* – Henry's elfin butterfly

Recommendations, Mitigation

Measures were recommended to mitigate potential effects of project area activities on known sensitive species populations and/or potential habitat. They are listed by species within the Biological Evaluation (FEIS Appendix D, Section VI). These measures cover northern goshawk, trumpeter swan, spruce grouse, black-backed woodpecker, Swainson's thrush, calypso orchid, ram's head lady's-slipper, and white adder's mouth. These mitigation measures are also included in the summary of project area mitigation measures listed in Appendix C.

4.2.14 Effects on Management Indicator Species (MIS)

The following effects analysis for Management Indicator Species (MIS) in the project area is summarized from the Wildlife resource specialist report (included as part of the project record). None of the alternatives are expected to threaten viability for any MIS within the project area. Additional information regarding MIS habitat availability, monitoring, and trend data can be found in Appendix H of the Cayuga EIS.

NOTE: Project area bird population estimates (existing condition) and projections (by alternative) are calculated using the NNFBIRD population modeling software developed by Dobiesz (1998); projections were calculated for Alternatives 1 (no action) and 3 (greatest amount of harvest) only, to indicate what the maximum variation might be. Projected populations are at the end of the first decade following implementation. These numerical estimates are based on survey data from the Nicolet National Forest, and involve some limitations in terms of sample sizes and stand age information. They are used as one source of information, in combination with past trends, habitat availability, and effects analysis.

Unless stated otherwise, recent trend information is from Lind et al., 2001.

Ring-necked duck

Adequate habitat is available Forest-wide to meet management objectives; habitat is available within project area. Project area population estimate: 8 pair. There is not good survey data for this species, but it is felt to be fairly common in northern Wisconsin, although at low densities, with stable populations. The project is not expected to have any noticeable effects on this species, due to a lack of direct effects on habitat. All alternatives, including Alternative 1, would involve a continuation of current beaver control and dam removal on McCarthy Creek. There could be beneficial indirect effects from the action alternatives, due to potential for increased beaver activity in some water bodies; wetlands within or adjacent to harvested stands would be protected by mitigation measures.

Common yellowthroat

Adequate habitat is available Forest-wide to meet management objectives; habitat is available within project area. Project area population estimate: 509 pair. There has been a significant population decline reported for this species on the Chequamegon since 1991; Breeding Bird Survey records also indicate a significant decline in the northern hardwood/spruce region that includes the Chequamegon. No significant change is reported for the three Wisconsin/Minnesota national forests combined. Project area populations are expected to remain more or less stable, although the combination of some aspen conversions (under any alternative, but less so with Alternative 3) combined with other area trends toward more closed-canopy forests could help perpetuate the current decline. Lowland shrub habitat is most important for this species; however, other types of disturbed, shrubby habitat will also be used. The areas of lowland shrub would not be affected substantially by the project; a very small amount would be cut adjacent to McCarthy Creek, and some could be affected by any increase in beaver activity. Clearcutting of aspen under the action alternatives could provide additional habitat in the form of young, shrubby regeneration. Recent harvest to the south of the project area has also provided increased habitat for this species.

Population projections: Alternative 1 – 614 pair; Alternative 3 – 504 pair.

Pileated woodpecker

Adequate habitat is available Forest-wide to meet management objectives; habitat is available within project area. Project area population estimate: 68 pair. No trend data is available for the Forest, but most reports indicate increasing trends (some significant) for region. Project area activities should result in more or less

stable populations over the long term. Alternative 1 would likely maintain the most stable population level, since there would be more areas remaining of over-mature aspen and conifer stands. There could be some local detrimental effects from harvest under the action alternatives, including removal of dead and dying jack pine in the Day Lake area, and clearcutting of over-mature (over 70-80 years old) aspen stands. In general though, all alternatives would involve a gradual maturing of the northern hardwood type, which would provide better structure (larger average diameter) for nesting and foraging. Selection cutting in hardwoods could remove some dead and dying trees, but would accelerate the growth of the remaining trees. There would be few impacts on suitable lowland conifer habitat, except for possibly a small amount of disturbance from construction of temporary winter roads. Mitigation measures would maintain some habitat features even in harvested stands by the retention of snags and cavity trees. The lack of activity in the Iron River IPWA would maintain a large amount of habitat in the form of over-mature aspen.

Population projections: Alternative 1 – 78 pair; Alternative 3 – 67 pair.

Pine warbler

Adequate habitat is not available Forest-wide to meet management objectives, according to Plan guidelines (red and white pine and white spruce greater than 130 years old). The pine warbler has been reported in much younger stands in Forest bird surveys however, with more reports from plantation-origin red pine than any other forest type. The species has been reported from a number of sites on the district. Project area population estimate: 71 pair. Latest information indicates no significant population change on the Forest since 1991, or on the three Wisconsin/Minnesota Forests combined, but a significant increase within the northern hardwood/spruce region. The population within the project area is expected to remain stable or increase. There would not be direct effects from clearcutting, although there could be some minor indirect effects where clearcutting was adjacent to pine warbler habitat. This species is not expected to be as susceptible to edge effects as some species, however, since it is not a ground nester, and has low records of parasitism. There could be some direct effects from thinning of preferred habitat, although much of this harvest would be done outside of the nesting season. The long-term indirect effect of this harvest could be an improvement in habitat from improved structure of the treated stands, and eventually from an increase in the white pine type. Alternative 1 would also involve a gradual maturing of the pine type, and would not involve any direct disturbance, but would also not involve any planting of white pine.

Population projections: Alternative 1 – 95 pair; Alternative 3 – 87 pair.

Blackburnian warbler

Adequate habitat is available Forest-wide to meet management objectives; habitat is available within project area. Project area population estimate: 404 pair. There is no significant population change reported on the Forest since 1991, or on the three Wisconsin/Minnesota Forests combined, but there is a significant increase in the northern hardwood/spruce region. This species requires mature conifer, including mature hardwood stands with a significant conifer component. Stable populations are predicted within the project area overall, with potential for a population increase under Alternative 1. There could be some local declines under the action alternatives, primarily due to clearcutting of mature balsam type. Indirect effects of clearcutting on adjacent stands is possible; however, this species, like the pine warbler, nests higher in trees rather than on the ground or in the shrub layer, so is less susceptible to predation; it also has few records of nest parasitism (Terres, 1980 – p. 966). There could be some direct effects in red pine, white spruce, and mixed hardwood/hemlock stands if harvest occurred during the nesting season. Habitat could improve over the long term with management of these stands, as the conifer matured and overall stand structure improved. Conifer components within northern hardwood stands would be reserved. There could be some long-term effects on habitat if deer browsing continued to affect survival of hemlock seedlings. The mature lowland conifer that is also used by this species would be essentially unaffected by project activities.

Population projections: Alternative 1 – 593 pair; Alternative 3 – 534 pair.

Brown creeper

Adequate habitat is available Forest-wide to meet management objectives; habitat is available within project area. Project area population estimate: 353 pair. There has been a significant population decrease on the Forest since 1991, but no significant change in the three Wisconsin/Minnesota Forests combined, or in the northern hardwood/spruce region. Implementation of Alternative 1 would likely result in fairly stable populations. There is a potential for local declines of this species under the action alternatives, due primarily to clearcutting of mature and over-mature aspen and balsam fir stands, and resulting loss of foraging and nesting habitat. This could result in overall project area population decline. There would be some limited indirect effects from clearcutting, due primarily to increased predation in adjacent stands (parasitism is uncommon for this species, probably due to its nesting habits). There could be some direct effects on this species from selection cutting in mixed hardwood stands, if harvest occurred during nesting season; there could be some indirect beneficial effects due to increased growth and structural complexity of the stands. Some large areas of suitable habitat

would be retained in all alternatives in the Iron River IPWA.

Population projections: Alternative 1 – 354 pair; Alternative 3 – 311 pair.

Olive-sided flycatcher

Adequate habitat is available Forest-wide to meet management objectives; habitat is available within project area. Project area population estimate: 71 pair. The abundance of this species is too low to assess trends on a local basis. The U.S. Geological Survey's Breeding Bird Survey (BBS) indicates significant declines in much of the birds' range, including the Lake States (NatureServe, 2000). This species is primarily a boreal species and is not common anywhere on the Forest. In the project area it would most likely be found in lowland conifer forests, but could also be found in mixed conifer/aspen forests. For this reason it could be directly affected by clearcutting, if the harvest was done during nesting season. Indirect effects would be less obvious, since this species seems tolerant of disturbance as long as nest and perch trees remain. Slightly higher numbers are therefore predicted for Alternative 1, but the action alternatives would probably result in relatively stable numbers also.

Population projections: Alternative 1 – 96 pair; Alternative 3 – 73 pair.

Barred owl

Adequate habitat is available Forest-wide to meet management objectives; habitat is available within project area. Project area population estimate: 6 pair. The abundance of this species is too low to assess trends on a local basis. BBS records indicate a significant population decline in eastern North America between 1978 and 1988 (NatureServe, 2000). Alternative 1 would likely result in stable populations due to lack of disturbance, and gradual maturing of habitat. The action alternatives could result in at least a temporary decline. Selective harvest of northern hardwood types could result in disturbance to nesting birds if the harvest was done in late winter or spring. Barred owls in harvested stands would be more susceptible to competition from great horned owls until the trees grew and the canopy closed. Clearcutting of mature and over-mature aspen stands could result in loss of habitat. The lack of action in the Iron River IPWA would maintain a large area of undisturbed nesting habitat.

Population projections: Alternative 1 – 7 pair; Alternative 3 – 6 pair.

Thirteen-lined ground squirrel

There is not adequate habitat Forest-wide to meet management objectives, according to Forest Plan guidelines; there is habitat available within the project area. Project area population estimate: population figures or estimates are not available for this species. Trend information is not available; however, it is likely that populations of this species fluctuate with changes in vegetation cover and yearly weather patterns. The species is considered common in Wisconsin, although it is less plentiful in forested parts of the state, including the Chequamegon. Population changes are difficult to estimate, but it is possible that there could be a long-term decline under any alternative, since all alternatives would involve some reduction in acreage of upland openings. Some suitable habitat would continue to remain in more open forest stands and brushy areas (anywhere that some grass development is allowed) and in agricultural areas in adjacent private lands.

Brook trout

Forest-wide population goals and habitat needs were not estimated as part of the Forest Plan process; habitat is available within project area. Project area population estimate: Population estimates for project area streams can only be extrapolated from comparison with other northern Wisconsin streams that have had a more extensive survey history. Estimates are available in terms of trout per mile for several other streams of a similar size to project area streams (under 15-foot width); however, this data comes from Class I trout streams, which would be expected to hold larger populations of brook trout (data is from Ed Avery, WDNR coldwater research, 12/10/01). These figures range from 166 trout per mile to 1386 trout per mile (there are approximately 9.8 miles of Class II trout stream in the project area). Habitat trend information is not available, but habitat quality has been improving Forest-wide recently; therefore, it is likely that populations of brook trout have increased. Alternative 1 would be expected to maintain a stable population over the short term. The action alternatives would likely result in a population increase within the project area in general, and specifically within McCarthy Creek, due to habitat improvements. Long-term effects of all alternatives would include an improvement in habitat and therefore trout populations, as riparian aspen gradually matured and converted to other forest types.

White-tailed deer

Adequate habitat is available Forest-wide to meet management objectives; habitat is available within the project area. Project area population estimate: 1405 individuals (based on Management Unit estimates for winter of 2000-2001). Local trends are likely similar to those for all of Management Unit 6, which has varied greatly

depending primarily on winter severity. The population in this unit in winter of 1997-1998 after two years of severe winters was less than half what it had been two years earlier. Other factors such as baiting and feeding, and hunting success also help determine overall population levels. Project area activities could have some temporary additive effects, since more woody browse and herbaceous material would be created by clearcutting. Over the long term, the action alternatives would have the effect of maintaining more of the aspen type, and therefore support more deer. Alternative 1 would result in less optimal habitat within the project area; however, there would still be adequate habitat available due to areas such as older clearcuts, roadsides, and adjacent agricultural areas.

Ruffed grouse

Adequate habitat is available Forest-wide to meet management objectives; habitat is available within the project area. Project area population estimate: 111 pair. Population trends in Wisconsin are basically stable; however, the cyclic nature of ruffed grouse populations complicates trend analysis. Currently area populations are in the downward side of the cycle. Cyclic trends will continue in the project area regardless of alternative chosen. There would be more habitat available in the short term under the action alternatives, compared to Alternative 1, due to clearcutting of aspen and creation of favorable shrub/early successional habitat. Activities proposed in Alternative 2, and especially Alternative 4, could also result in long-term decreases in aspen type, due to conversion of some aspen stands. This could result in a long-term decrease in grouse populations within the project area, especially if the Iron River IPWA did not experience active aspen management in the near future.

Spring peeper

Forest-wide population goals and habitat needs were not estimated as part of the Forest Plan process; habitat is available within the project area. Project area population estimate: population figures or estimates are not available for this species. Surveys are conducted yearly on the district for this species and other frogs; however, there is not adequate information to determine trends. The statewide population trend for 1984-1999 is a significant decline, with a non-significant decline for northwest Wisconsin (Mossman et al., 1998). Project area populations are predicted to be stable under all alternatives, or in slight decline. Any decline would likely reflect a regional or statewide decline, and would not be directly related to project activities. Habitat or populations will not be affected under any alternative; mitigation measures will protect wetland areas within or adjacent to treated areas.

4.3 Relationship Between Short-term Uses and Long-term Productivity

The National Environmental Policy Act requires consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

The short-term and long-productivity pertaining to water, soils and timber productivity are discussed in Section 4.2.

All alternatives would be implemented under the mandate of the Multiple Use and Sustained Yield Act of 1960, which requires the Forest Service to manage National Forest System lands for multiple uses, including timber, recreation, fish and wildlife, range, and watershed. All renewable resources are to be managed in such a way that they are available for future generations. The harvest and use of standing timber can be considered a short-term use of a renewable resource, trees can be reestablished and grown again if the productivity of the land is not impaired.

Maintaining the productivity of the land is a complex, long-term objective. All alternatives would protect the long-term productivity of the Project Area through the use of specific standards and guidelines, mitigation measures, and BMPs. Timber management activities would have direct, indirect, and cumulative effects on the economic, social, and biological environment.

Soil and water are two key factors in ecosystem productivity, and these resources would be protected in all effected areas in all alternatives to avoid damage that could take many decades to rectify. Sustained yield of timber, wildlife habitat, and other renewable resources all rely on maintaining long-term soil productivity. The quality and quantity of water from the Project Area may fluctuate as a result of short-term uses, but no long-term effects to the water resources are expected to occur as a result of resource management activities.

All alternatives would provide the wildlife habitat necessary to contribute to the maintenance of viable, well-distributed populations of existing native and desired non-native vertebrate species. The abundance and diversity of wildlife species depends on the quality, quantity, and distribution of habitat, whether used for breeding, feeding, or resting. Management Indicator Species (MIS) are used to represent the habitat requirements of all wildlife species found in the Project Area. By managing habitats and populations of indicator species, the other species associated with the same habitat would benefit. The alternatives provide standards, guidelines, and mitigation measures for maintaining long-term habitat and species productivity.

Timber harvest rotations, in aspen stands are normally on a 45-year or longer rotation, depending upon site

quality. Management of timber resources on these rotations could affect long-term productivity, depending on the intensity of silvicultural practices. Projected timber management activities are not anticipated to affect long-term productivity. Mitigation measures would be planned under all the alternatives to ensure future availability of other renewable resources as well.

Opportunities for developed and dispersed recreation use, including hiking, hunting, canoeing, skiing, camping, snowmobiling, and fishing would be maintained for future generations. The setting in which these activities occur varies, but the long-term potential for the Project Area to provide a spectrum of recreational opportunities would be maintained in all alternatives.

4.4 Irreversible and Irretrievable Commitments of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line rights-of-way or road. The effects analyses identified no irreversible or irretrievable commitments of resources for any of the 12 issues that were analyzed.

4.5 Optimality and Appropriateness of Harvest Method

Choosing the optimum harvest method for regenerating a particular stand is influenced by the silvicultural requirements of the species on the site, existing stand conditions, issues raised during the analysis, prior experiences in the area, and direction from the Forest Plan. A silvicultural prescription is assigned to each stand after a field examination of the stand is completed. This prescription is based primarily on the biological requirements of the stand and the objectives of the Management Area. This prescription is then subject to interdisciplinary analysis, with special consideration given to the issues raised during scoping and the alternatives developed.

Just as the objectives of each alternative are different, the harvest method for a given stand may also differ. In some cases, prescriptions may be modified in order to mitigate other resource concerns such as visual quality, water quality, or composition guidelines. Regardless of the alternative, the proposed harvest method would always be sufficient to ensure adequate regeneration stocking of the stand.

The National Forest Management Act of 1976 (Section 6(g)(3), (e)(iv) and (f)(i)) and the resulting Secretary's Regulations (36 CFR 219.15) require that vegetation management practices be chosen that are appropriate to meet the objectives and requirements of the Land and Resource Management Plan. Appendix D of the Forest Plan has a detailed discussion of this topic arranged in four sections; silvicultural systems and regeneration harvest methods, choice of harvest method, criteria for choosing harvest method by management prescription,

and the optimality of the harvest method.

The use of clearcutting is the optimum method for promoting the regeneration of certain species in the Project Area. These activities are consistent with the Forest Plan, in particular for regeneration of aspen, jack pine, and red pine. The use of even-aged management is consistent with the direction for Goal Areas 1 and 2. For further discussion, see Appendix D of the Chequamegon National Forest Land and Resource Management Plan.

In addition, there are a number of proposed treatment sites that would create temporary openings that are larger than 40-acres. These aspen harvest units (over 40 acres) are designed to manage large contiguous blocks and reduce edge and are subject to review under 36 CFR 219.27(d)(2). The review process followed the direction from the Regional Office stated in the September 1, 1999 memo to Forest Supervisors.

The Silvicultural Diagnosis Matrix (Cayuga Project Record) displays the analysis that was conducted for determining the optimality of clearcutting. .