4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This Chapter summarizes the physical, biological, social and economic environments of the project area and the effects of implementing each alternative on that environment. It also presents the scientific and analytical basis for the comparison of alternatives presented in Chapter 2.

Chapter Preview

4.1	Introduction
4.2	Soil Resources
4.3	Water Resources
4.4	Air Resources
4.5	Vegetation Structure and Composition
4.6	Landscape Pattern
4.7	Wildlife Resources
4.8	Fish Resources
4.9	Transportation System
4.10	Recreation Resources
4.11	Visual Resources
4.12	Heritage Resources
4.13	Economic Effects
4.14	Forest Plan Revision

4.2 Soil Resources

4.2.1 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 McCaslin 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, burning and nutrient removal.

4.2.2 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, displacement, burning, and nutrient removal. 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 section 2.3 for a list of mitigation measures and the tables in Appendix A for a listing of where they would be applied).

4.2.3 Direct and Indirect Effects of Alternative 1

This is the no action alternative.

4.2.3.1 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 roads, trails, campsites, stream banks and road/stream crossings have been identified within the project area and are discussed in Section 1.3 and in the Fisheries Resources section of Chapter Three (3.8.0). 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 McCaslin area.

4.2.3.2 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 unsurfaced 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.

4.2.3.3 Effects to Soil from Fire

There is no potential for soil impacts from prescribed burning in this alternative. A catastrophic wildfire event would have the potential to impact the physical, chemical and biological properties of soils depending upon the severity of the burn. Sandy soils with low organic matter content would be most susceptible to adverse impacts from a high intensity wildfire. There are less than 150 acres of the Vilas ELT that has this soil type within the project area. The extent, intensity and duration of any wildfire related effects to the soil resource would have to be evaluated on a case specific basis. The potential for a catastrophic wildfire event in the McCaslin area is very low.

4.2.3.4 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 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 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.

4.2.4 Direct and Indirect Effects of Alternatives 2, 3, 4 and 5

These are the action alternatives as described in Section 2.2. Proposed activities that have potential to affect the soil resource include:

- Timber harvesting
- Constructing new road
- Reconstruct existing road
- Prescribed fire – low intensity under burn
- Prescribed fire - moderate to high intensity broadcast burn

- Decommissioning roads
- Reconstructing trails to stabilize soil
- Stabilizing soil on river bank

Table 4.2-1 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.

The potential effects of alternative 2 through 5 on the soil resource were assessed on a site-specific basis by a soil scientist and other resource specialists 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 Alternative treatment tables in Appendix A lists the ELT, ecological landtype 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 Section 2.3.

Of the 22,000 acres of National Forest lands in the project area, from 31 to 40 percent would have potential ground-disturbing activities in alternatives 2-5 across the range of ELTs described in Section 3.2. This leaves between 60 to 69 percent of the federal lands in the project that do not have such activities planned. All of the ELTs receiving treatments in this alternative are also represented in the untreated portions of the project area.

Table 4.2-1 Potential Ground Disturbing Activities by Alternative

Activity	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Harvest Acres	8,688 acres	6,913 acres	8,842 acres	8,554 acres
Construct New Road	3 miles	0	3.43 miles	2.92 miles
Reconstruct Road	14.32 miles	1.16 miles	11.09 miles	6.77 miles
Underburn	169 acres	0	119 acres	119 acres
Broadcast Burn	53 acres	18 acres	53 acres	53 acres
Decommission Road/ Berms	22.14 miles 61 berms	30.43 miles 99 berm	26.36 miles 89 berms	27.61 miles 92 berms
Reconstruct Trail	150 feet	150 feet	150 feet	150 feet
Stabilize River Bank	100 feet	100 feet	100 feet	100 feet

4.2.4.1 Soil Erosion and Displacement

The potential for soil erosion and displacement is very low within proposed harvest areas. 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 Lakewood-Laona 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 will 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 tree tops to drag on the ground. This will 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.

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 McCaslin Project include:

- avoiding steep slope areas (>30%) within sale unit boundaries;
- 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.

See Section 2.3 for detailed descriptions of the mitigation measures for the McCaslin Project, and the tables in Appendix A to see where they would be applied.

Potential for soil erosion exists when mineral soil is exposed during the road construction and reconstruction process. This potential is eliminated or minimized by following Wisconsin Best Management Practices pages 21-37, Nicolet NF Land and Resource management Plan standards and guidelines pages 56-57, and FSH 7709.58 for site-specific road design features (in the project file at the Lakewood Ranger Station). The proposed road reconstruction would improve grade, drainage, and stabilize road surfaces, thus, reducing potential for erosion. Soil would be displaced and covered with other materials in the road construction and reconstruction process. 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).

Low intensity prescribed under burning on Stambaugh-Padus and Pence ELTs would not expose mineral soil and, if applied as planned, has no potential to cause soil erosion. Moderate to high intensity prescribed burning is proposed on 18 or 53 acres of Stambaugh-Padus ELT to encourage early successional fire adapted species and maintain openings. These areas average less than 10% slopes and have a thick litter and organic soil layer with good moisture retention. A spring or fall burn of an intensity sufficient to accomplish the stated objectives, would not consume the organic layer or create water repellent conditions, and mineral soil would not be exposed over enough area to cause erosion. Areas maintained as openings have a high component of sedges and grasses with dense root systems to keep the soil in place. A two foot wide line of bare mineral soil may be needed to keep fire from spreading outside of the burn area. This exposed soil would seed in naturally within one growing season and would not be an erosion concern.

Permanently closing roads, installing berms, reconstructing trails and stabilizing the rivers bank, 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.

4.2.4.2 Soil Compaction

The potential for soil compaction and rutting from operation of heavy equipment is slight for project sites on the sandy textured Vilas, Pence or Sarona-Keweenaw ELTs. Alternatives 2-5 propose to treat 1258, 1041,

1290, or 1251 acres, respectively, within these ELTs. Operation of heavy equipment would be monitored by the Sale Administrator and limited during excessively wet weather.

Potential for soil compaction and rutting in the fine sandy loam or silt loam textured Stambaugh-Padus and Iron River ELTs is moderate. Alternatives 2-5 propose to treat 7430, 5871, 7552, or 7303 acres, respectively, within these ELTs. These fine-textured ELTs hold moisture in surface horizons longer and lose strength when temporarily saturated from spring snowmelt and heavy rainfalls. These soils are well or moderately well drained and 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. Site-specific mitigation measures and design features listed in the treatment tables in Appendix A 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 ELTs both within and outside of the McCaslin project area. Findings to date indicate no signs of reduced productivity due to soil compaction or rutting (Elevation Sale Field Visit, 2001; Timber Sale Activity Review Report, 2000; End-of-Decade Monitoring Report Che-Nic NF 1986-1996, p65).

Constructing up to 3.43 miles of new road would compact new soil areas and change the land use from productive forest to transportation system. Reconstruction of between 1 and 14.3 miles of existing system roads would improve road surface conditions for the intended level of use and is not considered in assessing detrimental compaction, as discussed in the previous section 4.2.5.1. Decommissioning of between 22 to 30 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. Also, reconstruction would allow for more low-impact access.

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.

4.2.4.3 Effects to Soil from Fire

There is potential for soil impacts from prescribed burning in these alternatives.

A low intensity under burning of northern red oak plant communities on the Stambaugh-Padus and Pence ELTs is proposed to reduce brushy competition. Burning would be done in spring or fall when the litter layer is moist. The intensity and duration of a forest fire determines the effects on the physical, chemical and biological properties of the soil. These controlled fires would be relatively cool with no areas of heavy fuel buildup like slash piles or windrows of debris. A portion of the under story vegetation and forest floor debris would be burned. Prescribed fires seldom remove more than 50 percent of the surface organic layers and the soil organic fraction of the A horizon is not generally affected by light burns (Pritchett, 1979, p 420). Effects to the soil resource from under burning these sites may include (after Pritchett, 1979, pp420-433):

- An increase in available phosphorous, potassium, calcium and magnesium in the mineral soil for 1-5 years
- Some nitrogen loss through volatilization (minor amounts)
- Temporary increase in nitrogen availability to trees
- Temporary increase in tree growth due to availability of nutrients
- Minimal increase in soil temperature during the burn due to moist, insulating humus layer
- Very minimal increase in soil temperature after the burn because the canopy shades the darkened ground surface
- Initial decrease in soil microbes/bacteria followed by sharp increases as soon as the first rainfall following the burn
- Soil animals such as arthropods (e.g. beetles, ants, centipedes, millipedes, springtails, spiders, ticks, mites) are more numerous after controlled burns
- Earthworm populations may be decreased due to initial post burn adverse moisture conditions and reduced food supply

A moderate to high intensity prescribed burn is proposed for 18 or 53 acres on the Stambaugh-Padus ELT to maintain non-forested openings. These sites are existing openings and would be warmer and dryer during a spring or fall burn, than the red oak communities discussed above. However, the fuels are mostly grasses and shrubs and the intensity and duration of the burn would not be substantially increased due to lack of coarse woody fuel concentrations in contact with the ground. Soil organic matter would not be destroyed and overall effects to the soil resource would be similar to those described above. Soil temperature would temporarily increase from the darkened ground surface with no anticipated adverse effects to the quality of the soil resource. Sedges and grasses and shrubs would utilize the short-term increase in nutrients.

There would be no short or long-term detrimental soil disturbance effects from the prescribed burning proposed in these alternatives. The intensity and duration of the burns would not be severe and would not impair soil physical, chemical or biological properties.

4.2.4.4 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, prescribed fire, 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, prescribed fire, rutting and compaction are determined to be minimal, as described in the three previous sections, and will not adversely affect the inherent soil productivity of the ELTs 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).

New road construction would change the land use for that area from productive forest to part of the overall transportation system, however, permanently closing 22-30 miles of roads that would return to productive forest over time provides a net increase in productive forest land 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 treat 7,330, 6,900, 6,309, or 7,800 acres, respectively, with a thinning or selection harvest that removes between 20-40 percent of the existing overstory trees. This harvest method 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 propose to clearcut from 1099, 0, 2260 or 596 acres, respectively, by having all of the merchantable bole wood 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). About 93-98 percent of the clearcut acres are on relatively rich ELTs where nutrient storage is medium to high. This harvest method would not remove excessive amounts of nutrients from these ELTs 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). About 2-7 percent of the clearcut acres are on the Vilas ELT with sandy soils and naturally low inherent soil productivity. Since 1988 a design feature/mitigation measure specific to this ELT requires leaving the tree tops and limbs at the stump across the harvested area to maintain nutrients. Leaving the logging slash on-site is currently a common practice for all types of harvest on the Chequamegon-Nicolet National Forest. Stone et al (1999, p182) recommend limbing at the stump and retaining of slash on site to maintain productivity when harvesting aspen on sand soils.

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. They 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 section 2.3 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 60 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.

4.2.5 Total Cumulative Effects of all Actions (including Alternative 1, 2, 3, 4 and 5)

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

The analysis boundary for cumulative effects was determined to be those portions of ELTs, ecological landtypes 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 ELTs 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 3 has less potential to impact the soil resource than the other action Alternatives, because fewer acres are proposed for harvesting, road building and burning activities. Alternatives 2, 4, and 5 are relatively similar in the types of activities and amount of acres they propose to treat and would potentially impact more of the soil resource than Alternative 3. 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 mitigation measures and contract provisions would eliminate or minimize potential adverse impacts from erosion, displacement, compaction, rutting, burning, or nutrient removal. Storage of soil and biomass carbon is projected to increase in the vegetation and soil.

Future Actions
At this time there are no specific actions are known to be 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, burning or nutrient removal. Storage of soil and biomass carbon is projected to increase in the vegetation and soil.

Conclusions
The effects of implementing Alternatives 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.

4.3 Water Resources

4.3.1 Summary
Five types of resources were identified as having the potential to be impacted by McCaslin 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, and non-system road reconstruction on the project sites. Treatments proposed in all 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 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, no long-term detrimental water quality effects are expected to occur when the mitigating measures are followed and because of the nature of the project locations.

4.3.2 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). Refer to section 4.8 for a description of the potential effects of sedimentation on aquatic species and their associated habitats.

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) across all land ownerships in Wisconsin, including the National Forest, was monitored by interdisciplinary and interagency teams, during the years of 1995 to 1997. The field evaluations 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.

Nine timber sales on the Laona/Lakewood Ranger District were randomly selected and investigated by these teams. In these reviews, 118 BMP criteria were evaluated. These findings were then summarized into two ratings. The first rating was for Overall Application. A score of 1-5 was given, where 1=total negligence and 5=excellent. The second rating was for Overall Impacts, where 1=severe impacts and 5=very low impacts.

These scores were then added together with 2 being the lowest possible score and 10, the highest. Of the nine sales reviewed on the Laona/Lakewood Ranger District, eight received overall scores of 10. The ninth sale received an overall score of 9.

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 McCaslin project area and were described in section 3.3. 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.

4.3.3 Direct and Indirect Effects of Alternative 1

This alternative proposes no new federal actions, therefore no measurable adverse effects, direct or indirect, would occur to lakes, streams, riparian areas, wetlands, or floodplains as a result of the project activities.

4.3.4 Direct and Indirect Effects of Alternatives 2 - 5

Alternative 2

Thirty stands proposed for some type of treatment were identified as lying adjacent to a lake or stream, within the project area. Eight of these aren't proposed for harvesting, but for planting or hand release. Six of them are identified for thinning, ten for individual selection, one for over-story removal, and five for clear-cutting. Refer to Table 4.3-1, at the end of section 4.3.7 for a list of stands, water resources nearby, and proposed treatments by alternative.

Alternative 3

Twenty stands proposed for some type of treatment were identified as lying adjacent to a lake or stream, within the project area. Eight of these aren't proposed for harvesting, but for planting or hand release. Three of them are identified for thinning, nine for individual selection. No stands are proposed for clear-cutting or over-story removal. Refer to Table 4.3-1, at the end of section 4.3.7 for a list of stands, water resources nearby, and proposed treatments by alternative.

Alternative 4

Twenty-seven stands proposed for some type of treatment were identified as lying adjacent to a lake or stream, within the project area. Six of these aren't proposed for harvesting, but for planting or hand release. Five of them are identified for thinning, six for individual selection, one for over-story removal, and nine for clear-cutting. Refer to Table 4.3-1, at the end of section 4.3.7 for a list of stands, water resources nearby, and proposed treatments by alternative.

Alternative 5

Twenty-eight stands proposed for some type of treatment were identified as lying adjacent to a lake or stream, within the project area. Eight of these aren't proposed for harvesting, but for planting or hand release. Eleven of them are identified for thinning and nine for individual selection. No stands are proposed for over-story removal or clear-cutting. Refer to Table 4.3-1, at the end of this section for a list of stands, water resources nearby, and proposed treatments by alternative.

Alternatives 2-5
The majority of the treatments proposed near streams in all of the action alternatives involve the promotion of long-lived, larger diameter tree species in the riparian area. At least 60 square feet of basal area would also be left in the riparian areas. The result of such treatments would be increased shade and large woody debris inputs for years to come. Most of the treatments proposed near streams include thinning, individual tree selection, under-planting with no cut, or release. In the few stands near streams where clear-cutting is proposed, the riparian area improvements mentioned above will be applied at a minimum to the 100 foot buffer that begins at the high water mark. Mitigation measure Y, Wisconsin Best Management Practices for Riparian Management Zones, describes these practices in more detail.

The project sites occur primarily on nearly level to gently rolling topography. No detrimental erosion or sedimentation would be expected to occur from stand treatment, temporary road construction, and non-system road reconstruction on the project sites due to existing site conditions and mitigation measures. Treatments proposed in the alternative 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 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. A list of water resource related mitigating measures can be found in Section 2.3 and the stands for which they apply to in each alternative can be found in Appendix A.

Table 4.3-1 Vegetative Treatments near Water Bodies by Alternative

Stand	Waterbody	Alternative 2	Alternative 3	Alternative 4	Alternative 5
005039	NF Thunder	Release	Same as 2	Same as 2	Same as 2
010011	Long Lake	Select	Same as 2	Same as 2	Same as 2
010016	Long Lake	Select	Same as 2	Same as 2	Same as 2
011001	N. B. Oconto R.	Planting/release	Same as 2	Same as 2	Same as 2
011019	N.B. Oconto R.	Thin	Select	Clearcut	Same as 2
011024	NB Oconto	Thin	None	None	None
012012	Lincoln L.	Planting/release	Same as 2	CC/release	Same as 2
012028	N.B. Oconto R.	Planting/release	Same as 2	Same as 2	Same as 2
012029	N.B. Oconto R.	Planting/release	Same as 2	None	Same as 2
012030	N.B. Oconto R.	Planting/release	Same as 2	Same as 2	Same as 2
014010	Bluegill Creek	Thin	Same as 2	Same as 2	Same as 2
014018	Spring Lake	Planting/release	Same as 2	Same as 2	Same as 2
015017	N.B. Oconto R.	Thin	None	None	Thin
015020	Plantation L	Thin	Same as 2	Same as 2	Same as 2
024011	Oconto trib from John Lake	Release	Same as 2	Same as 2	Same as 2
024012	Oconto trib from John Lake	Select	None	Clearcut	None
167010	Trib to Otter Ck.	Thin	Same as 2	Same as 2	Same as 2
172003	Knowles Creek	Select	Same as 2	Thin	Same as 2
172011	Unnamed Lake	Clearcut	None	Same as 2	None
172013	Trib to Knowles	Select	Same as 2	Thin	Same as 2
173018	Knowles Creek	Select	Same as 2	Same as 2	Same as 2
174020	Pemma Creek	Clearcut	None	Same as 2	Thin
174029	Pemma Creek	Clearcut	None	Same as 2	Thin
176003	Shawano Creek	Select	Same as 2	Same as 2	Same as 2
176008	Shawano Creek	None	None	Clearcut	Thin
176010	Shawano	Clearcut	None	Clearcut	Thin
176012	Unnamed Lake	Select	Same as 2	Clearcut	Same as 2
176016	Seal Lake	Select	None	Same as 2	Same as 2
176016	Headwaters of Pemma Creek	Select	Same as 2	Same as 2	Same as 2
177027	Shawano trib.	Clearcut	None	Clearcut	Thin
202016	Knowles Creek	Overstory rem.	None	Same as 2	Thin

4.3.5 Total Cumulative Effects of all Actions (including all alternatives)

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

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.

Ten streams and five lakes within the McCaslin analysis area, were identified as being within 200 feet of some type of proposed treatment in at least one of the alternatives. They are listed in **Table 4.3-1**. The project sites are all on National Forest Land. There is private, tribal, and state land nearby the project sites.

Past activities on all ownerships within the analysis area have included timber harvest, road building, and agriculture. 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 timber harvest or agriculture. Long-term effects are those predicted to last more than one year after project completion.

Eighteen road/stream crossings were inventoried within the McCaslin project boundary. Seven of these crossings have been identified as contributing to stream sedimentation from road surface or embankment erosion. Two of them are on county roads; a tributary to Otter Creek at County Road C and West Thunder Creek at County Road F. Bluegill Creek at FR 2531 washed out in 1995. The other streams with crossings that are contributing sediment include Knowles Creek, a tributary to Shawano Creek, John's lake tributary, and Battle Creek. These seven crossings would continue to contribute a total of approximately 5 tons per year of sediment until they are repaired.

The Forest Road 2349 crossing of Shawano Creek is scheduled to be replaced in the summer of 2002. This project is estimated to result in a reduction of sedimentation of several tons per year. There are no known active timber sales near streams or lakes within the project boundary.

Similar management activities may be proposed in the foreseeable future, accompanied by the appropriate mitigation measures, road construction and reconstruction techniques, and harvesting procedures. Because of this, future management activities would not be expected to have adverse long-term cumulative effects to the quality of the water resources.

The Forest Road crossings of Battle, Bluegill, and Knowles creeks will be analyzed for repair and/or restoration at some time in the near future. The crossings of Johns Lake tributary, the tributary to Otter Creek, and W. Thunder Creek occur on private or county roads. Recommendations will be made to repair and/or restore them in the near future. Tribal and corporate timber harvests are planned to occur near Knowles creek between 2002 and 2015. Cumulative impacts to aquatic communities are expected to occur as a result of the past, present, and reasonably foreseeable future activities on National Forest and other lands. When activities are proposed near a lake or stream, many protective measures are in place to prevent any type of direct negative impact to the aquatic community. Indirect negative impacts would not occur due to the many protective measures that are in place to prevent negative impacts to the soil and water resources that occur within the entire watersheds of the project area.

The effects of the proposed activities, when added to the effects of past practices and events, current practices and reasonably foreseeable future proposed actions, would not be expected to result in any appreciable adverse cumulative effects to the quality of the water or wetland resources. BMP's are used on timber sales on other ownerships as well as the National Forest lands, to prevent the occurrence of excessive erosion and sedimentation to streams, lakes, and wetlands from timber harvest operations.

Table 4.3-2 Ownerships and activities adjacent to water bodies with proposed treatments

Water body	Past Actions	Present actions	Future actions
Battle Creek	Forest Service timber harvest	None	Culvert replacement at crossing by Forest Road 2349.
Bluegill Creek	Construction of Bluegill Cr Impoundment Forest Service timber harvest (cc) 1999	None	23 acres of thinning planned on pvt land 2008 Culvert replacement at crossing by Forest Road 2531.
E. Thunder Creek	Forest Service timber harvest	None	None
Johns Lake trib.	None identified	None	Culvert replacement at crossing by John Lake Rd.
Knowles Creek	Construction of Knowles Creek Impoundment Forest Service, tribal and corporate timber sales	Tribal and corporate timber sales (1992-2001).	Culvert replacement at crossing by Forest Road 2141. Tribal and corporate timber sales (2002-2015).
Knowles Creek tributary	Forest Service timber harvest	None	None identified.
McCaslin Brook	Forest Service timber harvest	None	None identified
North Branch Oconto River	Private timber harvest (thin) 1995 Forest Service timber harvest	None	None identified
Otter Creek Trib.	None identified	None	Culvert replacement at County C crossing
Pemma Creek	Forest Service timber harvest	None	None identified
Tributary to Pemma Creek	Forest Service timber harvest	None	None identified
Shawano Creek	Forest Service timber harvest	Forest Road 2349 culvert crossing scheduled to be replaced in summer 2002.	None identified
Tributary to Shawano Creek	Forest Service timber harvest	None	None identified
W. Thunder Creek	None identified	None	Culvert replacement at County F crossing

4.4 Air Resources

4.4.1 Summary

Preliminary analysis shows that air quality within the McCaslin Project Area is good and is within a Clean Air Act attainment area for particulate matter. Proposed activities that could have effects on air quality (road work and prescribed burns) were evaluated for their potential for impacts. It was determined that, due to the extent, intensity, and duration of the effects and their context within the northeastern Wisconsin airshed, effects would be minimal; further analysis of air impacts would be unnecessary.

4.4.2 Discussion

Under the action alternatives, a maximum of 169 acres of oak under-burning is proposed. This would be done at a low intensity to reduce brush and leaf litter while not creating enough heat to scorch the over-story oak trees. It would probably take place between March and May on days that have moderate humidity (35-65%), light wind and good smoke dispersal. It would likely take place during 2-3 separate days due to firefighter availability and once during a five to ten year period. Oak under story contains about 3.5 tons of fuel per acre (Fuel Model 9) and the 169-acre burn would produce about 17.7 tons of particulate matter.

A maximum of 53 acres of grassland burning is proposed to maintain open conditions. Conditions would be similar to those described above. This would probably be done in one day during a five to ten year period. Grass contains about 0.74 tons of fuel per acre (Fuel Model 1) and the 53-acre burn would produce about 0.4 tons of particulate matter.

Emissions from the two burns are well below the *de minimis* threshold of 100 tons for particulate matter and the project area is in attainment for particulate matter. Therefore, no further analyses are needed.

Under the action alternatives, approximately 3 miles of new road would be constructed to access timber stands for forest management activities. These roads would be gravel or dirt surfaced and would be closed after timber sales. In addition to the construction there would be many miles of roads (20+) that would be temporarily reopened to allow logging activities. Following harvests, they would be closed again. These are generally dirt roads. An additional 20 miles or more of unneeded existing roads in the project area would be closed and decommissioned as part of the proposal. These roads would not be used again for timber hauling or motorized public access.

Under the action alternatives, 21.7 to 28.7 miles of Forest Service roads would be open to public use. No dust would be generated during frozen conditions that occur predominantly from November through March (151 days) and during the remainder of the year on days when precipitation is at least 0.01 inches (75 days). Thus the potential to generate local dust on these roads occurs on about 38 percent of the days in the year. Traffic sufficient to generate dust is likely to occur much less frequently and typically in locations that are not near local residences or recreation areas. Therefore, the potential effects of the alternatives on dust and particulate matter are considered minimal and no further analyses are warranted.

4.5 Vegetation Structure and Composition

4.5.1 Summary

Forest Composition

Table 4.5-1, below, summarizes the effects of each of the alternatives on the overall upland forest composition in the McCaslin analysis area. There would be no changes to the lowland composition as a result of this project. The most notable tradeoff between the alternatives is in the amounts of aspen and hardwood types in each alternative. Overall, the amount of hardwood types is expected to increase in all alternatives except Alternative 4. Conversely, there would be a corresponding decrease in the amount of aspen in all alternatives other than Alternative 4.

Table 4.5-1: Summary of overall upland composition resulting from each alternative

	existing		Alternative 1		Alternative 2		Alternative 3		Alternative 4		Alternative 5	
FOREST TYPE	**ACRES**	**%**	**ACRES**	**%**	**ACRES**	**%**	**ACRES**	**%**	**ACRES**	**%**	**ACRES**	**%**
Jack Pine	286	1.5	286	1.5	286	1.5	286	1.5	286	1.5	286	1.5
Balsam fir	321	1.7	321	1.7	311	1.6	321	1.7	311	1.6	311	1.6
Red Pine	870	4.5	870	4.5	870	4.5	870	4.5	870	4.5	870	4.5
White Pine	872	4.5	872	4.5	872	4.5	872	4.5	858	4.5	872	4.5
White Spruce	641	3.3	641	3.3	609	3.2	641	3.3	553	2.9	609	3.2
Mixed Hardwoods	6730	35.1	6730	35.1	6965	36.4	6965	36.4	6088	31.8	7103	37.1
Oaks	1459	7.6	1459	7.6	1459	7.6	1459	7.6	1459	7.6	1459	7.6
White Birch	434	2.3	434	2.3	281	1.5	434	2.3	381	2.0	357	1.9
Hemlock	105	0.5	105	0.5	105	0.5	105	0.5	105	0.5	105	0.5
Aspen	7126	37.2	7126	37.2	7085	37.0	6976	36.4	7932	41.4	6871	35.8
Upland Opening	326	1.7	326	1.7	326	1.7	326	1.7	326	1.7	326	1.7
Total Upland Acres	**19170**	**100.0**	**19170**	**100.0**	**19170**	**100.0**	**19170**	**100.0**	**19170**	**100.0**	**19170**	**100.0**

The following tables (4.5-2 through 4.5-4) summarize the important changes that would take place within each of the Forest Plan Management Areas by alternative. Detailed tables showing all types can be found in Appendix F. As shown above, the most notable changes are in the amounts of aspen and hardwood. In some cases, the proposals move portions of the project area away from Forest Plan DFC's. This was sometimes the result of an alternative's emphasis of a particular condition, such as early successional habitat. In other cases, one type was moved away from the DFC to move another type closer to its DFC.

Table 4.5-2: Primary Vegetation Goals and Existing Conditions for MA 1.1/1.2: Mixed forests with a large aspen component

Vegetative Type	*Desired and Existing Conditions for Lakewood Portion (values in percentages)*						
	DFC	**Existing**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Hardwoods	13	12.4	12.4	14.8	12.4	10.0	13.2
White Birch	8	7.8	7.8	4.7	7.8	6.9	6.0
Aspen	63	48.3	48.3	49.1	48.3	52.2	49.4
Vegetative Type	*Desired and Existing Conditions for Laona Portion (values in percentages)*						
	DFC	**Existing**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
White Spruce	1	18.4	18.4	18.4	18.4	15.0	18.4
Hardwoods	37	27.7	27.7	27.7	29.8	24.5	37.2
Aspen	52	48.6	48.6	48.6	46.4	55.2	39.1

Table 4.5-3: Primary Vegetation Goals and Existing Conditions for MA 3.1/3.2: Even-aged hardwood forests managed for large sawtimber

Vegetative Type	*Desired and Existing Conditions for Lakewood Portion (values in percentages)*						
	DFC	**Existing**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
Hardwoods	32	29.4	29.4	31.6	30.2	25.6	30.6
White Birch	4	3.0	3.0	1.7	3.0	2.7	2.7
Aspen	28	49.4	49.4	49.1	48.6	54.1	49.2
Vegetative Type	*Desired and Existing Conditions for Laona Portion (values in percentages)*						
	DFC	**Existing**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
White Spruce	2	2.1	2.1	2.1	2.1	3.4	2.1
Hardwoods	53	66.0	66.0	66.2	67.2	61.5	68.7
Aspen	29	23.6	23.6	23.4	22.4	26.8	20.9

Table 4.5-4: Primary Vegetation Goals and Existing Conditions for MA 4.1/4.2: Upland softwood forest managed for pulpwood and sawtimber

Vegetative Type	*Desired and Existing Conditions for Laona Portion (values in percentages)*						
	DFC	**Existing**	**Alt 1**	**Alt 2**	**Alt 3**	**Alt 4**	**Alt 5**
White Spruce	8	33.4	33.4	33.4	33.4	28.6	33.4
Hardwoods	23	21.9	21.9	21.9	22.9	15.5	22.9
Aspen	20	32.6	32.6	32.6	31.6	43.8	31.6

Forest Structure

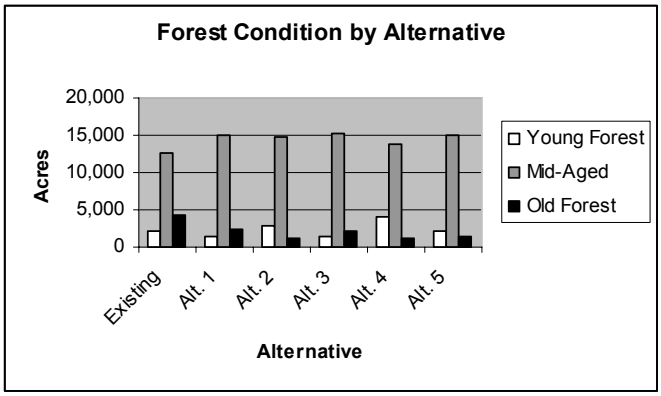
In terms of forest structure, **Table 4.5-5** and **Figure 4.5-1** summarize the general forest conditions that would result from each alternative in the McCaslin Project Area. Detailed tables of age class distribution by forest type can be found in Appendix F.

Table 4.5-5: Forest Age Condition Summary by Alternative

	Existing	%	Alt. 1	%	Alt. 2	%	Alt. 3	%	Alt. 4	%	Alt. 5	%
Young Forest	2,099	11	1,476	8	2,834	15	1,489	8	4,010	21	2,231	12
Mid-Aged Forest	14,536	77	14,974	79	14,809	77	15,124	80	13,760	73	15,099	80
Old Forest	2,207	12	2,392	13	1,199	6	2,229	12	1,072	6	1,512	8

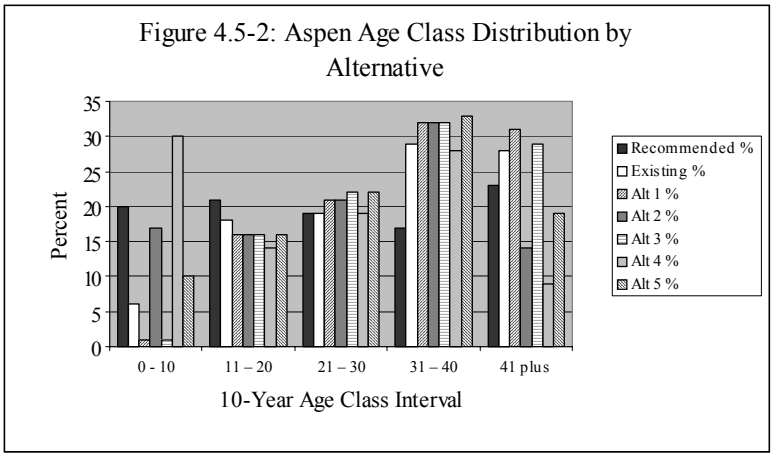
*upland types only. For definitions of each forest condition, see Table 3.5-9 in section 3.5.5.

Figure 4.5-1 Forest Condition by Alternative



Under each alternative, the aspen age class distribution would be expected to change as shown in **Figure 4.5-2.**

Figure 4.5-2 Aspen Age Class Distribution by Alternative



*as it would appear in 2005.

Beyond the effects described above, no notable changes to forest structure and composition are expected as a result of past, present, and future actions.

4.5.2 Introduction

This section will discuss the effects that each alternative is expected to have on the vegetative composition and structure of the project area. Effects will be displayed in relation to Forest Plan direction (USDA-FS, 1986) and the existing conditions outlined in section 3.5. In an attempt to provide relevant context for the Wildlife (4.7) and Landscape Pattern (4.6) sections, discussion will be included on the amounts and quality of young, mid-age, and old forest conditions. This is in concert with recommendations given in the Scientific Roundtable on Biological Diversity (1994).

Since aspen was an important issue in a number of public comments, more detailed discussion is included pertaining to its age class distribution. This is included under the Young Forest section. Changes in aspen composition are displayed in the general composition and Forest Plan MA composition sections.

Discussion will also be included in relation to butternut and hemlock, which were identified as species of concern. And, while available information is limited, this discussion will include general effects discussion on the amount of snags, cavity trees, and coarse woody debris.

The vegetation analysis area was the area within the project area boundary. Expected changes would be limited to this area. The Chequamegon-Nicolet Combined Data System (CDS) was queried to generate an information set for this area. The information was then exported into spreadsheets and analyzed to identify the effects of implementing each alternative. For the sake of analysis, implementation of each alternative was assumed to take place in 2005. The tables and figures depict conditions that are expected at that time.

The main focus of the discussion will be on harvest, reforestation, and prescribed burn activities since they are the most likely activities to affect forest composition and structure. Refer to **Table 2.1** in section 2.2 for a comparison of these activities by alternative.

In this section, environmental effects will be discussed frequently as they relate to short-term and long-term effects. Short-term effects are considered to be those that happen within ten years and long-term effects are considered those beyond ten years from the present. Short term effects will generally be more quantified. Long-term effects will be more qualitative since detailed predictions would require much speculation.

Discussion in this chapter will be limited to the uplands since no activities are proposed in the lowlands and no changes from the existing conditions (section 3.5) would be expected.

Mitigation measures and design features will be implemented as part of an effort to prevent or reduce the spread of NNIS. These measures include:

- Zone botanist (or someone designated by him) would rank/rate stands to determine which stands are at highest risk for contamination by which weed species. This would give us an idea of where to focus monitoring efforts.
- Monitor gravel sources (pit) if possible before use in the project area to determine if there is contamination by NNIS. Where fill is used in stands rated high risk for the types of invasive found in the pit, monitor annually for a minimum of 3 years to determine if NNIS plants become established following harvest activity. NNIS would be addressed with appropriate removal method available at that time.
- Minimize soil disturbance to the extent practical, consistent with the project objectives.
- Revegetate with native and desirable non-native species to quickly establish cover.
- Provide awareness sessions for timber sale contractors, at the pre-work session, and develop (or obtain existing copies of) handout booklets for identification.

Compliance with NFMA
All sites proposed for timber harvesting have been identified in the Forest Plan as suited for timber production. All sites to be harvested have been inventoried on the ground. Based upon a review of stands by certified silviculturists, all have been determined to meet suitability pursuant to 36 CFR 219.2 (c)(1). For details regarding proposed treatments and stand-specific information, please refer to Appendix A.

A certified silviculturist has reviewed all proposed timber harvest sites. Based upon this review, information included in the analysis file, and information included in district records, it is determined that the technology and knowledge exist to adequately restock the stands with five years after final harvests.

4.5.3 Direct and Indirect Effects of Alternative 1 (No Action)

4.5.3.1 Composition

General Composition
Since there are no activities proposed for this alternative, there would be no expected changes to vegetative composition in the short term. In the long term, natural succession would result in a trend towards a decrease in shorter-lived, shade intolerant species such as aspen and jack pine. At the same time, there would be an increase in longer lived, more shade tolerant species, such as sugar maple and white pine. Generally speaking, there would be a trend toward a reduction of within stand species diversity within upland hardwood stands.

Composition by Management Area
There would be no expected changes in the short term towards or away from composition objectives given in the Nicolet Forest Plan (1986) management areas. See section 3.5.4.2 for details.

In the long-term, there would be a trend towards more shade tolerant species. This would move the area toward some of the DFC's identified in the Plan:

- The desire for more hardwood in management areas 1.1 and 1.2 of the Laona portion;
- The desire to reduce aspen in management areas 3.1 and 3.2 of the Lakewood portion and 4.1 and 4.2 of the Laona portion.

However, this alternative would also move some areas away from their desired conditions:

- White pine would likely increase and aspen would likely decrease in MA 1.1/1.2 of the Lakewood portion.
- Hardwoods would likely increase in MA 3.1/3.2 on the Laona portion
- Aspen would likely decrease in management area 4.1/4.1 of the Lakewood portion.

Species of Concern
In the short term, there would be no anticipated change in the presence of butternut or hemlock within the project area. In the long term, a steady decrease in butternut would be expected. Butternut is a short-lived, shade intolerant species. Without some sort of regular disturbance that creates canopy gaps, butternut would not be able to regenerate and survive.

In the long term, there would likely be a minor increase in the amount of hemlock in the project area. Hemlock is a long-lived, shade tolerant species. Existing hemlocks should survive long into the future and, over time, some hemlock seedlings would be expected to grow beyond browse height. The degree of change would be dependant upon deer population levels in the area.

Existing populations of NNIS would likely continue to spread through natural dispersal processes and with vehicle assistance along roadways. A lack of soil disturbance associated with road construction and reconstruction activities may help to keep the spread of NNIS at a low rate.

4.5.3.2 Structure

General Structure
Under this alternative, in the short term, there would be no expected change to forest structure from the existing condition.

In the long term, minimal changes would be expected to existing hardwood stands. Overstory shading would prevent the recruitment and development of understories in most of these forest types. This would result in a general decline of within stand structural diversity. Young forest types, such as aspen and jack pine, would eventually decline and begin to convert to longer-lived, shade tolerant types. Young forest types and structures would become less prevalent and middle and older-aged forests would increase across the landscape.

In the short term, growth rates would remain stable and fluctuate only with naturally occurring short term weather changes and insect and disease outbreaks. In the long term, growth rates would decline as crown closure increases. This would run contrary to Forest Plan direction of maintaining favorable rates of growth for wood fiber production.

Young Forest
For the purpose of this discussion, all forest types are considered to be in a young forest condition when they are 20 years old or less. Special consideration is also given to early successional types such as aspen, birch, balsam fir, and jack pine since they are short-lived species, provide coarse woody debris at an earlier age, and provide certain wildlife species with important habitats (see section 4.7 for further discussion).

Currently, there are 2,099 acres of young forest stands in the project area. During the next ten years, the amount and distribution of young forest would be expected to decrease to 1,476 acres. This would be a 30% decrease from the existing condition.

Table F-1, which can be found in Appendix F, gives a detailed display of the age classes by forest type that would result from Alternative 1. Figure 4.5-3 displays the age class distribution that would result for the aspen type as a result of this alternative. This can be compared to Figure 3.5-2 (found in section 3.5.5.1) to see that the stands in the younger age classes would shift to the older age classes.

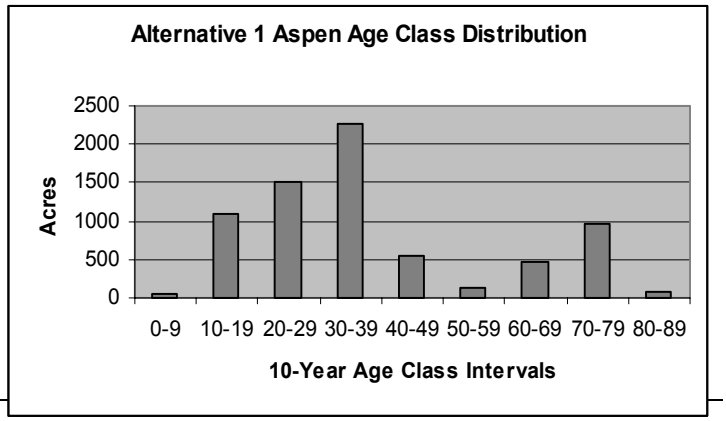


Figure 4.5-3 Alternative 1 Age Class Distribution

In the long term, a gradual further reduction of young forest conditions would be expected under this alternative. Within twenty years, young forest conditions would essentially

disappear from the project area. Young stands would develop, growing into middle aged forest. No large scale disturbance would be expected to result in any substantial areas of new young forest.

Mid-Aged Forest

For the purpose of this discussion, short-lived species, such as jack pine, aspen, balsam fir, and paper birch, are considered to be in a mid-aged forest condition when they are 21-60 years of age. All other upland species are considered mid-aged if they are 21-120 years of age (see section 3.5.5 for further discussion).

Currently, there are 14,536 acres of mid-aged forest stands in the project area. In the short term, the amount and distribution of mid-aged forest would be expected to increase to approximately 14,974 acres as some of the currently young-aged forests grow beyond twenty years. This would be an increase of 3% over the existing condition.

During the next twenty years, the amount of acreage in the mid-aged forest condition would be expected to increase. This trend would stop at that point and the amount of mid-aged forest would then begin to decrease as more stands grow into the old forest condition.

Old Forest

For the purpose of this discussion, short-lived species, such as jack pine, aspen, balsam fir, and paper birch, are considered to be in a old forest condition when they are greater than 60 years of age. All other upland species are considered old forest if they are greater than 120 years of age (see section 3.5.5 for further discussion).

Currently, there are 4,201 acres of old forest stands in the project area. In the short term, the amount and distribution of old forest would be expected to slightly increase to approximately 4,385 acres as some of the currently mid-aged forests grow into the old forest condition. This would be an increase of about 4% over the existing condition.

In the long term, the amount of acreage in the old forest condition would be expected to gradually increase. Barring some widespread stand regenerating natural disturbance, in about one hundred years, most of the upland landscape would eventually make its way into this condition.

Snags, Cavity Trees, and Down Wood
In the short term, there would be no expected change in the amount or distribution of snags, cavity trees, and down wood.

In the long term, this alternative would probably result in the greatest amount of snags, cavity trees, and down wood across the McCaslin analysis area. As the short-lived forest types reach old age, substantial amounts of dead, dying, and down wood would become available. This analysis assumes that no harvest would take place in the future. Therefore, no salvage would take place and all coarse woody debris would remain.

Longer-lived species would also produce coarse woody debris, but at a slower rate. Also, in Alternative 1, the growth rates of these trees would be lower than those of managed stands. Therefore, the amount of time needed to create larger snags would be greater than it would in managed stands. In any event, the overall amount of coarse woody debris would be greater in this “no action” scenario than under managed conditions.

4.5.4 Direct and Indirect Effects of Alternative 2 (the Proposed Action)

4.5.4.1 Composition

General Composition

Alternative 2 includes approximately 8,688 acres of harvest treatments, 374 acres of planting, and 119 acres of underburning. These are the main activities that have the potential to change vegetative composition. Some of the harvest actions would result in type changes. Examples include thinning in aspen (which would move the stands towards hardwood types) and overstory removal cuts in mixed stands, which would release understory trees of different species. These would result in immediate type conversions.

119 acres would be underburned under Alternatives 2,4, and 5. It would be done in northern red oak stands to develop a seedbed conducive to oak regeneration and to control unwanted understory competing with existing oak regeneration. This activity would have no effect on the forest type composition in the short or long term.

Under all of the action alternatives, release of desirable trees from unwanted competing vegetation would be done on 314 acres. Most of this release (270 acres) would be done to release long-lived conifers with almost 70% of that being white pine. The remaining release would be done on recently planted jack pine; a short-lived species. These release activities should have no effects on composition, other than maintaining the existing, desired forest type. The release of white pine is to allow young white pine to become part of the species composition in other forest types. The release of jack pine is for areas already typed as jack pine.

As a result of Alternative 2, the changes in the overall Project Area composition are expected to be minor. During the analysis, it was found that since the area is so large it would take large scale conversions to result in big changes to overall composition. Please refer to **Table 4.5-1** (in Section 4.5.1) to see the exact percentage changes by forest type by alternative. In summary, the hardwood types would increase by a little more than one percent while the paper birch type would be reduced by a little less than one percent.

In the long term, no measurable changes would be expected in overall forest type composition. Since early successional types such as aspen and jack pine would be widely regenerated in the short-term and future harvests are assumed, no notable long-term shifts toward more shade-tolerant species would be expected.

Composition by Management Area
Overall changes to forest type composition by Management Area (M.A) were found to be small under this alternative. Detailed tables listing estimated outcomes can be found in Appendix F. A summary of the more notable short-term effects is as follows:

For that portion of M.A.1.1/1.2 on the original Lakewood District:

- The composition of hardwood types would advance from the current 12.4% to 14.8%. This would move the area toward the DFC of 13%, but would also slightly exceed the goal in this portion of the management area.
- Through conversions to hardwood and aspen types, the birch type would decrease from its current 7.8% to 4.7%. This would move the birch composition away from the DFC of 8% in this portion of the management area.
- Aspen types would increase by about 1% to a total of 49.1%, moving from the existing condition of 48.3% toward the DFC of 63% for this part of the management area.

For that portion of M.A. 3.1/3.2 on the original Lakewood District:

- The composition of hardwood types would advance from the current 29.4% to 31.6%. This would move the area toward the DFC of 32% in this portion of the area.
- Through conversions to other types, the birch type would decrease from its current 3.0% to 1.7%. This is moving away from the DFC of 4% in this portion of the area.

There were no notable changes to the vegetative composition in any of the other management areas.

Species of Concern

This alternative proposes about 160 acres of overstory thinning to create conditions that would be conducive to butternut and eastern hemlock establishment. In areas with a butternut seed source, this would be done mainly through the creation of canopy gaps or by thinning overstory patches to reduced crown closures. In the short term, this would increase the likelihood of natural butternut regeneration in the McCaslin Project Area. It would allow germination and improved survival of butternut seedlings. Without some similar type of disturbance (Communication with Mike Ostry – North Central Research Station), butternut would not be able to regenerate and survive and would steadily disappear from the area.

In areas with an existing hemlock seed source, the overstory would be thinned to reduce the crown closure to approximately 60%. This would provide the shade-tolerant hemlock seedlings with enough light and the right moisture conditions to germinate and survive. In addition to the thinning, hemlock is proposed for underplanting, along with white pine and white spruce, on approximately 374 acres throughout the project area. No mature hemlock would be harvested under any alternative except for safety or access reasons (see Mitigation Measures in Section 2.3). Browsing by deer is the main source of mortality to regenerating hemlock on the Lakewood/Laona Ranger District. About 111 acres of the above acres would be temporarily fenced to provide protection from deer browsing. This should increase the successful establishment of hemlock in the project area.

Under this alternative, 374 acres would be planted or naturally seeded. All planting (237 acres) will be considered underplanting since it would be done in the understory of existing forest types. White pine and hemlock would be the major species planted. Natural seeding would be emphasized on 137 acres with hemlock being the major species. In the short and long term, the underplanting/seeding would cause no changes to the forest type composition. They are not intended to cause forest type conversions but to simply improve and restore visual quality and within stand long-lived conifer composition.

In the long term, with repeated treatments and gradual establishment, hemlock should steadily increase throughout the area. The future of butternut is less clear. While the actions proposed would be more beneficial than no action, the key to long-term survival of butternut hinges on potential resistance to butternut canker.

NNIS dispersal opportunities would be greatest in this alternative. Among the action alternatives, this alternative has the greatest amount of road reconstruction and the lowest amount of road decommissioning.

4.5.4.2 Structure

General Structure

The vegetation management activities proposed for Alternative 2 would have three broad influences on forest structure: 1) even-aged regeneration harvests; 2) intermediate thinnings; and 3) selection harvests.

Under Alternative 2, approximately 1,358 acres of even-age regeneration harvests are proposed. The majority of these involve clearcuts in aspen forest types. Lesser amounts of jack pine clearcutting, overstory removal treatments in aspen-spruce, and shelterwood harvests are also proposed. This would have the effect of creating young forest structure and affecting age class distributions in the landscape. Quantitatively, this can be viewed in terms of stand age class distributions. **Table F-2** in Appendix F displays the expected age class distribution by species that would result from Alternative 2. The expected forest structural conditions are discussed later in this section under young, mid-aged, and old forest conditions. The distribution of different types and age classes of forested stands is important in determining the nature of wildlife habitat at the landscape level. For more discussion on this, refer to sections 3.6, 3.7, 4.6, and 4.7.

The second major influence would come from the intermediate thinnings that are proposed. They have the primary effects of controlling stand density, inhibiting understory development, and promoting the growth of larger trees. So, while the scope of the effect is mainly viewed at the stand level, the indirect effects to habitat extend throughout the landscape. Alternative 2 proposes approximately 2,611 acres of commercial thinning. The majority of this would be in spruce and pine plantations that were established in the 1930's. Other thinning is proposed in oak and mixed hardwood stands under even-aged management systems and in aspen and birch stands, where the objective is to encourage conversion to more shade-tolerant species.

The proposed thinning would encourage better growth rates and larger trees in the residual stands. In general, the trees within these stands would be evenly-spaced and have a more or less continuous canopy.

The third influence would be expected from selection harvests that are used to promote uneven-aged conditions. Here, the purpose is twofold: 1) to control density in the residual stand; and 2) to encourage the establishment of a new age class with each entry. So, with uneven-aged selection harvests there is an emphasis on developing more complex "within-stand" structure. Like thinning, these effects are usually viewed at the stand level, but also extend across the landscape.

Alternative 2 proposes approximately 4,686 acres of selection harvest to promote uneven-aged northern hardwood stands. Where this takes place, forest structure would gradually become more complex, with occasional canopy gaps, pockets of regeneration, and steadily broadening range of tree sizes within the stand. While the stands would not yet be unevenly aged in a technical sense, the selective cuts would advance them toward that ultimate objective.

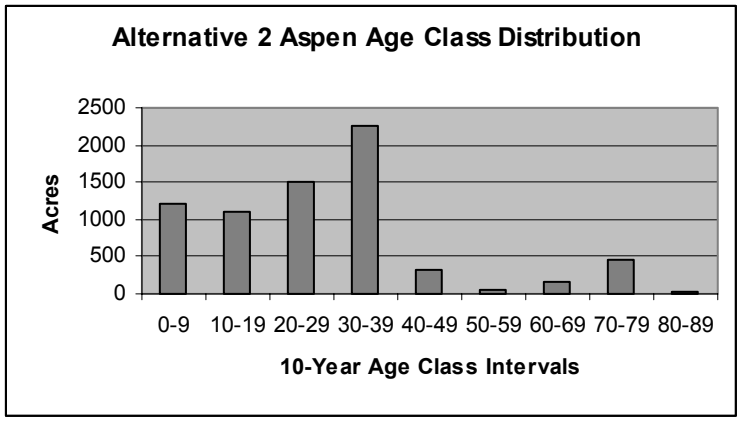
Young Forest

See section 4.5.3.2 to see how Young Forest is defined for this analysis.

Currently, there are 2,099 acres of young forest stands in the project area. Under Alternative 2, the amount and distribution of young forest would be expected to increase to 2,834 acres. This would be a 35% increase in the existing condition. This increase would be due mainly to even-aged regeneration harvest, especially aspen clearcuts in stands 40-69 years of age.

Table F-2, which can be found in Appendix F, gives a detailed display of the age classes by forest type that would result from Alternative 2. **Figure 4.5-4** displays the age class distribution that would result for the aspen type as a result of this alternative in the short term. This can be compared to Figure 3.5-3 (found in section 3.5.5.1) to see that there would be a substantial addition of acreage into the youngest age class. This would move the age classes of aspen stands toward a more evenly distributed state (as is recommended in the Nicolet Forest Plan, p.27).

Figure 4.5-4 Alternative 2 Aspen Age Class Distribution



Optimal Treatment of Aspen and Jack Pine

The management of the aspen and jack pine by clearcutting in Alternatives 2, 4, and 5 is the optimal silvicultural method where the objective is to regenerate aspen and jack pine (Forest Plan, p A-4 and A-6).

The regeneration of aspen and jack pine is best accomplished by clearcutting, as these species require full sunlight for vigorous growth and successful competition with shade-tolerant species. As little as 10-15 square feet/acre of basal area of residual overstory will slow aspen sucker growth by 35-40% (USDA General Technical Report NC-36).

Jack pine seedlings require full sunlight to be successfully established (USDA General Technical Report NC-32). Thus, the shelterwood, seed tree, and individual tree selection methods would not be as effective in regenerating these stands because the residual overstory would reduce the sunlight reaching the ground. Group selection harvests would also not be as effective due to excessive shade. Group selections involve small openings (less than 2 acres) and perimeter trees would not allow adequate sunlight for optimum regeneration of aspen and jack pine.

The shelterwood and overstory removal harvests that are proposed in the action alternatives are the optimum methods of releasing advanced regeneration of white spruce, oak, and other intermediately tolerant species. The use of these methods would release the target species, while providing enough residual overstory to prevent aggressive competition by fast growing shade intolerant species.

Mid-Aged Forest

See section 4.5.3.2 to see how Mid-Aged Forest is defined for this analysis.

Currently, there are 14,536 acres of mid-aged forest stands in the project area. In the short term, the amount and distribution of mid-aged forest would be expected to increase to approximately 14,809 acres as some of the currently young-aged forests grow beyond twenty years. This would be an increase of 2% over the existing condition. This increase would be the result of young forest stands (primarily aspen) growing out of the 10-19 year age class and into the 20-29 year age class.

Old Forest

See section 4.5.3.2 to see how Old Forest is defined for this analysis.

Currently, there are 2,207 acres of old forest stands in the project area. In the short term, the amount and distribution of old forest would be expected to substantially decrease to approximately 1,199 acres as mature

and overmature aspen, white birch, and jack pine are regenerated to the youngest age class. Nearly all of these acres would come from age classes in the 60-79 year range. This would be a decrease of about 46% over the existing condition.

Snags, Cavity Trees, and Down Wood
Under this alternative the amount of available snags would be expected to slightly decrease within the stands receiving harvest treatments. Within stands proposed for thinning and selective harvests, trees with defects would often be favored for removal compared to sound trees. However, the reader should not take this to mean that it is a goal to eliminate snag and cavity trees from the stands. It is a goal to retain at least 8-12 snags per acre (where available) in the partial cuts included in the alternatives (see section 2.3, Mitigation Measures) and this is often exceeded in many stands..

In most areas, coarse woody debris in the 6-16 inch range is plentiful, but snags and down wood in the larger size classes are much less common in the analysis area. This is mainly because the stands are still relatively young and have not had the time to develop large numbers of the bigger trees. Over time, this will happen. Periodic thinnings and selection harvests should help in this regard since trees in well-stocked stands have higher growth rates- trees get bigger, quicker.

Within the regeneration harvest areas, more snags and cavity trees would be removed. Many of these stands are mature or overmature and, therefore, have more defective trees. To mitigate this, groups and individual snag and reserve trees would be left within even-aged regeneration areas (see Section 2.3). In addition, cull material and tops would be left on site following harvest.

4.5.5 Direct and Indirect Effects of Alternative 3

4.5.5.1 Composition

General Composition
In response to public concerns related to issues such as forest fragmentation, the ID Team developed Alternative 3. This alternative emphasizes the development and maintenance of larger blocks of contiguous forested habitats.

Alternative 3 includes approximately 6,913 acres of harvest treatments and 288 acres of planting. These are the main activities that have the potential to change vegetative composition. The majority of the harvests would not result in forest type changes, but rather involve harvests to control stocking or to regenerate the same types that are being harvested. However, some of the harvest actions would result in type changes. These would be limited primarily to thinning in aspen (which would move the stand towards hardwood types), some of which would result in immediate type conversions.

As a result of Alternative 3, the overall Project Area composition is not expected to change much in the short term. Please refer to **Table 4.5-1** (in Section 4.5.1) to see the exact percentage changes by forest type by alternative. In summary, the hardwood types would increase by a little more than one percent while the aspen type would be reduced by a little less than one percent. This alternative emphasizes interior habitat and includes about 230 acres of aspen thinning to encourage the conversion of those stands to northern hardwood types. About 170 acres of this would be expected to immediately classify as hardwood following the thinning; the remainder will gradually convert in the decades following this entry.

Composition by Management Area
Overall changes to forest type composition by Management Area (M.A.) were found to be incremental under this alternative. Detailed tables listing estimated outcomes can be found in the previous section 4.5.2. A summary of the more notable short-term effects is as follows:

For that portion of M.A. 1.1/1.2 on the original Laona District:
- The composition of hardwood types would advance from the current 27.7% to 29.8%. This would move the area toward the DFC of 37%
- Aspen types would decrease by about 2% to a total of 46.4%, moving from the existing condition of 48.6% away from the DFC of 52% for this part of the management area.

For that portion of M.A. 3.1/3.2 on the original Lakewood District:
- Aspen would decrease from 49.4% to 48.6%, moving toward the DFC of 28% aspen.

For that portion of M.A. 3.1/3.2 on the original Laona District:
- Hardwood types would increase from 66% to 67.2%, moving away from the DFC of 53% hardwood.
- Aspen would decrease from 23.6% to 22.4%, moving away from the DFC of 29% aspen.

For that portion of M.A. 4.1/4.2 on the original Laona District:
- Hardwood types would increase from 21.9% to 22.9% nearly achieving the DFC of 23% hardwood.
- Aspen would decrease from 32.6% to 31.6%, moving toward the DFC of 20% aspen.

There were no notable changes to the vegetative composition in any of the other management areas.

Species of Concern

The effects of this alternative on the composition of butternut and eastern hemlock would be similar to those discussed for Alternative 2. The same actions are proposed to encourage the establishment of these species under Alternative 3 with one exception. Under Alternative 3, there would be 86 fewer acres proposed for hemlock/white pine/white spruce planting/seeding. This would be slightly less beneficial to the restoration/maintenance of these species than the Proposed Action, but better than No Action.

Under this alternative, 288 acres would be planted or naturally seeded. About 140 acres would be considered underplanting since it would be done in the understory of existing forest types. White pine and hemlock would be the major species planted. Natural seeding would be emphasized on approximately 148 acres with hemlock being the major species. In the short and long term, the underplanting/seeding would cause no changes to the forest type composition. As in Alternative 2, they are not intended to cause forest type conversions but to simply improve within-stand diversity.

This alternative has no new road construction and the smallest amount of road reconstruction activities, and consequently should provide the fewest opportunities for NNIS dispersal when compared to the other action alternatives.

4.5.5.2 Structure

General Structure

There would be two main groups of vegetation management activities proposed in Alternative 3 that would have broad influences on forest structure: 1) intermediate thinnings; and 2) selection harvests.

Under Alternative 3, 13 acres of even-aged regeneration harvests are proposed. Even-aged regeneration harvests have the effect of creating young forest structure and affecting the age class distribution in the landscape. **Table F-3** in Appendix F displays the expected age class distribution by species that would result from Alternative 3. The expected forest structural conditions are discussed later in this section under young, mid-aged, and old forest conditions.

The first main influence to forest structure would come from the intermediate thinnings that are proposed. They have the primary effects of controlling stand density, inhibiting understory development, and promoting the growth of larger trees. So, while the scope of the effect is mainly viewed at the stand level, the indirect effects to habitat extend throughout the landscape. Alternative 3 proposes approximately 1,911 acres of commercial thinning. The majority of this would be in spruce and pine plantations that were established in the 1930's. Other thinning is proposed in oak and mixed hardwood stands under even-aged management systems and in aspen and birch stands, where the objective is to encourage conversion to more shade-tolerant species by reducing aspen suckering and stump sprouting.

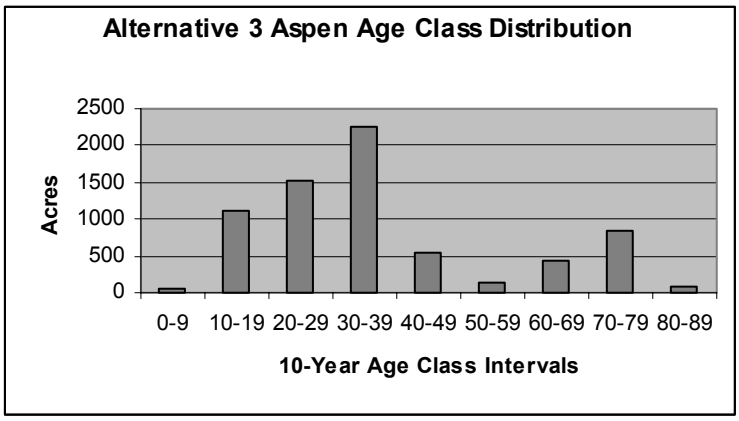
The proposed thinning would encourage better growth rates and larger trees in the residual stands. In general, the trees within these stands would be evenly-spaced and have a more or less continuous canopy.

The second influence would be expected from selection harvests that are used to promote uneven-aged conditions. Here, the purpose is twofold: 1) to control density in the residual stand; and 2) to encourage the establishment of a new age class with each entry. So, with uneven-aged selection harvests there is an emphasis on developing more complex "within-stand" structure. Like thinning, these effects are usually viewed at the stand level, but also extend across the landscape.

Alternative 3 proposes approximately 4,989 acres of selection harvest to promote uneven-aged northern hardwood stands. Where this takes place, forest structure would gradually become more complex, with occasional canopy gaps, pockets of regeneration, and steadily broadening range of tree sizes within the stand. This action would move the stands more towards uneven-aged conditions.

Young Forest
See section 4.5.3.2 to see how Young Forest is defined for this analysis.

Figure 4.5-5 Alternative 3 Aspen Age Class Distribution



Currently, there are 2,099 acres of young forest stands in the project area. Under Alternative 3, the amount and distribution of young forest would be expected to decrease to 1,489 acres. This would be a 29% decrease from the existing condition. This decrease would be due to the ingrowth of trees in the 10-19 year age class into the 20-29 year age class during the next ten years. Since there would be a minimal amount of even-aged regeneration, there would be an addition of only 13 acres into the 0-9 year age class during the next ten years.

Table F-3, which can be found in Appendix F, gives a detailed display of the age classes by forest type that would result from Alternative 3. **Figure 4.5-5** displays the age class distribution that would result for the aspen type as a result of this alternative in the short term. This can be compared to **Figure 3.5-3** (found in section 3.5.5.1) to see that there would be a shift of aspen acreage into the next older age classes. In regard to aspen, the effects of this alternative would be essentially the same as those of the No Action alternative. No aspen is being regenerated under this alternative and so there would be no additions to the young forest condition. This alternative would not move the aspen stands in the McCaslin project area toward a more regulated state as is recommended in the Nicolet Forest Plan (p.27).

Mid-Aged Forest
See section 4.5.3.2 to see how Mid-Aged Forest is defined for this analysis.

Currently, there are 14,536 acres of mid-aged forest stands in the project area. In the short term, the amount and distribution of mid-aged forest would be expected to increase to approximately 15,124 acres as some of the currently young-aged forests grow beyond twenty years. This would be an increase of 4% over the existing condition. This increase would be the result of young forest stands (primarily aspen) growing out of the 10-19 year age class and into the 20-29 year age class.

Old Forest
See section 4.5.3.2 to see how Old Forest is defined for this analysis.

Currently, there are 2,207 acres of old forest stands in the project area. In the short term, the amount and distribution of old forest wouldn't be expected to change substantially. Only 22 acres would grow from the Mid-aged forest condition into the Old Forest condition during the next ten years. This would amount to no measurable change on a percentage basis.

Snags, Cavity Trees, and Down Wood
The effects to snags and coarse woody debris would be similar to those discussed for Alternative 2. The main difference would be that Alternative 3 has only 13 acres of even-aged regeneration harvest. Therefore, this alternative would result in an overall greater amount of snags remaining after treatment.

4.5.6 Direct and Indirect Effects of Alternative 4

4.5.6.1 Composition

General Composition

In response to public concerns on the amount and distribution of aspen and young forests, the Interdisciplinary Team developed Alternative 4. This alternative emphasizes the maintenance of aspen and other young forest types in the area.

Alternative 4 includes approximately 8,842 acres of harvest treatments and 159 acres of planting. These are the main activities that have the potential to change vegetative composition. The majority of the harvests would not result in forest type changes, but rather involve harvests to control stocking or to regenerate the same types that are being harvested. However, some of the harvest actions would result in type changes. In this alternative, these would be limited primarily to clearcut harvests in hardwood and other types that currently have an aspen component. Clearcuts in stands with at least 20 square feet/acre of basal area in aspen would be expected to result in aspen-dominated stands following harvests. Since this alternative placed an emphasis on aspen management, many such treatments were included in the proposal.

As a result of Alternative 4, the overall Project Area composition is expected to make a minor shift away from hardwoods and toward aspen. Please refer to **Table 4.5-1** (in Section 4.5.1) to see the exact percentage changes by forest type by alternative. In summary, the hardwood types would decrease by a little over three percent while the aspen type would increase by a little more than four percent. This alternative emphasizes aspen and early-successional habitat and includes about 700 acres of conversions to aspen from other types as a result of regeneration harvests.

Composition by Management Area

While, among the alternatives, this alternative makes the greatest changes to composition, the overall changes to forest type composition by Management Area (M.A.) were still relatively small under this alternative. Detailed tables listing estimated outcomes can be found in the previous section 4.5.2. A summary of the more notable short-term effects is as follows:

For that portion of M.A. 1.1/1.2 on the original Lakewood District:

- Hardwood types would decrease from 12.4% to 10%, moving away from the DFC of 13% hardwood.
- Aspen would increase from 48.3% to 52.2%, moving toward the DFC of 63% aspen.

For that portion of M.A. 1.1/1.2 on the original Laona District:

- The composition of white spruce would decrease from 18.4% to 15.0%. This would move the area toward the DFC of 1%
- The composition of hardwood types would decrease from 27.7% to 24.5%. This would move the area away from the DFC of 37%
- Aspen types would increase by about 6.5% to a total of 55.2%, moving from the existing condition of 48.6% toward the DFC of 52% (and actually exceed the goal) for this part of the management area.

For that portion of M.A. 3.1/3.2 on the original Lakewood District:

- Hardwood would decrease from 29.4% to 25.6%, moving away from the DFC of 32%.
- Aspen would increase from 49.4% to 54.1%, moving away from the DFC of 28% aspen.

For that portion of M.A. 3.1/3.2 on the original Laona District:

- White spruce types would increase from 2.1% to 3.4%, moving away from the DFC of 2% white spruce.
- Hardwood types would decrease from 66% to 61.5%, moving away from the DFC of 53% hardwood.
- Aspen would increase from 23.6% to 26.8%, moving towards the DFC of 29% aspen.

For that portion of M.A. 4.1/4.2 on the original Laona District:

- White spruce types would decrease from 33.4% to 28.6%, moving towards the DFC of 8% white spruce.
- Hardwood types would decrease from 21.9% to 15.5% moving away from the DFC of 23% hardwood.
- Aspen would increase from 32.6% to 43.8%, moving away from the DFC of 20% aspen.

There were no notable changes to the vegetative composition in that portion of M.A. 4.1/4.2 on the original Lakewood District

Species of Concern
The effects of this alternative on the composition of butternut and eastern hemlock would be similar to those discussed for Alternatives 2 and 3. The same actions are proposed to encourage the establishment of these species with one exception. Under Alternative 4, there would be 159 acres of hemlock/white pine/white spruce planting/seeding. This is the lowest amount of the action alternatives. This would be slightly less beneficial to the restoration/maintenance of these species than Alternative 3, but would be better than No Action.

Dispersal opportunities for NNIS in this alternative would be similar to Alternative 2. This alternative has slightly more new road construction, less reconstruction, and more decommissioning than Alternative 2.

4.5.6.2 Structure

General Structure
The vegetation management activities proposed for Alternative 4 would have three broad influences on forest structure: 1) even-aged regeneration harvests; 2) intermediate thinnings; and 3) selection harvests.

Under Alternative 4, approximately 2,533 acres of even-age regeneration harvests are proposed. The majority of these involve clearcuts with the objective of regenerating aspen forest types. This would have the effect of creating young forest structure and affecting age class distributions in the landscape. This can be quantified in terms of stand age class distributions. **Table F-4** in Appendix F displays the expected age class distribution by species that would result from Alternative 4. The expected forest structural conditions are discussed later in this section under young, mid-aged, and old forest conditions.

The second major influence would come from the intermediate thinnings that are proposed. They have the primary effects of controlling stand density, inhibiting understory development, and promoting the growth of larger trees. So, while the scope of the effect is mainly viewed at the stand level, the indirect effects to habitat extend throughout the landscape. Alternative 4 proposes approximately 2,521 acres of commercial thinning. The majority of this would be in spruce and pine plantations that were established in the 1930's.

The proposed thinning would encourage better growth rates and larger trees in the residual stands. In general, the trees within these stands would be evenly-spaced and have a more or less continuous canopy.

The third influence would be expected from selection harvests that are used to promote uneven-aged conditions. Here, the purpose is twofold: 1) to control density in the residual stand; and 2) to encourage the establishment of a new age class with each entry. So, with uneven-aged selection harvests there is an emphasis on developing more complex "within-stand" structure. Like thinning, these effects are usually viewed at the stand level, but also extend across the landscape.

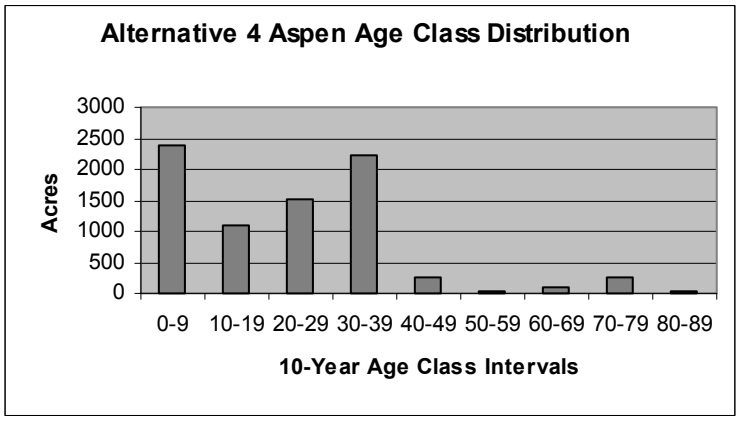
Alternative 4 proposes approximately 3,788 acres of selection harvest to promote uneven-aged northern hardwood stands. Where this takes place, forest structure would gradually become more complex, with occasional canopy gaps, pockets of regeneration, and steadily broadening range of tree sizes within the stand.

Young Forest
See section 4.5.3.2 to see how Young Forest is defined for this analysis.

Currently, there are 2,099 acres of young forest stands in the project area. Under Alternative 4, which emphasizes young forest conditions and early-successional types, the amount and distribution of young forest would be expected to increase to 4,010 acres. This would be a 91% increase from the existing condition. This large increase would be due to widespread even-aged regeneration harvests primarily in aspen and hardwood stands greater than 40 years of age. Of the alternatives, this one would result in the greatest amount of young forests.

Table F-4, which can be found in Appendix F, gives a detailed display of the age classes by forest type that would result from Alternative 4. **Figure 4.5-5** displays the age class distribution that would result for the aspen types in the short term as a result of this alternative. This can be compared to **Figure 3.5-3** (found in section 3.5.5.1) to see that there would be a substantial shift of aspen acreage from 40+ year age classes to the 0-9 year age class. Of the four action alternatives, Alternative 4 would move the aspen age class distribution most closely in line with the distribution recommended in the Nicolet Forest Plan (p. 27).

Figure 4.5-5 Alternative 4 Aspen Age Class Distribution



Mid-Aged Forest
See section 4.5.3.2 to see how Mid-Aged Forest is defined for this analysis.

Currently, there are 14,536 acres of mid-aged forest stands in the project area. In the short term, the amount and distribution of mid-aged forest would be expected to decrease to approximately 13,760 acres as many of the 40-60-year-old stands are regenerated to the young forest condition. This would be a decrease of 5% over the existing condition. Of the alternatives, this one would result in the least amount of mid-aged forests.

Old Forest
See section 4.5.3.2 to see how Old Forest is defined for this analysis.

Currently, there are 2,207 acres of old forest stands in the project area. In the short term, the amount of old forest would be expected to decrease to about 1,072 acres. This 51% reduction would be the result of converting many 60+ year-old aspen, birch, and jack pine types to young forest conditions. Of the alternatives, Alternative 4 would result in the least amount of acres in the Old Forest condition.

Snags, Cavity Trees, and Down Wood
The effects of this alternative would be similar to those described for Alternative 2. However, since a greater acreage of the stands harvested in Alternative 4 would be even-aged regeneration harvests, there would be a larger reduction in the number of snags and cavity trees throughout the area. As mentioned earlier, mitigation measures (see section 2.3) would be included to retain snags and reserve trees throughout clearcut units, but the overall numbers of snags and cavity trees would still be reduced.

4.5.7 Direct and Indirect Effects of Alternative 5

4.5.7.1 Composition

General Composition
In response to conflicting public concerns, the ID team developed Alternative 5. Alternative 5 tries to emphasize both interior habitat (in the north half) and early successional habitat (in the south half) in the McCaslin Project Area.

Alternative 5 includes approximately 8,554 acres of harvest treatments and 276 acres of planting. These are the main activities that have the potential to change vegetative composition. The majority of the harvests would not result in forest type changes, but rather involve harvests to control stocking or to regenerate the same types that are being harvested. However, some of the harvest actions would result in type changes. This would take place in two general areas.

First, under this alternative, clearcuts are proposed in hardwoods and other types with an aspen component. One of the objectives of Alternative 5 is to emphasize the amount of aspen and early-successional forest in the south half of the project area. Clearcuts in stands with at least 20 square feet/acre of basal area in aspen would be expected to result in aspen-dominated stands following harvests.

The second group of harvest actions that would have the greatest influence on overall forest composition would be those that thin early successional types, such as aspen. Thinning such stands would encourage more shade-tolerant northern hardwoods by reducing aspen suckering. This is one of the goals in the northern portion of the McCaslin Area under Alternative 5 (see section 2.2) .

The primary result of Alternative 5 on the overall forest composition would be a 2% increase in northern hardwoods and a decrease of a little over 1% in the aspen types. Please refer to **Table 4.5-1** (in Section 4.5.1) to see the exact percentage changes by forest type by alternative. The greatest gains in hardwood types would take place in the north half of the project area where aspen stands are thinned and effectively converted to hardwood types. On the other hand, while there would be a net decrease in the aspen type, there would actually be aspen gains through type conversions in the southern part of the area.

Composition by Management Area
The following series of statements summarizes the more notable short-term changes in forest composition by Forest Plan Management Area. Detailed tables listing estimated outcomes can be found in section 4.5.2.

For that portion of M.A. 1.1/1.2 on the original Lakewood District:
- Hardwood types would increase from 12.4% to 13.2%, moving toward (and slightly exceeding) the DFC of 13% hardwood.
- Aspen would increase from 48.3% to 49.4%, moving toward the DFC of 63% aspen.
- Paper birch would decrease from 7.8% to 6%, moving away from the DFC of 8%.

For that portion of M.A. 1.1/1.2 on the original Laona District:
- The composition of hardwood types would increase from 27.7% to 37.2%. This would move toward (and slightly exceed) the DFC of 37%.
- Aspen would decrease from 48.6% to 39.1%, moving away from the DFC of 52% aspen.
- For that portion of M.A. 3.1/3.2 on the original Lakewood District:
- Hardwood would increase from 29.4% to 30.6%, moving toward the DFC of 32%.

For that portion of M.A. 3.1/3.2 on the original Laona District:
- Hardwood types would increase from 66% to 68.7%, moving away from the DFC of 53% hardwood.
- Aspen would decrease from 23.6% to 20.9%, moving away from the DFC of 29%.

For that portion of M.A. 4.1/4.2 on the original Laona District:
- Hardwood types would increase from 21.9% to 22.9% nearly achieving the DFC of 23%.
- Aspen would decrease from 32.6% to 31.6%, moving toward the DFC of 20% aspen.

There would be no notable changes to the vegetative composition in that portion of M.A. 4.1/4.2 on the original Lakewood District

Species of Concern
The effects of this alternative on the composition of butternut and eastern hemlock would be similar to those discussed for the other action alternatives. The same actions are proposed to encourage the establishment of these species with one exception. Under Alternative 5, there would be 276 acres of hemlock/white pine/white spruce planting/seeding. This is 12 fewer acres than what is proposed in Alternative 3 and would have corresponding effects in maintaining/enhancing butternut and hemlock.

NNIS dispersal opportunities would be similar to but slightly less in this alternative than in Alternative 4. Road construction and reconstruction is lower while the amount of decommissioning is higher.

4.5.6.3 Structure
General Structure
The vegetation management activities proposed for Alternative 5 would have three broad influences on forest structure: 1) even-aged regeneration harvests; 2) intermediate thinnings; and 3) selection harvests.

Under Alternative 5, approximately 754 acres of even-age regeneration harvests are proposed. The majority of these involve clearcuts with the objective of regenerating aspen forest types in the southern part of the area. This would have the effect of creating young forest structure and affecting age class distributions in the landscape. This can be quantified in terms of stand age class distributions. **Table F-5** in Appendix F displays the expected age class distribution by species that would result from Alternative 5. The expected forest structural conditions are discussed later in this section under young, mid-aged, and old forest conditions.

The second major influence would come from the intermediate thinnings that are proposed. They have the primary effects of controlling stand density, inhibiting understory development, and promoting the growth of larger trees. So, while the scope of the effect is mainly viewed at the stand level, the indirect effects to habitat extend throughout the landscape. Alternative 5 proposes approximately 3,094 acres of commercial thinning. The majority of this would be in spruce and pine plantations that were established in the 1930's. Some would also take place in early successional types in the northern portion of the area. In those areas, the objective is to encourage the conversion to hardwood types.

The proposed thinning would encourage better growth rates and larger trees in the residual stands. In general, the trees within these stands would be evenly-spaced and have a more or less continuous canopy.

The third influence would be expected from selection harvests that are used to promote uneven-aged conditions. Here, the purpose is twofold: 1) to control density in the residual stand; and 2) to encourage the establishment of a new age class with each entry. So, with uneven-aged selection harvests there is an emphasis on developing more complex "within-stand" structure. Like thinning, these effects are usually viewed at the stand level, but also extend across the landscape.

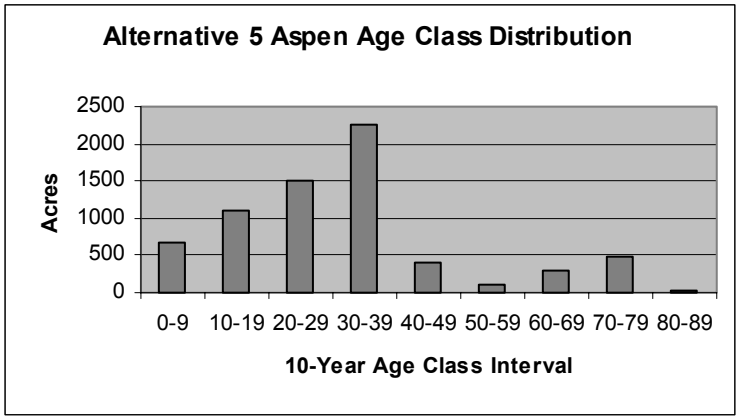
Alternative 5 proposes approximately 4,706 acres of selection harvest to promote uneven-aged northern hardwood stands. Where this takes place, forest structure would gradually become more complex, with occasional canopy gaps, pockets of regeneration, and steadily broadening range of tree sizes within the stand.

Young Forest
See section 4.5.3.2 to see how Young Forest is defined for this analysis.

Currently, there are 2,099 acres of young forest stands in the project area. Under Alternative 5, the amount and distribution of young forest would be expected to increase to 2,231 acres. This would be a 6% increase from the existing condition. This modest increase would result from about 750 acres of regenerated stands being added to the 0-9 year age class while, at the same time, about 600 acres shift into the 20-29 year age class.

Table F-5, which can be found in Appendix F, gives a detailed display of the age classes by forest type that would result from Alternative 5. **Figure 4.5-6** displays the age class distribution that would result for the aspen types in the short term as a result of this alternative. This can be compared to **Figure 3.5-3** (found in section 3.5.5.1) to see that there would be a shift of aspen acreage from 40+ year age classes to the 0-9 year age class.

Figure 4.5-6 Alternative 5 Aspen Age Class Distribution



Mid-Aged Forest
See section 4.5.3.2 to see how Mid-Aged Forest is defined for this analysis.

Currently, there are 14,536 acres of mid-aged forest stands in the project area. In the short term, the amount and distribution of mid-aged forest would be expected to increase to approximately 15,099 acres as stands in the 10-19-year age class shift into the 20-29-year age class. This would be an increase of 4% over the existing condition.

Old Forest
See section 4.5.3.2 to see how Old Forest is defined for this analysis.

Currently, there are 2,207 acres of old forest stands in the project area. In the short term, the amount of old forest would be expected to decrease to about 1,512 acres. This 32% reduction would be the result of converting many 60+ year-old aspen, birch, and jack pine types to young forest conditions.

Snags, Cavity Trees, and Down Wood
The effects of this alternative would be similar to those described for Alternative 2, but to a lesser degree. While the overall harvest acreage in Alternative 5 is similar, the amount of even-aged regeneration harvests is nearly half that proposed in Alternative 2. It's anticipated that there would be a smaller reduction in coarse woody debris within thinned and selectively cut units than in stands regenerated by even-aged systems. See section 2.3 to see the mitigation measures that would be included to retain snags and reserve trees in the McCaslin Project Area.

4.5.8 Cumulative Effects of All Alternatives

4.5.8.1 Introduction

The bounds of this cumulative effect analysis included an area extending approximately 2 miles around the McCaslin project area boundary. It was felt that effects to wildlife within the project area would be largely limited to this area. Other broadscale information, such as WiscLand satellite imagery and Forest-level data were also considered in this analysis to provide a larger context.

Information was obtained from the Wisconsin Department of Natural Resources (DNR) on activities taking place on private lands in the area. Many of the private properties in the area are enrolled in the Managed Forest Tax Law (MFL). As a result, records of forestry activities are available from the DNR's county foresters. Other timber harvests taking place on private lands are required to file a cutting notice with the DNR. This information was also obtained, however, it should be noted that compliance with the cutting notice requirement has been variable.

Records of past forestry activities on private lands dated from about 1990 to the present. Planned future harvests extended to approximately 2015.

Information was also provided by the Forest County Potawatomi Tribe. The Tribe has several parcels of forestland within and adjacent to the project area that are actively managed. The inventory data for these lands included forest types, years of origin, and planned activities and so the IDT was able to get listings of past and planned future activities.

Nicolet Hardwoods, LTD owns about 600 acres of forestland in the center of the project area that is actively managed for northern hardwoods. The company shared inventory information with the Forest Service, including forest types, stocking levels, and past and planned future activities.

4.5.8.2 Past Actions

In the late Nineteenth and early Twentieth Centuries, the forests in the analysis area were cut over in what were essentially landscape level clearcut harvests. Aerial photographs of the area from 1938 show a landscape dominated by brush and regenerating forests. Following these harvests, much of the land was acquired by the Federal Government and, in 1933, the Nicolet National Forest was established.

The first duties of the federal land managers were related to wildfire protection and reforestation of the cutover lands. Working together with local citizens and members of the Civilian Conservation Corps, thousands of acres within the area were planted in spruce and pine plantations. A basic road network was improved and other resource improvement activities followed.

As the forests grew, the number of harvests and timber stand improvement activities increased. As discussed in section 3.5, many thinnings took place with the goal of improving habitat, tree growth, and yield. Regeneration harvests were also implemented with the goals of regulating the landscape for a diversity of forest structure and sustained resource yields over time.

Today's existing condition is a direct result of these past actions. A review of the surrounding landscape shows a continuation of forest types and age structures outside of the project area and on other ownerships. The following **Table 4.5-6** compares composition and structural conditions within the project area to those found within the larger cumulative effects analysis area.

Table 4.5-6: General Composition and Structural Conditions of Upland National Forest Within the McCaslin Cumulative Effects Area

Composition	Project Area		Cum. Effects Area	
Type	**Acres**	**%**	**Acres**	**%**
Jack Pine	286	1.5	303	0.7
Balsam fir	321	1.7	579	1.3
Red Pine	870	4.5	1698	3.7
White Pine	872	4.5	1162	2.6
White Spruce	641	3.3	1213	2.7
Mixed Hardwoods	6730	35.1	18649	41.2
Oaks	1459	7.6	4415	9.7
White Birch	434	2.3	1077	2.4
Hemlock	105	0.5	128	0.3
Aspen	7126	37.2	14927	33.0
Upland Opening	326	1.7	1149	2.5
Total	19,170	100.0	45,301	100.0
	Project Area		**Cum. Effects Area**	
Structure	**Acres**	**%**	**Acres**	**%**
Young Forest	2,099	11	4691	11
Mid-Aged	14,536	77	34481	79
Old Forest	2,207	12	4503	10

Since 1990, on National Forest lands within the project area, approximately 798 acres of even-aged regeneration, 1,557 acres of thinning, and 471 acres of selection harvests have taken place. In the area immediately adjacent to the project area, approximately 1,322 acres of even-aged regeneration, 6,241 acres of thinning, and 3,866 acres of selective harvests have taken place in the same time period.

On other ownerships in and around the analysis area, past activities influencing vegetation structure and composition have been largely similar to those found on National Forest lands. On Potawatomi lands in the area (about 640 acres), about 18 acres of aspen regeneration and 176 acres of hardwood selection harvests have taken place in recent years.

Nicolet Hardwoods, Ltd. has conducted northern hardwood selection harvests on their 600 acre tract of land twice since 1990.

Private landowners in and around the project area (about 27,700 acres) have done about 440 acres of even-aged regeneration harvests and about 1532 acres of thinning or selection harvests since 1990.

4.5.8.3 Present Actions

Present actions are those actions known to be occurring at the time of this writing. Within the cumulative effects analysis area, there are 174 acres of sold harvest units that are pending harvest. They are located outside of the McCaslin Project Area on the southeast side. They include 121 acres of even-aged regeneration harvests, 25 acres of selection harvest, and 28 acres of commercial thinning. There are currently no actions occurring on Tribal, Corporate, or private lands within the area.

4.5.8.4 Future Actions

Other than the actions proposed in this project, there are no planned future actions on National Forest lands in the project area. Outside of the project area there are approximately 1143 acres of even-aged regeneration harvests, 3652 acres of selection harvests, and 146 acres of commercial thinning planned. These are tentatively scheduled between 2005 and 2015.

On Potawatomi lands in the area, 20 acres of spruce thinning, 7 acres of aspen regeneration, and 118 acres of northern hardwood selection harvests are planned between 2005 and 2015.

Nicolet Hardwoods, Ltd. plans about 600 acres of northern hardwood selection harvest in about the year 2010.

On private lands in the area, there are about 225 acres of aspen regeneration harvests and 2,403 thinning and selection harvests planned to take place between now and 2015.

4.5.8.5 Conclusions

The forest management activities of the past have shaped the existing conditions that are present in the area today. The forestland in other ownership is largely a continuation of the compositions and structures that are found on adjacent National Forest lands.

Future actions are expected to be a continuation of past patterns. Both the level and nature of harvests planned on all ownerships are a continuation of the current trend. There is nothing to indicate that past, present, or reasonably foreseeable future actions occurring in the area would cause any notable changes in the overall structure or composition of forestland in the area from the existing condition.

4.6 Landscape Pattern

4.6.1 Summary

Many issues were considered in the analysis and discussion of the landscape pattern in the McCaslin project area. These issues include: patch size, edge, openings, corridors/connectivity, interior habitat, Research Natural Areas, LAD areas, and old growth.

Three indicators were used to numerically analyze the landscape pattern including: acres of interior habitat, acres of edge-affected habitat, and miles of edge. As part of this analysis we assumed that regeneration cuts and A, B, and C class roads contribute to edge, and partial cuts do not contribute to edge.

In the long term, (greater than 10 years) the cumulative effects of all actions in the project area are likely to continue to follow the trend of past actions. Hardwood forests would continue to mature while supporting timber harvest, and scattered temporary openings would be created by regeneration harvests. Road closures and new road construction would likely decrease as the road system is fully developed to meet management needs.

In the short term, (less than 10 years) Alternatives 2 and 4 would cause the greatest change to the existing landscape pattern. Regeneration harvests would work to reduce the acreage of interior habitat and increase the acreage of edge-affected early successional habitat. Alternatives 3 and 5 would cause very little change to the existing landscape pattern, as both Alternatives have much smaller amounts of proposed regeneration harvests.

Among the five alternatives, Alternative 1 would likely be the most beneficial for plant and animal species associated with interior forest habitat. This alternative does not regenerate early successional habitat and would have the least impact to disturbance sensitive species. Alternatives 3 and 5 follow by maintaining nearly as much interior forest habitat and creating very little early successional habitat. Species sensitive to disturbances such as logging activity and road maintenance activity would be more negatively affected by Alternatives 3 and 5 than by Alternative 1.

Among the five alternatives, Alternative 4 would likely be the most beneficial for plant and animal species associated with early successional habitat as this alternative proposes the largest amount of regeneration harvest. Alterative 2 follows by proposing a smaller amount of regeneration harvest, and similar plans for road construction and maintenance activities.

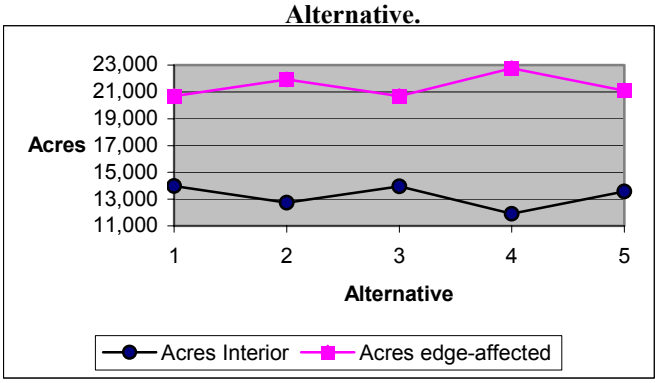
Table 4.6-1: Fragmentation indicators for each Alternative. Shown are acres of interior habitat on NF lands, acres of edge-affected habitat on NF lands, and total miles of edge within the project area. Also shown is the percent increase or decrease of each indicator from the existing condition (using Alt. 1 as the existing condition).

Alternative	Acres Interior	% Change from existing condition	Acres edge-affected	% Change from existing condition	Miles of edge	% Change from existing condition
1	13,974	0%	20,685	0%	854.6	0%
2	12,737	-9.7%	21,922	+9.44%	869.2	+1.7%
3	13,967	~0%	20,693	~0%	857.2	+0.3%
4	11,900	-17.4%	22,760	+10.0%	851.1	-0.4%
5	13,579	-3.0%	21,081	+2.0%	845.5	-1.1%

4.6.2 Direct and Indirect Effects of Alternative 1

4.6.2.1 Fragmentation

Figure 4.6-1: Fragmentation indicators for each Alternative.



As no activities are proposed, this Alternative would not result in any direct changes to landscape pattern except through natural processes. In the short-term (less than 10 years), no additional open or early seral habitats would be created, and mature aspen stands would begin converting to longer-lived hardwoods as the aspen dies out. Road densities would not be reduced via closures and road maintenance and construction activities would not occur. The amount of edge would not change except as past regeneration harvests continue to mature, reducing the edge adjacent to mature stands.

In the long-term (greater than 10 years), the amount of interior habitat would continue to increase as early seral stands continue to mature. Given enough time, patch sizes would increase as young stands mature and form continuous canopy with surrounding stands. Habitat corridors would change slowly over time (greater than 10 years before changes become noticeable) as early seral forests mature and blend with the surrounding forest.

As a result of Alternative 1, the existing conditions relative to fragmentation, interior forest, and edge-affected forests would remain the same. There would be approximately 845.6 miles of edge, 13,974 acres of interior forest, and 20,685 acres of edge-affected forest.

4.6.2.2 RNA's, LAD Areas, and Old Growth

Alternative 1 would not result in any changes to RNA or LAD areas except through natural processes. No activities would occur in or adjacent to these areas so there would be no additional impacts from edge effects.

4.6.3 Direct and Indirect Effects of Alternative 2

4.6.3.1 Fragmentation

As shown in **Table 4.6-1**, implementation of Alternative 2 would result in changes from the current landscape pattern. Miles of edge produced by roads and regeneration harvests would increase 1.7% or 14.6 miles. Acres of edge-affected forest would increase by 9.44% or 1237 acres and acres of interior forest would decrease 9.7% or 1237 acres. These changes would primarily be a result of the proposed 1358 acres of regeneration harvests.

Most of these changes would occur in the north half of the project area. Changes attributable to regeneration harvests are considered temporary, as the young forests would mature over time (greater than 10 years). Changes attributable to road construction and reconstruction activities are considered a long-term (greater than 10 years) change to the landscape.

The general pattern is that of a reduction in interior patch size in the north half of the project area and very little change in interior patch size in the south half of the project area. Some interior habitat corridors may be interrupted by regeneration harvests with a subsequent increase in connectivity of early seral habitats.

As a result of implementation of Alternative 2, there would be approximately 869.2 miles of edge, 12,737 acres of interior forest, and 21,922 acres of edge-affected forest.

4.6.3.2 RNA's, LAD Areas, and Old Growth

A selection harvest is proposed adjacent to McCaslin Mountain RNA but should not affect the integrity of the RNA.

No activities are proposed in the LAD areas and no regeneration harvests are proposed adjacent to the LAD areas. This would help maintain future management options in these areas.

No old growth is proposed for designation in this Alternative, although some stands eligible for harvest would not be entered. These stands may contribute old growth values to the project area.

4.6.4 Direct and Indirect Effects of Alternative 3

4.6.4.1 Fragmentation

As shown in **Table 4.6-1**, implementation of Alternative 3 would result in very little change from the current landscape pattern. Miles of edge produced by roads and regeneration harvests would increase .3% or 2.6 miles. Acres of edge-affected forest would increase by 8 acres, and acres of interior forest would decrease 8 acres.

No road construction is proposed and only 13 acres of regeneration harvests are proposed in the project area. As a result, the implementation of Alternative 3 would result in almost no change to the landscape pattern from the existing condition. Aspen stands proposed for regeneration harvests in the other Alternatives would be thinned or allowed to convert to hardwoods in this Alternative. Patch size, interior habitat conditions, and landscape corridors are nearly identical to the existing condition as described in section 3.6.3.1.

As a result of implementation of Alternative 3, there would be approximately 857.2 miles of edge, 13,967 acres of interior forest, and 20,693 acres of edge-affected forest.

4.6.4.2 RNA's, LAD Areas, and Old Growth

No activities are proposed in or adjacent to McCaslin Mountain RNA.

No activities are proposed in the LAD areas and no regeneration harvests are proposed adjacent to the LAD areas. This would help maintain future management options in these areas.

No old growth is proposed for designation in this Alternative, although some stands eligible for harvest would not be entered. These stands may contribute old growth values to the project area.

4.6.5 Direct and Indirect Effects of Alternative 4

4.6.5.1 Fragmentation

As shown in **Table 4.6-1**, implementation of Alternative 4 would result in changes from the current landscape pattern. Miles of edge produced by roads and regeneration harvests would decrease 0.4% or 3.5 miles. Acres of edge-affected forest would increase by 10% or 2075 acres, and acres of interior forest would decrease 17.4% or 2075 acres. These changes would primarily be a result of the proposed 2533 acres of regeneration harvests.

Some losses of interior acres would occur in the south half of the project area, but the majority of the interior acres lost would be in the north half of the project area. Three of the largest interior blocks in the north half would have a considerable reduction in size. Changes attributable to regeneration harvests are considered temporary, as the young forests would mature over time (greater than 10 years). Changes attributable to road construction and reconstruction activities are considered a long-term (greater than 10 years) change to the landscape.

Miles of edge has a slight decrease, as existing clearcuts with a high amount of edge are consolidated with proposed clearcuts to reduce the amount of edge in these areas. In other areas, miles of edge may increase due to road construction and clearcuts in interior areas.

Interior habitat corridors may be interrupted by regeneration harvests with a subsequent increase in connectivity of early seral habitats.

As a result of implementation of Alternative 4, there would be approximately 851.1 miles of edge, 11,900 acres of interior forest, and 22,760 acres of edge-affected forest.

4.6.5.2 RNA's, LAD Areas, and Old Growth

A clearcut harvest is proposed adjacent to the north side of McCaslin Mountain RNA. This stand is in a large area of existing young aspen regeneration and should not affect the overall integrity of the RNA.

No activities are proposed in the LAD areas and no regeneration harvests are proposed adjacent to the LAD areas, although some thinning harvests are proposed adjacent to LAD areas. The proposed activities should maintain future management options in the LAD areas.

No old growth is proposed for designation in this Alternative, although some stands eligible for harvest would not be entered. These stands may contribute old growth values to the project area.

4.6.6 Direct and Indirect Effects of Alternative 5

4.6.6.1 Fragmentation

As shown in **Table 4.6-1**, implementation of Alternative 5 would result in changes from the current landscape pattern. Miles of edge produced by roads and regeneration harvests would decrease 1.1% or 9.1 miles. Acres of edge-affected forest would increase by 2% or 396 acres, and acres of interior forest would decrease 3.0% or 396 acres. These changes would primarily be a result of the proposed 754 acres of regeneration harvests.

In this Alternative, opportunities for interior forest are emphasized in the north half of the project area where few regeneration harvests are proposed. As a result, little change is expected in interior forest acres in this area. Regeneration harvests are concentrated in the south half of the project area where the existing forest is younger and opportunities for interior forest are fewer. Overall, the change in interior forest acres is relatively small. Landscape corridors would remain largely unchanged in this Alternative.

Miles of edge has a slight decrease, as existing clearcuts with a high amount of edge are consolidated with proposed clearcuts to reduce the amount of edge in these areas. In other areas, miles of edge may increase due to road construction and clearcuts in interior areas.

As a result of implementation of Alternative 5, there would be approximately 845.5 miles of edge, 13,579 acres of interior forest, and 21,081 acres of edge-affected forest.

4.6.6.2 RNA's, LAD Areas, and Old Growth

A selection harvest is proposed adjacent to McCaslin Mountain RNA but should not affect the integrity of the RNA.

No activities are proposed in the LAD areas and no regeneration harvests are proposed adjacent to the LAD areas. This would help maintain future management options in these areas.

No old growth is proposed for designation in this Alternative, although some stands eligible for harvest would not be entered. These stands may contribute old growth values to the project area.

4.6.7 Total Cumulative Effects of all Actions (including Alternatives 1, 2, 3, 4, and 5)

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

The McCaslin project area and adjacent land is the core area considered in the cumulative effects analysis, however, landscape scale effects should be considered as part of the general landscape pattern of Northeast Wisconsin. For this project, impacts occurring during the first 10 years are considered short-term effects, and

long-term effects are considered over the 20-50 year time frame. The normal planning period for a project area is 10-15 years.

Past Actions
Past actions have greatly influenced the current landscape patterns in the project area. Turn of the century logging removed nearly all the primary forest in the project area. This forest has since regenerated to "second growth" forest. In addition, conifer plantations were established by the CCC in the 1930's and the Forest Service in the 1960's and 70's. Timber harvesting returned to the area in the 1970's and 80's with emphasis on harvesting maturing aspen and thinning of developing hardwood stands. Additional roads were constructed to access the maturing hardwood stands. Scattered clearcutting and opening development occurred in the area in an effort to promote inter-stand diversity and aspen maintenance. In general, forest types and landscape patterns on private properties within and adjacent to the project area are a continuation of those found on federal lands. See the McCaslin project file for more detailed information.

Since the late 1970's, harvest activity has occurred on National Forest land in the project area, with the most recent activity in the north half of the project area. These activities have been a continuation of past activities including the harvest of maturing aspen and the thinning of conifer plantations and second growth hardwood units. Maintenance of existing facilities including roads and trails has occurred.

Between 1978 and 2001, at least 21 timber sales have taken place on Forest Service lands in and directly adjacent to the analysis area. As part of these sales, approximately 3200 acres of even-aged regeneration harvests (clearcut, overstory removal, and shelterwood) and approximately 5900 acres of partial cuts (selection, improvement, and commercial thinning) have taken place.

Between 1990 and 2001 approximately 440 acres of regeneration harvests and approximately 2900 acres of partial cuts have been reported on other ownerships (private, tribal, and corporate lands) in and around the project area. Data on private land activities inside the project area boundaries has been included in the fragmentation calculations. Upon reviewing satellite land type imagery, it was determined that conditions outside the project do not differ markedly from inside the project area, and therefore actions outside the project area were not included in the fragmentation model. However, this more qualitative information is being considered in Section 4. 7 – Effects on Biodiversity/ Wildlife Resources.

Private development is primarily restricted to the southern half of the project area. A small amount of agricultural land is present near the southern edge as well as portions of the towns of Lakewood and Townsend. Residential developments have been built around many of the lakes, especially Wheeler Lake and Pickerel Lake.

Present Actions
There are no planned Forest Service timber sales inside the project area but there are some active sales outside the project area north of Highway C.

Locations of active timber sales on private lands are unknown. Two residential subdivisions (17 and 40 acres each) are being developed on private lands approximately two miles north of Townsend.

Future Actions
Currently there are no known Forest Service timber sales or road construction activities planned in and around the project area, but such activities are likely to take place again in the future. These activities would be similar to past actions including regeneration harvests, partial cuts, and road construction and maintenance activities. Such activities would likely not take place for at least 10 years.

Between 2002 and 2016 approximately 230 acres of regeneration harvests and 3140 acres of partial cuts are reportedly planned for harvest on other ownerships (private, tribal, and corporate lands) in and around the project area.

Development pressure on private lands is likely to continue, especially on lakefront property. According to the Wisconsin Department of Natural Resources, using the current development trend, all undeveloped lakes

in Wisconsin not in public ownership could be developed within 20 years (WDNR 2002). Most of the lakes in the project area wholly or predominately privately owned.

Private ownership is likely to continue the pattern of larger forested tracts being parceled off into smaller and smaller lots for residential development. Such development involves forest clearing for homes and road building, which are permanent fragmentation features.

Natural disturbance events such as windstorms would continue to occur which may contribute to fragmentation through the creation of edge and early successional patches.

Summary of Cumulative Effects resulting from Proposals and Past, Present, and Reasonably Foreseeable Future Actions

In the long term, (greater than 10 years) the cumulative effects of all actions in the project area are likely to continue to follow the trend of past actions. Hardwood forests would continue to mature while supporting timber harvest, and scattered temporary openings would be created by regeneration harvests. Road closures and new road construction would likely decrease as the road system is fully developed to meet management needs.

In the short term, (less than 10 years) Alternatives 2 and 4 would cause the greatest change to the existing landscape pattern. Regeneration harvests would work to reduce the acreage of interior habitat and increase the acreage of edge-affected early successional habitat. Alternatives 3 and 5 would cause very little change to the existing landscape pattern, as both Alternatives have much smaller amounts of proposed regeneration harvests.

Private lands would likely continue to be fragmented as large parcels are broken into smaller lots for rural home development and associated road construction. Lakeshore property would continue to be under the greatest development pressure and many private lakes may lose remaining natural shoreline.

4.7 Wildlife Resources Including TES, RFSS and MIS

4.7.1 Summary

The bald eagle was the only documented TES in the MPA. Due to mitigation measures, none of the alternatives would be expected to have any negative impacts to the birds or their habitats. Thirty-six RFSS were analyzed and of these, 29 had no impacts and 7 were determined to possibly have individuals impacted but not likely to cause a trend to Federal listing or loss of viability. The MIS analysis included 12 species and most of these were NTM birds.

4.7.2 Introduction

General effects of management activities affecting the fish and wildlife resources are described in the Nicolet Forest Plan FEIS on pages 4-107 and 4-108. General riparian area effects are described on pages 4-106. Effects to TES and RFSS are discussed in detail in the Analysis of Effects to TES (AE) document and Biological Evaluation (BE), respectively (in the McCaslin analysis file) with a summary of findings and effects described in Appendix D (Tables D-1 and D-2). The direct and indirect effects analysis includes potential effects of proposed timber harvest, site preparation activities, transportation system management, wildlife habitat management, and recreation improvement projects. The analysis discussed below considered the most up to date sources of information available, which included contact with various species experts, recent literature reviews, and numerous site specific field surveys conducted by FS professional and technical level biologists, ecologists, and botanists. Additional field surveys for songbirds and woodland raptors were conducted under contact often using taped calls for sensitive and reclusive species.

The term "direct effects" will relate to effects that impact individual animals or populations; the term "indirect effects" will be used to describe effects that impact habitat or habitat conditions, resulting in potential impacts to animals or populations requiring those habitats. The phrase "short term" will relate to the time period within fifteen years of project implementation. The phrase "long term" will relate to a time period greater than fifteen years from project implementation. The practices of hardwood thinning, improvement, and

selection harvest will be considered together in this analysis as selection cutting, since their effects on vegetation and stand structure are essentially the same.

4.7.3 Summary of Effects Threatened and Endangered Species

The bald eagle is the only federally listed species found in the project area. There would be no impacts to bald eagle or their habitats in any of the action alternatives. Design features that would avoid or mitigate adverse effects are required in all actions near the two known bald eagle nests in the project area. Standards and Guidelines for protection of eagle nests and nesting areas are outlined in section 2.3 Mitigation Measures and Design Features. These features provide contingency requirements if additional nest sites are discovered. More information on TES is detailed in the Analysis of Effects to TES (McCaslin Project File).

4.7.4 Summary of Effects Regional Forester's Sensitive Species

The BE included 36 plant and animal species that had observation records and/or available habitat. It was determined that there would be no negative impacts to 29 of these species. One plant species (Butternut) and 2 wildlife (northern blue and tawny crescent spot butterfly) were determined to have a beneficial impact. The remaining seven (Goshawk, Red-shouldered hawk, Swainson's thrush, Cerulean warbler, Goblin fern, Blunt-lobed grapefern, and American ginseng) were determined to have possible impacts to individuals but not likely to cause a trend to Federal listing or loss of viability. Mitigation measures were recommended to avoid or reduce potential effects of project area activities on known sensitive species populations and/or potential habitat.

Cumulative effects analysis was conducted on those selected RFSS and the effects from past, present and future actions on private lands, combined with the direct and indirect effects of proposed Alternatives would not add negatively impacts their populations. The detailed BE is located in Appendix D.

4.7.5 Management Indicator Species

4.7.5.1 Brook Trout

The brook trout is a popular game fish that utilizes cool and well oxygenated, small to medium sized creeks and select lakes. They are considered opportunistic feeders as they eat various invertebrate and vertebrate animals, primarily terrestrial and aquatic insects.

Alternative 1

The North Branch Oconto River would maintain its current habitat conditions, classified as fair, if no management activities were to take place. Knowles Creek, an unnamed tributary to Knowles Creek, and Mosquito Creek would also maintain their current habitat conditions that are fair to poor, if no management activities were to take place.

Alternative 2-5

In all alternatives, there would be no negative impacts from timber harvest and roadwork activities. This is because all streams, lakes, and wetlands near these activities would have protective buffers placed around them in accordance to Best Management Practices (WDNR, 1995). The felling of approximately 25 trees and placement of brush bundles (500 feet) along the North Branch Oconto River would enhance current trout habitat by restoring the densities of large woody debris to pre-logging conditions. These activities would also reduce stream channel widths and create deeper pool habitats that are a critical habitat component for trout during all seasons. These structures also produce current velocity diversification which brook trout use depending on their developmental stage. Also within the North Branch Oconto River, about ½ mile of in-stream debris will be removed. This activity would help reduce stream channel widths, increase current velocities, and help the river to scour deeper pool habitat. Habitat restoration projects proposed for Knowles Creek, Tributary to Knowles Creek and Mosquito Creek would consist of installing brush bundles and log/rootwad cover structures. These projects would help restore some of the critical habitat conditions for brook trout. All of these factors would help restore instream habitat to maximize benefits to brook trout and other aquatic species.

4.7.5.2 White-tailed deer

White-tailed deer, a very popular game species, use almost every upland habitat on the forest to some degree as well as edges of wetlands. An abundance of grasses and small woody vegetation are a favorite food

source. Deer also have a special need for dense cover during the winter for thermal protection in proximity to adequate browse. Availability of essential habitats (forage and cover) are an important part in estimating deer populations (WDNR, 1998). However, winter weather and artificial baiting are major influences in altering deer populations. These factors are not predictable or controllable and are beyond the scope of this project. Due to this, discussions on deer populations within Alternatives will be based solely on available forage and cover habitats.

Alternative 1

Deer populations would decline under this alternative, however they would most likely still be above desired carrying capacity. Availability of quality forage for deer would decline due to an absence of timber harvest activities and maturing timber stands. However, it is unlikely that food would ever become unavailable. During the next ten years, the amount and distribution of young forest would be expected to decrease to 1,476 acres or a 30% decrease from existing condition (section 4.5.5.2). Currently only 6% of the aspen is between the ages of 0-10, and as these stands age, the deer would move to other areas that provide more young forage and/or would increase browsing on other vegetation types. This could have negative results in the long-term. Mature aspen stands would gradually die and would not be replaced by younger aspen as other shade tolerant tree species gradually increase dominance. Aspen is a short-lived tree and stands older than 60 years can become more susceptible to disease and natural degeneration; currently 28% of total aspen in MPA is greater than 40 years old. Wildlife openings would not be maintained under Alternative 1. Some would gradually revert to forest, but much of the existing edge associated with roads and trails, including closed roads, would remain and continue to provide spring/ summer forage. Thermal cover would still remain in mature conifer stands and develop over the long-term in younger stands. No displacement or disturbance to deer would occur due to any harvest treatments.

Alternative 2

Under this alternative, deer populations would increase the second highest amount as a result of clear-cut and overstory removal acres. White-tailed deer would benefit the most from timber harvest occurring in aspen stands. This would provide the highest quality forage for the short and long-term periods. This alternative proposes the second highest amount of aspen clearcuts and overstory removal acres. Clearcuts occurring in other deciduous stands would also provide young herbaceous growth and in pine habitats that would provide forage in the form of grasses and forbs for several years after the harvest. Total clearcuts acres in these habitats would be similar to Alternative 5 and more than Alternative 3 and less than 4. Overall, the there would be a 35 % increase in young forest habitat (section 4.5.5.). Thinning of oak stands would reduce competition for growing space and encourage better growth, healthier crowns, and promote increased mast production on released oak trees that would provide high quality acorn crop for fall forage. Proposed oak thinning acres are similar across all alternatives. Understory burning of oak in Alternatives 2,4, and 5 would benefit understory forbs and aid in the establishment of oak regeneration and acorn crop production. Selective harvests can have short-term benefits to deer habitat due to the increase in understory development. Eventually the canopy of harvested stands would grow closed, reducing sunlight and affecting the growth of the forbs and shrub layer, but over time these managed stands would tend to maintain a more developed understory than an unmanaged stand. There are also short-term effects in availability of forage from hardwood tops that are available for browsing. In winter, the tops remaining from harvested trees will often attract deer for feeding, especially during severe winters. Under Alternative 2, Selection cut acres are the second highest of all alternatives. Shelterwood and overstory removal harvests would have short-term and long-term effects on the understory development. Since the canopy would be opened to a greater degree than select cuts, the effects would be longer lasting. As with selection cutting, there would also be short-term effects from the availability of hardwood tops for browse. Winter habitat would remain due to no harvest treatments in lowland conifer stands and pine thinnings would have little impact because deer do not normally utilize these forest types. Understory planting would provide potential thermal cover in the long-term. Opening maintenance would benefit deer by maintaining the open and edge habitats in these areas for the long-term. Deer have large home ranges, and appear to adjust quickly to displacement from harvest activity and may adjust their foraging behavior from day to night to avoid harvesting activity. Noise from logging equipment may cause a direct effect of displacing deer to other areas during the day, but they would return at night to feed on down treetops. These effects would also occur in alternatives 3, 4 and 5. This alternative produces the second largest increase in acres of edge effected and the largest increase in miles of edge that would benefit deer forage availability (Table 4.6-1).

Alternative 3

Deer populations would increase under this alternative, however they would only be slightly more than those in Alternative 1. This is because this alternative emphasizes interior habitat conditions and, therefore, has only thinning and selection harvest treatments (see section 2.0 Alternatives). The effects of these would be similar to those described for the partial cuts in Alternative 2. The difference from the other alternatives is the lack of clearcuts and overstory removal treatments that would result in a 29% decrease in young forests acres (4.5.5.2 Forest Structure). This would reduce the amount of available forage for deer in the area (see Alternative 1 for details). Due to lack of clearcut treatments, this alternative creates almost no edge and this would reduce deer forage (Table 4.6-1). Over the short term, there would be no effects to white-tailed deer populations since little change in existing habitat conditions would occur. Over the long term, deer populations would decrease due to a reduction in habitat quality as early successional habitats mature.

Alternative 4

Deer populations would increase the most under this alternative due to it creating the most early successional habitat in the short term period. This alternative and Alternative 2 have similar harvest treatments and the effects of these activities to deer would be similar. The main difference is that Alternative 4 proposes the largest amounts of aspen and overall clearcut acres. This would result in a 91% increase in young forest acres (4.5.5.7.2 Forest Structure). Over the short term, white-tailed deer populations would benefit from increased amounts of preferred forage. Over the long term, populations would continue to benefit as high quality early successional forage is maintained with harvest treatments.

Alternative 5

Deer populations would increase under this alternative, however they would most likely be less than Alternatives 4 and Alternative 2. This alternative and Alternative 2 have similar harvest treatments and the effects of these activities in those timber stands to deer would be similar. The difference is that this alternative has the second lowest amount of aspen and overall clearcuts. Also, it has the highest amount of aspen thinning for conversion to hardwoods. These factors would result in a 6% decrease in young forest acres. The conversion acres would provide early successional habitat in the short-term but, in the long-term, as they convert to hardwood types, their value to deer will decrease.

4.7.5.3 Ruffed Grouse

The ruffed grouse, another very popular game species, uses young stands of many different deciduous forest types. However, aspen forests can support grouse population densities that greatly exceed those attained in other forest communities. Ruffed grouse will use mature aspen for feeding on buds and catkins in early spring and winter, but also use the dense young growth for cover and brood raising. Even-aged regeneration conducted through clearcuts, shelterwoods, and overstory removals are the most appropriate method to create ruffed grouse habitat. These methods remove a majority or the entire upper canopy, which results in enough understory development to provide hiding cover. Optimum habitats for grouse include young (6-15 year old), even-aged deciduous stands that typically support up to 25,000 stems per acre (Dessecker et al., 2001). Aspen management supplies some of the best habitat when clearcut every 40 years in small dispersed patches that are 1-2 acres (Dessecker et al., 2001). Population estimates for grouse following alternative treatments were not available because grouse density numbers (grouse /acre) in various age classes of habitat were not available. The NNF BBS records drumming grouse but it is conducted too late in the spring to accurately estimate populations. Based on above information we will assume that with greater amounts of earlier successional habitat there would be higher grouse populations.

Alternative 1

Ruffed grouse populations would decline slowly as early successional conditions mature in the short and long term periods. Brood rearing cover is currently limited and would be reduced in the short-term period as young aspen stands mature through natural succession. Edge conditions would also be lost as an older age class structure develops in forested stands. Older aged aspen in the project area would continue to provide foraging and winter cover in the form of catkins and buds, but the MPA would not be considered an optimal grouse area without protective (hiding) cover habitat.

Alternatives 2 through 5

Since aspen is the critical habitat type for grouse it will be the main discussion point as alternatives are compared. All action alternatives propose timber harvest treatments that would result in the creation of some regenerating/young forest conditions to benefit grouse. Alternative 4 would provide the greatest amount of early successional habitat (increase 91%, section 4.5.7.2) due to the largest number of clearcut acres followed by Alternative 2 (increase 35 %, section 4.5.4.2). Alternative 5 has the third highest amount of clearcuts but also has the highest amounts of aspen thinnings for conversion to hardwoods. These conversion acres would provide early successional habitat in the short and long term as understory brush and trees develop to provide grouse cover. Alternative 3 has no clearcuts or overstory removal harvest treatments and would create the least amount regenerating habitat (decrease 29%, section 4.5.5.2). Presently there is only 6% of the forested project area in the 0-10 age class. Unless early successional habitat is created, ruffed grouse numbers would slowly decline over the short and long-term. All alternatives would result in maintaining older age classes of aspen that would provide foraging and winter cover.

4.7.5.4 Pileated woodpecker and barred owl

Discussion on the pileated woodpecker and barred owl is combined due to similarities in habitat use. Pileated woodpeckers primarily inhabit mature and uneven aged timber that contains large snags (USDA FS, 1986a) and also use mixed coniferous forests. They are an omnivorous lower-canopy forager during the non-breeding season and feed on insects by excavating tree bark year round but they will also eat various fruits and berries. The NNFBBS data found that most birds were identified in mature northern hardwoods, lowland conifer, aspen and oak stands.
Barred owls utilize mature large super canopy trees and snags with large cavities (USDA FS, 1986a) for roost sites and nesting cavities. They also use mature northern hardwoods, lowland conifers, and oak stands (A. Paulios, 2002). They feed mostly on mice but also on a wide variety of other small mammals, birds, reptiles and amphibians. A. Paulios (2002) indicated that barred owl populations and habitat were stable and well represented over the entire NNF.

All action alternatives propose timber harvest treatments that could result in some disturbance to these birds. If harvesting occurred during the summer season, direct disturbance could disrupt nesting of both birds due to equipment use and tree felling. There could also be disruption to barred owl nesting from winter harvest since these birds initiate their nesting during late February. Foraging and other activities by the pileated woodpecker could be affected by winter harvest since it is also a year-round resident. However, if birds were to move from stands with timber activities there would be undisturbed habitat available within the MPA. Mitigation measures (2.3 Mitigation Measures and Design Features) for all alternatives have design features that maintain ample numbers of existing and potential future snag and den trees in the long-term period. Minimum reserve numbers may not be possible in some stands if adequate numbers don't currently exist or if some snags need to be felled to meet OSHA safety requirements. However, these felled snags can be left on site as down woody debris. In addition, insects, disease, and physical damaged trees constantly provide additional dead and dying trees.

Alternative 1

This alternative would be most beneficial for both species due to large blocks of undisturbed habitat and snag development. Available habitat and population numbers for both species would increase the greatest amount of all alternatives. The MPA is a relatively young aged forest (70 to 80 years) and does not have much natural development of large snag and cavity trees (3.5.5.4 Snags, Cavities Trees, and Down Wood). However, in most forest types there are some older trees that have developed into cavity and/or snag trees. Some shorter-lived trees, like aspen, provide soft cavity and snag trees for a variety of wildlife species earlier than longer-lived species. As hardwood stands mature and large cavity trees become more available, habitat would slowly continue to improve over the long-term in this alternative. The result of this would be more foraging and nesting opportunities for these species. Since no harvest activities would occur, there would be no negative impacts from disturbance, no direct habitat losses, and the largest areas of interior forest habitat would remain intact.

Alternative 2

Available habitat acres and population estimates for both species would increase with this alternative (Table 4.7.1 and Table 4.7.2). These numbers are similar to Alternatives 3 and 5. The reason for this is that mature

northern hardwood acres would increase due to minimal long-term effects on stand structure resulting from selection harvests. Selection and thinning harvest treatments create a temporary change in stand structure by reducing the number of trees per acre. This results in a more open stand below the forest canopy. This would create some unfavorable conditions for barred owls and pileated woodpeckers in the short-term, but in the long-term, there would be more favorable habitat from additional tree growth and greater structural diversity. Acres of interior habitat would be reduced by 9.7% (Table 4.6-1). This is the second largest amount and would occur in the northern part where some of the largest tracts of habitat for these species exist.

Alternative 3

Of the action alternatives, this would benefit both species the most due to larger blocks of undisturbed habitat. However, the other alternatives provided sufficient habitat acres. Available habitat acres and population estimates for both species would increase when compared to existing conditions (see Table 4.7-1 and Table 4.7.2). The main difference from the other action alternatives is there are no clearcuts or overstory removal treatments and thus acres of interior habitat and snag development are maintained or developed (see section 4.6).

Alternative 4

Available habitat acres and population estimates for both species would increase when compared to existing conditions. However, it would be the lowest amount of all alternatives (~ 400 acres less than action alternatives for both species). This lower increase in habitat acres was due to more clearcuts in hardwood stands that do not occur in other alternatives. The clearcuts also reduce the amount of interior habitat for both species. Snag development would be the lowest due to highest harvest acres in mature aspen and hardwood stands.

Alternative 5

Available habitat acres and population estimates for both species would increase when compared to existing conditions (see Table 4.7-1 and Table 4.7-2). The difference from other action alternatives is lowest amounts of clearcuts and conversion of aspen to hardwoods. In the long-term, this would provide for larger blocks of interior habitat acres and potential for more snag development.

4.7.5.5 Common Raven

The common raven is a year-round resident of northern Wisconsin and utilizes mature pine stands (USDA FS, 1986a). They have been consistently identified by the NNF BBS in all ages of aspen, northern hardwoods, lowland conifer and intermediate and mature ages of red pine. Ravens are primarily scavengers that rely on carrion but are very opportunistic feeders; small birds and mammals, bird eggs, insects, seeds and fruit (NRRI, 2002). Effects from harvests in aspen and hardwoods would be similar as described above and below with other MIS bird species. Effects from pine management will be addressed below as the main discussion point as alternatives are combined for comparison.

Alternative 1

Available habitat acres and population estimates would increase the most under this alternative when compared to existing conditions This is mainly due to the absence of harvest treatments which would allow all habitats to mature and increase nesting opportunity. Ravens would also benefit from the large contiguous forest tracts currently available and lack of disturbance from timber harvest activities.

Alternative 2 through 5

Available habitat acres and population estimates would increase by approximately the same amounts when alternatives are compared to existing conditions (Table 4.7-1). Harvest during winter and spring could affect nesting ravens since they begin breeding in mid-February. If birds were disturbed during this period there would be other mature stands without proposed activities that could be used for relocation. Pine management acres are the same for Alternatives 2,4, and 5 (approximately 1,500) with over 90% of those harvests occurring with thinning treatments. Alternative 3 would benefit common ravens the most because there is about 150 less acres of pine management and all are with thinning treatments. Disturbance from these treatments and the structural change would make the mature stands unsuitable in the short-term but would provide suitable habitat in the long-term.

Table 4.7.1a Changes in MIS habitat acres by alternative from current conditions using NNF-BBS species density data.

Species	Current	Alt 1		Alt 2		Alt 3		Alt 4		Alt 5	
	Habitat Acres	Habita t Acres	Change from Current Acres	Habitat Acres	Change from Current Acres	Habitat Acres	Change from Current Acres	Habitat Acres	Change from Current Acres	Habitat Acres	Change from Current Acres
Barred owl	8,100	9,137	1,037	8,846	746	8,852	752	8,441	341	8,852	752
Blackburnian warbler	8,794	12,320	3,526	10,871	2,077	12,036	3,242	9,977	1,183	11,463	2,669
Black-throated green warbler	9,364	13,011	3,647	11,595	2,231	12,727	3,363	10,748	1,384	12,186	2,822
Common Raven	15,539	15,621	82	15,585	46	15,600	61	15,585	46	15,600	61
Chestnut sided warbler	16,107	16,107	0	16,107	0	16,107	0	16,107	0	16,107	0
Ovenbird	16,332	16,474	142	16,473	141	16,473	141	16,455	123	16,473	141
Pine warbler	12,187	11,617	(-570)	11,663	(-524)	10,589	(-1,598)	11,652	(-535)	11,098	(-1,089)
Pileated woodpecker	14,424	15,327	903	15,037	613	15,043	619	14,632	208	15,043	619
Red-eyed vireo	15,503	15,503	0	15,503	0	15,503	0	15,503	0	15,503	0
Scarlet Tanager	17,286	17,286	0	17,286	0	17,286	0	17,286	0	17,286	0
Golden-winged warbler	9,090	9,090	0	9,090	0	9,090	0	9,090	0	9,090	0

Table 4.7.1b Changes in MIS populations by alternative from current conditions using NNF-BBS species density data.

Species	Current	Alt 1		Alt 2		Alt 3		Alt 4		Alt 5	
	Est. Pop.	Est. Pop.	Change from Current Pop.	Est. Pop.	Change from Current Pop.	Est. Pop.	Change from Current Pop.	Est. Pop.	Change from Current Pop.	Est. Pop.	Change from Current Pop.
Barred owl	12	14	2	13	1	13	1	13	1	14	2
Blackburnian warbler	858	1,003	145	933	75	970	112	869	11	951	93
Black-throated green warbler	677	817	140	764	87	790	113	717	40	788	111
Common Raven	179	185	6	180	1	185	6	179	0	183	4
Chestnut sided warbler	713	603	(-110)	608	(-105)	604	(-109)	613	(-100)	606	(-107)
Ovenbird	2,158	2,112	(-46)	2,198	40	2,210	52	2,202	44	2,204	46
Pine warbler	213	271	58	208	(-5)	195	(-18)	207	(-6)	201	(-12)
Pileated woodpecker	148	160	12	156	8	156	8	149	1	156	8
Red-eyed vireo	1,786	1,906	120	1,854	68	1,902	116	1,829	43	1,879	93
Scarlet Tanager	388	374	(-14)	378	(-10)	376	(-12)	381	(-7)	378	(-10)
Golden-winged warbler	302	317	15	169	(-133)	317	15	283	(-19)	305	3

Table 4.7-2a Ranking of comparison between selected MIS habitat acres by Alternatives

Species	Alt 1		Alt 2		Alt 3		Alt 4		Alt 5	
	Ranking Habitat Acres	% Change	Ranking Habitat Acres	% Change	Ranking Habitat Acres	% Change	Ranking Habitat Acres	% Change	Ranking Habitat Acres	% Change
Barred owl	1	11.3	3	8.4	2*	8.5	4	4.0	2*	8.5
Blackburnian warbler	1	28.6	4	19.1	2	26.9	3	11.9	3	23.3
Black-throated green warbler	1	28.0	5	19.2	2	26.4	4	12.9	3	23.2
Common Raven	1	0.5	4	0.3	3	0.4	4	0.3	2	0.4
Chestnut sided warbler	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0
Ovenbird	1*	0.9	1*	0.9	1*	0.9	2	0.7	1*	0.9
Pine warbler	3	(-4.9)	2	(-4.5)	5	(-15.1)	1	(-4.6)	4	(-9.8)
Pileated woodpecker	1	5.9	3	4.1	2	4.1	4	1.4	2	4.1
Red-eyed vireo	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0
Scarlet Tanager	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0
Golden-winged warbler	ND	0.0	ND	0.0	ND	0.0	ND	0.0	ND	0.0

Table 4.7-2b Ranking of comparison between selected population estimates by Alternative

Species	Alt 1		Alt 2		Alt 3		Alt 4		Alt 5	
	Ranking Population	% Change	Ranking Population	% Change	Ranking Population	% Change	Ranking Population	% Change	Ranking Population	% Change
Barred owl	1*	14.3	2*	7.7	2*	7.7	2*	7.7	1*	14.3
Blackburnian warbler	1	14.5	4	8.0	2	11.5	5	1.3	3	9.8
Black-throated green warbler	1	17.1	4	11.4	2	14.3	5	5.6	3	14.1
Common Raven	1*	3.2	3	0.6	1*	3.2	4	0.0	2	2.2
Chestnut sided warbler	5	(-18.2)	2	(-17.3)	4	(-18.0)	1	(-16.3)	3	(-17.7)
Ovenbird	5	(-2.2)	4	1.8	1	2.4	3	2.0	2	2.1
Pine warbler	1	21.4	2	(-2.4)	5	(-9.2)	3	(-2.9)	4	(-6.0)
Pileated woodpecker	1	7.5	2*	5.1	2*	5.1	3	0.7	2*	5.1
Red-eyed vireo	1	6.3	4	3.7	2	6.1	5	2.4	3	4.9
Scarlet Tanager	4	(-3.7)	2	(-2.6)	3	(-3.2)	1	(-1.8)	2	(-2.6)
Golden-winged warbler	1*	4.7	4	(-78.7)	1*	4.7	3	(-6.7)	2	1.0

* = same value as another alternative

ND = no difference between alternatives

% change = percent change from current conditions

4.7.5.5 Neotropical Migrants (NTM's)

All action alternatives propose timber harvest treatments that would result in similar vegetation alterations and effects. These effects are addressed to all MIS NTM's as a group first and then, later in this section, other detailed effects from the alternatives are addressed to individual birds.

The practice of clearcutting creates an immediate change in the structure and age class of a forest stand. A stand that is composed primarily of mature trees, with a certain number of dead, damaged, or diseased trees, is converted to a relatively even-aged regenerating stand that may retain some snags and live mature trees. Clearcutting creates a temporary opening in the forest canopy, allowing a greater amount of sunlight to reach the forest floor. The regeneration in these stands would be primarily aspen or jack pine with varying amounts of balsam fir, hardwoods, or other species depending on the species mix of the parent stand. The transition between the clearcut stand and surrounding areas may be a sharply defined edge or a more gradual change, depending on the surrounding vegetation type and the quantity of standing trees remaining in the clearcut. There may be a reduction in stand species diversity if species present prior to cutting did not regenerate, or regenerated more slowly than the primary type. NTM's using affected parts of those stands would be forced to move into other parts of the project area where mature forests are more prevalent. Following Forest Service national direction, most clearcut units proposed in the action alternatives are 40 acres in size or smaller. However, there can be exceptions to this restriction by Regional Forester approval to meet specific management goals and in alternatives 4, there are 14 clearcut blocks of aspen harvest larger than 40 acres. These large blocks of aspen would be harvested as single units rather than being broken into smaller units. In doing this, 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. These larger units would also help represent a greater variation in overall patch size on the landscape that 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).

Selection cuts create a temporary change in stand structure as the numbers of trees per acre are reduced, resulting in a more open stand structure below the forest canopy. This increase in understory sunlight allows a more vigorous growth of tree seedlings, shrub species, and herbaceous plants. Canopy gap management would also occur in these stands. This would be a temporary condition because the gaps would close in 10-15 years as branches from adjacent trees grow in an effort to gain more access to sunlight. Canopy gaps would enhance the regeneration of trees in a similar manner that occurs in nature when mature trees tip over. After being exposed to increased sunlight, seedlings develop and grow in dense clumps, which in turn provide habitat for nesting interior NTM birds. Stands managed by selection cutting eventually grow back to a closed canopy condition, although generally with greater structural variation than before harvest. The timing of selection harvests, as with all treatments, could directly affect the NTM, especially during the spring and summer breeding and young rearing period. Summer harvest could affect tree and ground dwelling species that use trees for hiding cover, nesting, or foraging habitat. Fall harvest may affect fewer arboreal or ground dwelling species, but could potentially affect late breeding and foraging birds. Shelterwood regeneration treatments effectively open the existing forest canopy, allowing more sunlight to reach the forest floor than selection cuts. This results in a growth of tree and shrub species underneath the remaining mature trees. Opening the canopy can negatively impact NTM's that nest in canopies of mature forests, but it can also benefit those that utilize thick understory growth. Overstory removal removes a majority of the mature trees growing in a stand with established regeneration. This simplifies the stand habitat diversity to one of strictly seedlings and saplings. Most bird species are likely to lose suitable nesting habitat from this overstory elimination. At the same time, other species preferring early successional conditions would gain habitat in the form of a shrub/brush understory. All treatments can produce varying degrees of fragmentation and edge effect (Section 3.7.5.) and this is addressed with each alternative below.

Blackburnian warblers utilize a variety of lowland and upland, mature coniferous forests. They are also found in deciduous forest areas that have a mature conifer component that include hemlock and white pine (USDA FS, 1986a, Howe 1995). The NNF BBS data for McCaslin identified that the greatest numbers of Black-burnian warblers were found in mature aspen, northern hardwoods and white spruce stands. They nest in conifer trees and also forage in these trees for invertebrates and their densities may be affected by spruce budworm outbreaks (NRRI, 2002).

Black-throated green warblers are associated with a variety of upland deciduous mature forests that include some type of hemlock component (Howe 1995). The Nicolet Forest Plan also mentions that softwood forests are of prime importance for this species (USDA FS, 1986a). The NNFBIRD data for McCaslin identified that the greatest numbers of black-throated green warblers would be found in mature aspen, northern hardwoods and oak stands. These birds are considered a "high tree warbler" were they nest in the upper canopy and feed on invertebrates such as caterpillars, spiders and beetles (NRRI, 2002).

Chestnut-sided warblers breed in early-successional deciduous (aspen/birch) communities usually associated with dense shrub layer (Howe 1995). The Nicolet Forest Plan (1986a) also includes shrub swamp and upland opening habitats in a description of preferred habitat. The NNFBIRD data for the McCaslin Area identified that the greatest chestnut-sided warbler numbers would be found in northern hardwoods, aspen, paper birch, white spruce stands and shrub swamp. Nests are usually located in sapling or low brush only a few feet from the ground. They are insectivores but will eat berries when insects are scarce (NRRI, 2002).

Ovenbirds can be found in almost all habitat types but prefer mature upland hardwood forest and also aspen/birch stands (USDA FS, 1986a, Howe 1995). The NNFBIRD data for McCaslin identified that the greatest numbers of ovenbirds would be found in northern hardwoods, aspen, white pine and mature oak stands. These birds are unique in they are among the few that are ground nesters and also forage there on insects, worms and snails (NRRI, 2002).

Pine Warblers have a highly specific habitat requirements being found mostly in mature jack, white and red pine stands (USDA FS, 1986a, Howe 1995). The NNFBIRD data for McCaslin identified that the greatest numbers of pine warblers would be found in red pine, white pine, white spruce, oak and young aspen stands. Pine warblers nest in pine trees on horizontal branches or among the foliage at the branch tip about 5 feet above the ground and feed on insects gleaned from the pine foliage (NRRI, 2002).

Red-eyed vireos are one of the most abundant birds on the NNF and are found both in mature and immature hardwoods and in aspen/birch stands (USDA FS, 1986a, Howe 1995). The NNFBIRD data for McCaslin identified that the greatest numbers of red-eyed vireos would be found in northern hardwoods, aspens, and oaks. Nests are generally located 2-3 meters above the ground in shrubs of low branches where there is more dense tree cover. They are insectivores and will feed both the subcanopy and lower portions of the forest canopy.

Scarlet Tanagers breed in mature deciduous forests but are also found in mixed and coniferous forests that include balsam fir/spruce stands (USDA FS, 1986a, Howe 1995). The NNFBIRD data for McCaslin identified that the greatest numbers of scarlet tanagers would be found in aspen, northern hardwoods, oak, white pine and white spruce. Tanagers nest 8-15 ft above the ground, well out on branches. They feed in the upper canopy on insects (NRRI, 2002).

Golden-winged warblers are usually located in lowland conifers and regenerating aspen/birch stands (Howe 1995). The NNFBIRD data for McCaslin identified that the greatest numbers of golden-winged warblers would be found in aspen, paper birch, lowland conifer and lowland shrub habitat. They nest in loose colonies of up to 10 pairs, and their nest are placed on or near the ground where it is supported and concealed by weed stalks. It is insectivorous, gleaning and probing for insects near the tops of shrubs and trees (NRRI, 2002).

Alternative 1

Ovenbird, red-eyed vireo, scarlet tanager, blackburnian, black-throated green and pine warblers would benefit the most form this alternative due to large blocks of undisturbed mature habitat. With one exception, long-term habitat acres would increase for all species under this alternative. Populations would also increase in all except for three species (Table 4.7-1). The decrease in pine warbler habitat would mainly be associated with the loss of early-successional aspen forest. However, an increase in mature pines would allow for an increase in their population. Ovenbirds and scarlet tanager habitat acres would increase, but their population would be expected to decrease slightly. This would be due to a loss in habitat acres that had a higher population density than the habitat type that is expected increase. The scarlet tanager's higher population densities are in young spruce and intermediate aged paper birch, white pine and white spruce. This trend is repeated in all other alternatives. All other bird species that utilize mature or near-mature, closed canopy forest would continue to benefit from the use of this habitat in the short and long term. This was reflected with increases in population

densities within mature habitat for those birds. Structural diversity in some stands would be lower and could be a limiting factor for some NTM's. Many of these stands have relatively small average tree diameters and limited snags, cavity trees, and large woody debris (section 3.5.5.4) due to massive clearcutting and wildfires of the late 1800s and early 1900s. Natural canopy gaps would occur from time to time as individual trees blow down in wind storms, creating some diversity in stand structure (but not as much as would be expected in the action alternatives). Conifer components would likely increase in deciduous stands as they slowly continue to transition into a mixed hardwood/conifer forest. This would benefit the blackburnian and black-throated green warblers. Changes in the existing condition of vegetation community type or age class composition would occur through the natural process of forest succession or through large scale disturbances (fire, ice storm, or insect and disease infestations). There would be no effects from the creation of edge and fragmentation since there would be no harvest treatments or road construction.

Alternative 2
All species habitat acres would increase under this alternative in the long-term except for one. These populations would also increase except for four species (Table 4.7-1). The pine warbler's population is expected to decrease slightly in response to reduction in mature white pine. Golden winged warbler's population would decline somewhat due the harvest of aspen stands that currently have high population densities. Species that utilize early successional habitat (0-10 years old) like the golden-winged and chestnut-sided warblers, would be expected to show an increase in the alternatives that include harvest treatments that create this habitat. The analysis did not indicate this because it was conducted at 15 years post harvest and that age class was not represented at that time. However, in the years preceding this date, those bird populations would have increased as early successional vegetation became established in these post clearcut, overstory removal and selterwood stands. This trend is repeated in all action alternatives and would especially apparent with Alternative 4. Blackburnian and black-throated green warblers would have the lowest increase in their habitat acres when compared to all other alternatives. This increase would be from the minimal effects of selection cuts in mature northern hardwoods in the long-term; this trend is repeated in all action alternatives. Blackburnian and black-throated green warblers would also benefit in the long term from the hardwood harvest that would create conditions that favor hemlock. Habitat acres for chestnut-sided warbler, red-eyed vireo, scarlet tanager, and golden-winged warbler did not change with this alternative because selected habitat included all age classes. As the stands age increases or decreases, the stands would move into the next age class and would be used again in calculating total available habitat acres. Pine harvest acres are similar with all action alternatives and would benefit the black-throated green and blackburnian warbler in the long-term because over 90% are thinning cuts.

The proposed timber harvests (mainly clearcuts acres) would increase forest fragmentation within the project area and could negatively affect NTM populations. Compared to the other alternatives, Alternative 2 produces the second largest decrease in acres of interior habitat and second largest increase in acres of edge effected and the largest increase in miles of edge (Table 4.6-1). This fragmentation and edge effect is a result from this alternative having the highest road reconstruction miles, second highest road construction, and the lowest deconstruction and closed road miles.

Alternative 3
All species habitat acres would increase the most under this alternative in the long-term except for one. These populations would also increase except for three species (Table 4.7-1). Pine warbler habitat decreased the most of all alternatives due to lack of young aspen. Chestnut-sided and pine warbler populations would decline due to no early-successional growth created from clearcuts or overstory treatments. There would however be a lack of variety in habitats and large range of variation for key structural attributes that would not support a diverse bird community (Sallabanks, et al 2001). The lack of these treatment types would increased the acres of mature forests through out the project area. Species populations associated with mature forests increased the most of all action alternatives (Table 4.7-1). Habitat acres for red-eyed vireo, scarlet tanager, chestnut-sided, golden-winged warblers did not change with this alternative for the same reason described in Alternative 2. Similar to Alternative 1, there would be the very little change to the amount of existing interior habitat, edge creation and new roadwork. All of these would benefit NTM's.

Alternative 4
Early successional habitat specialist like the chestnut sided and golden-winged warbler would benefit the most from this Alternative. All species habitat acres would increase although they would be the least of all

alternatives except for one. These populations would also increase except for four species (Table 4.7-1). Scarlet tanager warbler, chestnut sided, golden-winged warbler populations results were similar to Alternative 2. Pine warbler habitat decreased and scarlet tanager, red-eyed vireo, chestnut-sided and golden-winged warbler acres did not change for the same reason described in Alternative 2 and is repeated in Alternative 5. Interior habitat acres are decreased the most (-17.4%) and acres of edge effected (+10.0%) are increased the most. Both these impacts on the large interior sections in the north part of the project could negatively impact NTM's populations. However, miles of edge in the project area are reduced (-0.45) (Table 4.6-1).

Alternative 5
All species habitat acres would increase the second most of all action alternatives in the long-term except for one. These populations would also increase except for three species (Table 4.7-1). Acres of harvest treatments are very similar to alternative 2 except there are about double the clearcut acres that would benefit chestnut-sided and pine warbler. The clearcuts are concentrated in the southern half of the project area. Species that utilize large blocks, Blackburnian, black-throated green warblers, red-eyed vireo, and scarlet tanagers would benefit in the northern half. Interior habitat acres are decreased the third most (-3.0%), acres of edge effected (+2.0%) would increase the third highest amount (+2.0%). However, miles of edge in the project area are reduced the most of any Alternative (-1.1 miles, see Table 4.6-1).

4.7.6 Cumulative Effects to MIS

The cumulative effects analysis for the wildlife resource will consider past, present and future activities on private lands in the MPA and within a 2 mile buffer of the project area. The time frame covered will be from approximately 10 years ago and 15 years from project implementation.

Past
The forested landscape and vegetation across the NNF was altered during the logging era of late 1880's and early 1900's. The conifer and mixed hardwood/conifer forests were cut and extensive slash fires burned the area. This severe alteration of wildlife habitat, in addition to market hunting and direct persecution by humans, led to the extirpation or reduction of numerous large herbivores and predators (e.g., moose, wolf, fisher, marten). Aided by recovery efforts and restoration of habitats, several of these species are now on their way back. Presently the vegetative landscape within the northern part of the MPA is a continuous canopy of pole and mature size sugar maple-basswood, red oak, aspen, and white spruce-balsam fir-aspen stands. In the southern part, the Forest is more fragmented with private lands and dominated by aspen, mixed northern hardwoods, red oak and jack, red and white pine stands. Scattered non-forested habitat can be found in both areas that include small grassy openings, sedge meadows, bogs, and various types of wetlands. Since 1990, about 14,255 acres of forest habitat on NF lands and about 3,765 acres on other ownerships have been harvested in upland habitats of the cumulative effects area. Of these acres, approximately 7,645 acres (17%) were selection or improvement cuts in northern hardwood forests and 2,500 acres (6%) were clearcut treatments. Impacts from these recent activities did not cause significant changes in MIS population levels since most are well represent today in the MPA and follow their normal cyclical patterns.

Present
Presently there are about 175 acres of various harvest treatments taking place in the McCaslin Area. This should not add any notable impacts to MIS birds, deer or brook trout.

Future
Potential future actions occurring would include activities similar to those that have occurred in the recent past. Typically these actions would include timber harvests, road construction and reconstruction, and the continued maintenance of existing trails and wildlife openings. Outside the MPA area there are about 1,145 acres of even aged management, 146 acres of thinnings, and 3,650 acres selection of improvement cuts scheduled across all ownerships. One of the more noticeable cumulative impacts on the forest landscape is the steady escalation of private land development. As larger blocks are subdivided into smaller parcels, the habitat is often altered were there is a direct loss of potentially suitable habitat or reduction in the quality of the habitat for some species. When each parcel is developed the number of road miles across the forest increases and existing roads accessing the various parcels are typically improved. Usually the number of miles of road in federal ownership increase with development because access must often be provided across National Forest lands. Other activities known or expected to occur in the foreseeable future are recreational pursuits; including hunting, trapping, fishing, and snowmobile use. Hunting, trapping, and fishing have been

occurring in these areas for many decades. Pressure is highest during rifle deer season, and there is moderate activity during the period for training bear dogs and grouse hunting. Deer, grouse, bear, waterfowl, snowshoe hare, furbearers will be affected directly through harvest. Predators and prey of these species will be affected to a lesser degree. Population levels and harvest are managed by WDNR to maintain viability of all game species and ensure future harvests. The impacts of proposed timber harvest on game species should be minimal or beneficial depending on the species, so there should be no negative cumulative effects.

Summary
As a result of the above activities, there would be no additional impacts to TES, RFSS and MIS other than those direct/indirect effects already described in this document, BE and Analysis of Effects to TES.

Deer, ruffed grouse, golden-winged, chestnut-sided warblers and would benefit from even-aged management. Distributed across the landscape, this management may have caused fragmentation, but would not have created unsuitable habitat for mature forest species to affect their viability. Most of these clearcuts have occurred in over mature aspen and dying jack pine forests that would have opened up naturally in the future. Species that prefer mature forest and larger tracks of continuous forests would benefit as timber age classes shift towards older habitat with selection and improvement cuts. Effects from these harvest treatment vary in forest types, but primarily include opening the canopy to varying degrees and changing stand development. Opening the canopy can make a stand unsuitable for some species in the short term. During this period mature forest dependent species like barred owls, pileated woodpeckers, scarlet tanagers, red-eyed vireo, blackburnian, and black-throated green warblers may concentrate in remaining blocks of suitable habitat and young forest species would expanded into new habitat. In the long term it will allow for understory development and increased growth in remaining trees that would be beneficial to a these species and allow them to return and utilize this habitat. The impacts of selection cuts are less than clearcuts, so fewer MIS would be affected and the impacts would last only for the short-term period. Impacts from above activities to brook trout habitat would not adversely impacted them due to WDNR water quality protective guidelines.

In conclusion, the cumulative effects of all action alternatives in combination with those activities on private lands would involve a continuation to varying degrees of current vegetation patterns and forest types. Activities would involve human-caused and random natural disturbances that would likely result in varying levels of both positive and negative habitat alteration. Areas of regenerating forest treatments would have more disturbance than would occur with natural disturbance alone. Habitat for early successional species would be perpetuated, although probably not to the level found in past decades and habitat for interior forest species would be maintained or increased depending on alternative. Therefore, the effects from past, present and future actions on private lands, combined with the direct and indirect effects of proposed Alternatives would not negatively impact the populations of TES, RFSS, MIS and those species associated with the habitat they represent.

4.8 Fisheries Resources

4.8.1 Summary

Due to the mitigation measures and design features used, none of the alternatives analyzed would be expected to have any adverse effects on fish or fish habitat. Erosion control and fish habitat restoration activities that are included in Alternatives 2-5 would be expected to be beneficial to fish and fish habitat by restoring physical habitat, such as large woody debris (LWD) to water bodies that were negatively impacted over a hundred years ago. The planting of white pine and hemlock along the south shore of the North Branch Oconto River would have positive long-term effects on fish populations and their habitats.

4.8.2 Introduction

Fish populations and habitat within the McCaslin project area were negatively impacted by log drive activities from 1870-1900. Many of the impacts from this era were so severe they are still evident today and continue to limit the fisheries resources. These activities are well recorded on larger streams and rivers and to a lesser extent on the smaller streams of the project area and throughout the lake states. Some of the written documentation from these activities is stated below. Over the past 50+ years fish habitat restoration projects have been undertaken on many lakes, rivers and streams on the Chequamegon-Nicolet National Forest. These

projects have helped restore physical habitat, such as large woody debris (LWD) to water bodies that were negatively impacted over a hundred years ago.

Large woody debris is an important component of fish habitat and consists of entire trees, logs, tree-tops, stumps, boles, root wads, or large branches. Cover refers to all elements of fish macro-and micro-habitat that provides shelter, protection, creates lower water velocities, and enhances feeding opportunities (Benchley, et al 1993).

The fisheries resource analysis boundaries for direct/indirect and cumulative effects of this project set are delineated on a map titled "Fisheries Resources Analysis Boundaries" which is located in the project file. It is anticipated that if any short or long-term impacts (positive or negative) exist or occur to streams within the project area that they could result in impacts measurable up to two miles downstream. A short-term impact would less than one month in duration. A long-term impact would be one that persists longer than one month.

The following issues were identified from the initial scoping process: macroinvertebrates, water temperature effects, measures to protect critical spawning and rearing habitat, changes to stream substrate, measures to protect critical fish habitats, effects of roads on fish and their habitats, effects on wood turtle habitat, mussels, and aquatic exotic species populations. Throughout the effects discussion, these eight issues were combined into the two general categories of 1) effects to aquatic habitat and 2) effects to aquatic species.

4.8.3 Direct and Indirect Effects of Alternative 1

This is the no action alternative. Under this alternative, routine maintenance would continue, but the proposals discussed for the action alternatives in Chapter 2 would not be implemented. No timber harvest, roadwork, or habitat improvement projects would take place in this alternative. It is possible that separate erosion control or habitat improvement projects could take place, but they would be a result of a different project and analysis.

Direct and Indirect Effects on Aquatic Habitat

There would be no short-term effects on water temperature or the expected level of sediment over the existing condition as a result of Alternative 1. In the long-term trees would grow taller and enlarge their canopies, which should increase shading along lakes and streams, as a result water temperatures would be expected to decrease.

The effects of current road/stream crossings and vehicle traffic within the project area are not measurable. Since this is the no action alternative no activities would occur that would have additional impacts to fish habitat from sedimentation. Several road/stream crossings within the project area would be fixed in 2002 and 2003, under the 10 Percent Roads and Trails program.

The dispersed campsites at Lincoln Lake and along the North Branch Oconto River currently generate surface erosion to these water bodies. These sites would not be addressed as part of this alternative. Although all the areas mentioned above are small in size, and intensity, they are currently and would continue to add sediment and degrade water bodies associated with them for years or even decades. In the long term this sediment is not expected to cause a noticeable decrease in aquatic species densities or numbers.

Direct/Indirect Effects on Aquatic Species

There would be no known short-term positive or negative effects to macroinvertebrates associated with this alternative. The long-term populations and habitat for macroinvertebrates may stay the same or increase, based on the expected increase of large woody debris being incorporated into the streams and lakes due to trees growing larger, dying, and falling into adjacent streams and lakes.

There would be no expected short-term or long-term increase or decrease of fish, mussels, or aquatic exotic species.

4.8.4 Direct and Indirect Effects of Alternatives 2, 3, 4, and 5

Since each of these four alternatives include the same activities that have the potential to affect aquatic habitat and species, discussion has been combined to eliminate unnecessary repetition. These activities include harvesting trees, installing instream and lake cover structures, and planting trees.

Direct and Indirect Effects on Aquatic Habitat
Due to the use of Best Management Practices, there would be no short-term effects on water temperature or the level of sedimentation over the existing condition as a result of Alternative 2, 3, 4, and 5. In the long-term trees would grow taller and enlarge their canopies, which should increase shading along lakes and streams. As a result water temperatures might decrease slightly.

The effects of current road/stream crossings and vehicle traffic within the project area are not measurable. Several road/stream crossings within the project area would be fixed in 2002 and 2003, under the 10 Percent Roads and Trails program.

The dispersed campsites at Lincoln Lake and along the North Branch Oconto River currently generate surface erosion to these water bodies. These sites would be addressed as part of these alternatives. Although all the areas mentioned above are small in size, and intensity, they are currently and would continue to add sediment to the water bodies associated with them for years or even decades. In the long term this sediment is not expected to cause a measurable decrease in aquatic species densities or numbers.

The creation of whole trees, brush bundles, and log cover structures would help restore the long-term physical structure to lakes and streams within the project area. The conifer tree plantings along the shores of Lincoln Lake and the North Branch Oconto River would start growing long-lived tree species for long-term recruitment of LWD into the streams, river and lakes identified in the project area.

Direct/Indirect Effects on Aquatic Species
There would be no known short-term positive or negative effects to macroinvertebrates associated with these alternatives. The long-term populations and habitat for macroinvertebrates would stay the same or increase, based on the expected increase of large woody debris being incorporated into the streams and lakes due to trees growing larger, dying, and falling into adjacent streams and lakes. There would be no expected short-term or long-term increase or decrease of fish, mussels, or aquatic exotic species.

4.8.5 Total Cumulative Effects of all Alternatives

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

Past Actions
During the period from 1870-1900 McCaslin Brook and the North Branch Oconto River within the project area, were negatively impacted from log driving activities. Rocks were blasted out, logs and windfalls were cleared out of the river. These early logging activities caused massive changes to the physical characteristics of these two streams. Historic log driving activities, and past timber harvesting have resulted in less large woody debris than is considered optimal. Historic dam building on the North Branch Oconto River has negatively altered the river channel above the dams.

Over the past 50+ years fish habitat restoration projects have been undertaken on many lakes, rivers and streams on the Chequamegon-Nicolet National Forest. These projects have helped restore physical habitat, such as large woody debris (LWD) to water bodies that were negatively impacted over a hundred years ago. The existing fish habitat could be restored by adding LWD to selected streams and lakes, to reverse some of the known effects of past activities.

In the past numerous timber sales have occurred throughout and outside the analysis area. At the time managers attempted to leave vegetated buffer zones along lakes and streams. Some vegetation management activities that occurred along streams and lakes within the project area from 1960 to 1992 likely reduced the amount of LWD from some water bodies. These activities likely had a direct and indirect effect on aquatic species and their habitats. The loss of large woody debris (LWD) may affect stream-channel stability and contribute to a loss of fish habitat in some rivers and streams. Within the last 2 years in the Forest County area of the project area there have been three active timber sales (Scatter Shot, Peanut, and King Lake sales). BMP's were used and no impacts to aquatic resources occurred. All three of these timber sales are closed.

Present Actions
The recent housing development on the north end of John Lake is located in an upland area with no wetlands involved except John Lake. The effects to fish habitat and water quality in John Lake are unknown. John Lake is completely surrounded by non-federal land for a distance of over ¼ mile in all directions. The actions proposed in the action alternatives would have no effects on fish or fish habitat on John Lake and, therefore, there should be no additive (cumulative) effects with this development. Any impacts that may occur at this site would be far removed from the sites of potential impacts within the McCaslin project area. Because of this and since no measurable direct or indirect impacts are expected under any of the alternatives, there would be no potential for cumulative effects in combination with this ongoing activity.

A Ten Percent Road/Stream crossing project is scheduled at Knowles Creek Road/Shawano Creek this year. This should restore stream channel integrity, improve fish migration, and reduce or eliminate sedimentation. There are no active timber sales within or immediately adjacent to the project area.

Future Actions
By analyzing scientific fish survey data (monitoring), habitat restoration projects have, are, and would continue to be conducted on streams, rivers and lakes of the Chequamegon-Nicolet National Forest to restore habitats for all aquatic species. These projects would be implemented to mimic natural conditions, blend in with the natural shorelines and streambanks, and strive to restore some of the physical structure to these water bodies. If the aquatic habitat restoration projects identified above were completed, fish and other aquatic species populations could be expected to increase into the future. In addition the process of growing long-lived tree species for long-term recruitment of LWD into the streams, river and lakes would help restore habitat naturally in the future.

Table 3.8-4 in section 3.8.4 lists specific roads on National Forest lands within the project area currently having a negative impact on fish and fish habitat. Some of these crossings are currently scheduled to be corrected or are anticipated to be corrected in the future through the Forest Service's Ten Percent Roads and Trails Program or road maintenance programs. There are many other road/stream crossings on private property within the project area that are having similar or greater negative impacts to fish and fish habitat. Two specific areas are culverts under driveways that are impacting Fenske Creek (flows from Hidden Lake) in T33N, R16E, N1/2 SE1/4 Section 9.

During the next ten years there may be a proposal to remove the remains of the two dams on the North Branch of the Oconto River. By using project design criteria, removal of the two dams could have a positive effect on fish habitat and water quality (by lowering water temperatures). Along with the dam removal, whole trees and boulders might be incorporated into the river channel in the areas above the dams to restore physical structure, which would benefit aquatic species, especially fish.

Aquatic exotic species are known to occur in several lakes within the project area (see section 3.8.6). There would not be any increase in the spread of aquatic exotic species within the project area because no activities would occur in wetland areas. However, the likelihood of these exotic species or new ones being introduced or spreading into the area could occur from recreational activities by the public.

Conclusions
As a result of Alternative 1 and all known past, present and reasonably foreseeable activities, some positive measurable cumulative impacts to aquatic resources would be expected. It is likely that fish and macroinvertebrate populations would noticeably increase in limited areas where proposed future road crossing projects are proposed, as well as planned watershed improvement projects, such as the removal of the remains of the Holt and Hemlock dams on the North Branch Oconto River and additional whole tree installations and boulder placement within the impact zone of these dams, and possibly working with the private land owners to fix the culverts that are impacting Fenske Creek.

As a result of Alternatives 2, 3, 4, and 5 and all past, present, and reasonably foreseeable activities, positive measurable cumulative impacts would be expected. It is believed that fish and macroinvertebrate populations would noticeably increase in limited areas where proposed habitat improvement and road crossing projects are proposed. These projects would include the erosion control and habitat improvement projects included in Alternative 2-5, as well as planned watershed improvement projects such as the removal of the remains of the

Holt and Hemlock dams on the North Branch Oconto River and additional whole tree installations and boulder placement within the impact zone of these dams, and possibly working with the private land owners to fix the culverts that are impacting Fenske Creek. In addition to these, watershed improvement projects have been identified for County Road C/Tributary to Otter Creek, and County Road F/West Thunder Creek and would be reasonably foreseeable improvements. The sum of these actions would be expected to result in limited, positive cumulative effects in the affected areas.

4.9 Transportation System

4.9.1 Summary

The following tables summarize the open road densities and total mileage (open and closed) that would result from each alternative. For more detailed information, see sections 4.9.3-4.9.7.

Table 4.9-1: Total Road Density by Management Area and Alternative (miles/sq. mile)

MA	Existing Cond.	Alt 1	% Change	Alt 2	% Change	Alt 3	% Change	Alt 4	% Change	Alt 5	% Change
1.1	5.55	5.55	0%	5.12	-8%	4.99	-10%	5.10	-8%	5.08	-9%
3.1	5.24	5.24	0%	5.30	+1%	5.13	-2%	5.33	+2%	5.31	+1%
4.1	6.69	6.69	0%	7.56	+13%	6.25	-7%	7.39	+10%	7.27	+9%
1.2	5.29	5.29	0%	4.78	-10%	3.66	-31%	4.32	-18%	4.13	-22%
3.2	5.26	5.26	0%	4.33	-18%	3.91	-26%	4.15	-21%	4.08	-22%
4.2	5.21	5.21	0%	4.77	-8%	4.69	-10%	4.74	-9%	4.72	-9%
8.1	4.51	4.51	0%	3.26	-28%	2.96	-34%	3.06	-32%	3.06	-32%
9.1	5.84	5.84	0%	5.84	0%	5.84	0%	5.84	0%	5.84	0%
All	**5.30**	**5.30**	**0%**	**4.75**	**-10%**	**4.42**	**-17%**	**4.64**	**-12%**	**4.59**	**-13%**

Table 4.9-2 Overall Open Road Density by Alternative (in miles/square mile)

	Existing Condition	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5
Density in miles/square mile	3.38	3.38	3.17	2.95	3.07	3.03
% Change from existing		0%	-6%	-13%	-9%	-10%

Table 4.9-3Desired, Existing, and Resulting Open Road Density by Management Area and Alternative (units are in miles/square mile)

MA	DFC	Existing Cond.	Alt 1	% Change	Alt 2	% Change	Alt 3	% Change	Alt 4	% Change	Alt 5	% Change
1.1	≤ 4	4.34	4.34	0	3.96	-9%	3.88	-11%	3.94	-9%	3.92	-10%
3.1	≤ 4	3.18	3.18	0	3.14	0%	2.95	-7%	2.95	-7%	2.95	-7%
4.1	≤ 4	6.08	6.08	0	6.08	0%	5.63	-7%	5.91	-3%	5.78	-5%
1.2	≤ 2	1.58	1.58	0	1.58	0%	1.46	-8%	1.51	-4%	1.46	-8%
3.2	≤ 2	2.96	2.96	0	2.66	-10%	2.35	-11%	2.57	-13%	2.49	-6%
4.2	≤ 2	4.27	4.27	0	4.20	-2%	4.05	-5%	4.09	-4%	4.08	-4%
8.1		3.33	3.33	0	3.01	-10%	2.91	-13%	3.01	-10%	3.01	-10%
9.1		5.84	5.84	0	5.84	0%	5.84	0%	5.84	0%	5.84	0%
Overall Ranking			**5th**		**4th**		**1st**		**3rd**		**2nd**	

4.9.2 Introduction

The bounds of the analysis for determining direct and indirect effects will be the project area. The rationale for this is to provide the best link to measure progress towards the projected road density objectives for each management area. According to the Forest Plan, maximum skidding distance would be 1320' in Management Areas X.1. This makes it necessary to construct roads or improve them to accommodate modern logging trucks. Likewise, roads that aren't needed would be closed or decommissioned to move towards Plan goals.

The following actions with the potential to affect road density are proposed:

Table 4.9-4 Proposed Actions With Potential to Affect Road Density

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Classified Road					
Decommission	0.00	1.45	1.45	1.45	1.45
Reconstruct/Maintain	0.00	1.33	0.07	4.45	5.15
Reconstruct/Upgrade	0.00	2.34	5.08	0.70	0.00
Construct to tsl C	0.00	1.71	0.00	1.65	0.50
Construct to tsl D	0.00	1.29	0.00	1.78	2.42
Open to closed	0.00	1.21	2.22	2.22	2.22
Total System Roads					
Open	61.17	72.43	70.67	71.33	72.01
Closed	16.86	34.54	32.52	35.98	36.44
Total	78.03	106.97	103.19	108.21	108.45
Unclassified Road					
Decommission	0.00	20.69	28.98	24.91	26.16
Reconstruct to tsl D	0.00	1.99	0.56	2.34	3.12
Reconstruct to tsl C	0.00	8.66	0.53	6.34	1.76
Converted to classified	0.00	16.74	25.52	19.52	24.07
Total System Roads					
Open	55.36	36.69	31.00	33.91	32.31
Closed	49.25	19.84	18.02	17.59	17.19
Total	104.61	56.53	49.02	51.50	49.50
Total	182.64	163.50	152.21	159.71	157.95

Notes:
Reconstruct/Maintain will restore a classified road to its past Traffic Service Level. These mileages don't reflect normal maintenance that will take place on arterial and collector roads.
Reconstruct/Upgrade will improve a classified road to a higher Traffic Service Level.
Reconstruct to TSL D will improve an unclassified road to Traffic Service Level D.
Reconstruct to TSL C will improve an unclassified road to Traffic Service Level C.
Convert to classified will result in the addition of unclassified roads to the classified road system. These roads may receive maintenance such as brushing, reshaping, sub grade stabilization and drainage structure improvement.

There was concern that, with the increase in roads that the potential for ORV (Off-Road Vehicle) use could increase. Under all the action alternatives, the amount of roads that would be decommissioned exceeds the amount of roads that would be constructed. The roads that will be improved by reconstruction are open and already accessible to ORVs. This may increase the amount of use on these lower standard roads by reducing the risk and allowing a more prudent driver with the opportunity to access them. Many of these lower standard roads have a tendency over time to return to their preexisting condition due to the discontinuation of user maintenance after management activity completion.

For detailed tables displaying the outcomes of the alternatives as they relate to road densities, refer to Appendix G.

4.9.3 Direct and Indirect Effects of Alternative 1

Under this alternative, none of the proposed actions would be implemented within the McCaslin project area. Normal road maintenance would continue to occur such as road grading, brushing and drainage structure maintenance. There would be no ground disturbing activities such as road construction or decommissioning. There would be no changes in road densities as a result of this alternative. Consequently, there would be no movement toward Forest Plan objectives.

4.9.3.1 Road Density

Total Road Density

The total road density for Alternative 1 would remain at 5.30 miles per square mile. This figure includes all measurable roads within the project area: open and closed, classified and unclassified. This total density includes 2.26 miles per square mile of classified roads and 3.04 miles per square mile of unclassified. Of the five alternatives, this one ranks 5th in reducing the overall total road density.

Open Road Density

The open road density for Alternative 1 would remain at 3.38 miles per square mile. This includes all measurable open roads within the project area. There are 1.77 miles per square mile of open classified roads and 1.61 miles per square mile of open unclassified roads. Of the five alternatives, this one ranks 5th in reducing the overall open road density.

Land Management Direction

Table 4.9-5 shows that no changes in open road densities would result from implementing Alternative 1. Under this alternative, there would be no movement towards the desired open road densities identified in the Nicolet Forest Plan. This alternative ranks 5th among the five alternatives in meeting Forest Plan DFCs for open road densities

Table 4.9-5 Open Road Densities Resulting from Alternative 1

MA	Area	DFC open road density	Existing	Alt 1	Change
	(in Acres)	(in miles / mile^2)	(in miles / mile^2)	(in miles / mile^2)	%
1.1	3,468	≤ 4	4.34	4.34	0
3.1	4,509		3.18	3.18	0
4.1	390		6.08	6.08	0
1.2	1,170	≤ 2	1.58	1.58	0
3.2	9,436		2.96	2.96	0
4.2	2,564		4.27	4.27	0
8.1	631		3.33	3.33	0
9.1	82		5.84	5.84	0

4.9.4 Direct and Indirect Effects of Alternative 2

With this alternative, the following changes to the existing road network displayed in Alternative 1 would occur:

- 3.00 miles of new forest roads would be constructed.
- 14.32 miles of existing forest roads would be reconstructed.
- 22.14 miles of existing forest roads would be decommissioned.
- 1.21 miles of existing open roads would be closed.
- 16.74 miles of existing unclassified roads would be added to the classified road system.

4.9.4.1 Road Density

Total Road Density

The total road density resulting from Alternative 2 would be 4.75 miles per square mile. This would include all measurable roads within the project area: open and closed, classified and unclassified. The total density would include 3.26 miles per square mile of classified roads and 1.49 miles per square mile of unclassified. In terms of overall road density, Alternative 2 ranks 4th out of the five alternatives by reducing the overall project area density by 10%.

Open Road Density

The overall open road density for Alternative 2 would be 3.17 miles per square mile. This figure includes all measurable open roads within the project area. There are 2.10 miles per square mile of open classified roads and 1.07 miles per square mile of open unclassified roads. Alternative 2 ranks 4th out of the five alternatives in terms of reducing the overall open road density of the project area by 6%.

4.9.4.2 Land Management Direction

Table 4.9-5 summarizes the changes in open road density by Management Area that would result from Alternative 2. This alternative would rank 4th among the alternatives in moving the area toward the DFC's for open road densities by Management Area. Detailed discussion by Management follows.

Management Areas 1.1/1.2
Under Alternative 2, the *total* road density in Management Area 1.1 would be 5.12 miles per square mile. Of this, 3.96 miles per square mile are open and 1.16 miles per square mile are closed. The road density for the classified road system in this management area is 2.45 miles per square mile of open roads and 0.33 miles per square mile of closed roads.

Table 4.9-5 Change in Open Road Densities Resulting from Alternative 2

MA	Area	DFC open road density	Existing	Alt 2	Change
	(in Acres)	(in miles / mile^2)	(in miles / mile^2)	(in miles / mile^2)	%
1.1	3,468	≤ 4	4.34	3.96	-9%
3.1	4,509		3.18	3.18	0%
4.1	390		6.08	6.08	0%
1.2	1,170	≤ 2	1.58	1.58	0%
3.2	9,436		2.96	2.66	-10%
4.2	2,564		4.27	4.20	-2%
8.1	631		3.33	3.01	-10%
9.1	82		5.84	5.84	0%

The total road density in Management Area 1.2 would be 4.78 miles per square mile. Of this, 1.58 miles per square mile are open and 3.21 miles per square mile are closed. The road density for the classified road system in this management area is 1.36 miles per square mile of open roads and 2.25 miles per square mile of closed roads.

Management Areas 3.1/3.2
The total road density in management area 3.1 would be 5.30 miles per square mile. Of this, 3.14 miles per square mile are open and 2.16 miles per square mile are closed. The road density for the classified road system in this management area is 1.88 miles per square mile of open roads and 1.44 miles per square mile of closed roads.

The total road density in management area 3.2 would be 4.33 miles per square mile. Of this, 2.66 miles per square mile are open and 1.67 miles per square mile are closed. The road density for the classified road system in this management area is 1.85 miles per square mile of open roads and 1.14 miles per square mile of closed roads.

Management Areas 4.1/4.2
The total road density in management area 4.1 would be 7.56 miles per square mile. Of this, 6.08 miles per square mile are open and 1.49 miles per square mile are closed. The road density for the classified road system in this management area is 3.87 miles per square mile of open roads and 0.87 miles per square mile of closed roads.

The total road density in management area 4.2 would be 4.77 miles per square mile. Of this, 4.20 miles per square mile are open and 0.57 miles per square mile are closed. The road density for the classified road system in this management area is 2.70 miles per square mile of open roads and 0.45 miles per square mile of closed roads.

Management Areas 8.1/9.1
The total road density in management area 8.1 would be 3.26 miles per square mile. Of this, 3.01 miles per square mile are open and 0.25 miles per square mile are closed. The road density for the classified road system in this management area is 2.86 miles per square mile of open roads and 0.00 miles per square mile of closed roads.

The total road density in management area 9.1 would be 5.84 miles per square mile. Of this, 5.84 miles per square mile are open and no roads are closed. The road density for the classified road system in this management area is 5.67 miles per square mile of open roads and 0.00 miles per square mile of closed roads.

4.9.5 Direct and Indirect Effects of Alternative 3

With this alternative, the following changes to the existing road network displayed in Alternative 1 would occur:

- 6.24 miles of existing forest roads would be reconstructed.
- 30.43 miles of existing forest roads would be decommissioned.
- 2.22 miles of existing open roads would be closed.
- 25.52 miles of existing unclassified roads would be added to the classified road system.

4.9.5.1 Road Density

Total Road Density

The total road density under Alternative 3 would be 4.42 miles/square mile. This includes all measurable roads within the project area, open and closed, classified and unclassified. There are 3.00 miles per square mile of classified roads and 1.42 miles per square mile of unclassified. In terms of overall road density, Alternative 3 ranks 1st of the five alternatives by reducing the overall project area density by 17%.

Open Road Density

The overall open road density for Alternative 3 would be 2.95 miles per square mile. This includes all measurable open roads within the project area. There are 2.05 miles per square mile of open classified roads and 0.90 miles per square mile of open unclassified. Alternative 3 ranks 1st of the five alternatives in terms of reducing the overall open road density of the project area by 13%.

4.9.5.2 Land Management Direction

Table 4.9-6 summarizes the changes in open road density by Management Area that would result from Alternative 3. This alternative would rank 1st among the alternatives in moving the area toward the DFC's for open road densities by Management Area. Detailed discussion by Management follows.

Table 4.9-6 Change in Open Road Densities Resulting from Alternative 3

MA	Area	DFC open road density	Existing	Alt 3	Change
	(in Acres)	(in miles / mile^2)	(in miles / mile^2)	(in miles / mile^2)	%
1.1	3,468	≤ 4	4.34	3.88	-11%
3.1	4,509		3.18	2.95	-7%
4.1	390		6.08	5.63	-7%
1.2	1,170	≤ 2	1.58	1.46	-8%
3.2	9,436		2.96	2.35	-11%
4.2	2,564		4.27	4.05	-5%
8.1	631		3.33	2.91	-13%
9.1	82		5.84	5.84	0%

Management Areas 1.1/1.2

The overall road density in Management Area 1.1 would be 4.99 miles per square mile. Of this, 3.88 miles per square mile are open and 1.11 miles per square mile are closed. The road density for the classified road system in this management area is 2.44 miles per square mile of open roads and 0.34 miles per square mile of closed roads.

The overall road density in Management Area 1.2 would be 3.66 miles per square mile. Of this, 1.46 miles per square mile are open and 2.21 miles per square mile are closed. The road density for the classified road system in this management area is 1.33 miles per square mile of open roads and 1.43 miles per square mile of closed roads.

Management Areas 3.1/3.2

The overall road density in Management Area 3.1 would be 5.13 miles per square mile. Of this, 2.95 miles per square mile are open and 2.18 miles per square mile are closed. The road density for the classified road system in this management area is 1.88 miles per square mile of open roads and 1.51 miles per square mile of closed roads.

The overall road density in Management Area 3.2 would be 3.91 miles per square mile. Of this, 2.35 miles per square mile are open and 1.56 miles per square mile are closed. The road density for the classified road system in this management area is 1.78 miles per square mile of open roads and 1.12 miles per square mile of closed roads.

Management Areas 4.1/4.2

The overall road density in Management Area 4.1 would be 6.25 miles per square mile. Of this, 5.63 miles per square mile are open and 0.62 miles per square mile are closed. The road density for the classified road system in this management area is 3.72 miles per square mile of open roads and 0.00 miles per square mile of closed roads.

The overall road density in Management Area 4.2 would be 4.69 miles per square mile. Of this, 4.05 miles per square mile are open and 0.65 miles per square mile are closed. The road density for the classified road system in this management area is 2.56 miles per square mile of open roads and 0.40 miles per square mile of closed roads.

Management Areas 8.1/9.1
The overall road density in Management Area 8.1 would be 2.96 miles per square mile. Of this, 2.91 miles per square mile are open and 0.05 miles per square mile are closed. The road density for the classified road system in this management area is 2.86 miles per square mile of open roads and 0.00 miles per square mile of closed roads.

The overall road density in Management Area 9.1 would be 5.84 miles per square mile. Of this, 5.84 miles per square mile are open and 0.00 miles per square mile are closed. The road density for the classified road system in this management area is 5.67 miles per square mile of open roads and 0.00 miles per square mile of closed roads.

4.9.6 Direct and Indirect Effects of Alternative 4

With this alternative, the following changes to the existing road network displayed in Alternative 1 would occur:

- 3.43 miles of new forest roads would be constructed.
- 13.83 miles of existing forest roads would be reconstructed.
- 26.36 miles of existing forest roads would be decommissioned.
- 2.22 miles of existing open roads would be closed.
- 19.52 miles of existing unclassified roads would be added to the classified road system.

4.9.6.1 Road Density

Total Road Density
The total road density resulting from Alternative 4 would be 4.64 miles/square mile. This includes all measurable roads within the project area, open and closed, classified and unclassified. There are 3.15 miles per square mile of classified roads and 1.49 miles per square mile of unclassified. In terms of overall road density, Alternative 4 ranks 3rd out of the five alternatives by reducing the overall project area density by 12%.

Open Road Density
The overall open road density for Alternative 4 would be 3.07 miles per square mile. This includes all measurable open roads within the project area. There are 2.56 miles per square mile of open classified roads and 0.51 miles per square mile of open unclassified. Alternative 4 ranks 3rd of the five alternatives in terms of reducing the overall open road density of the project area by 9%.

4.9.6.2 Land Management Direction

Table 4.9-7 summarizes the changes in open road density by Management Area that would result from Alternative 4. This alternative would rank 3rd among the alternatives in moving the area toward the DFC's for open road densities by Management Area. Detailed discussion by Management follows.

Table 4.9-7 Change in Open Road Densities Resulting from Alternative 4

MA	Area	DFC open road density	Existing	Alt 4	Change
	(in Acres)	(in miles / mile^2)	(in miles / mile^2)	(in miles / mile^2)	%
1.1	3,468	≤ 4	4.34	3.94	-9%
3.1	4,509		3.18	2.95	-7%
4.1	390		6.08	5.91	-3%
1.2	1,170	≤ 2	1.58	1.51	-4%
3.2	9,436		2.96	2.57	-13%
4.2	2,564		4.27	4.09	-4%
8.1	631		3.33	3.01	-10%
9.1	82		5.84	5.84	0%

Management Areas 1.1/1.2
The overall road density in Management Area 1.1 would be

5.10 miles per square mile. Of this, 3.94 miles per square mile are open and 1.16 miles per square mile are closed. The road density for the classified road system in this management area is 2.44 miles per square mile of open roads and 0.33 miles per square mile of closed roads.

The overall road density in Management Area 1.2 would be 4.32 miles per square mile. Of this, 1.51 miles per square mile are open and 2.81 miles per square mile are closed. The road density for the classified road system in this management area is 1.38 miles per square mile of open roads and 2.22 miles per square mile of closed roads.

Management Areas 3.1/3.2
The overall road density in Management Area 3.1 would be 5.33 miles per square mile. Of this, 2.95 miles per square mile are open and 2.38 miles per square mile are closed. The road density for the classified road system in this management area is 1.88 miles per square mile of open roads and 1.67 miles per square mile of closed roads.

The overall road density in Management Area 3.2 would be 4.15 miles per square mile. Of this, 2.57 miles per square mile are open and 1.58 miles per square mile are closed. The road density for the classified road system in this management area is 1.84 miles per square mile of open roads and 1.14 miles per square mile of closed roads.

Management Areas 4.1/4.2
The overall road density in Management Area 4.1 would be 7.39 miles per square mile. Of this, 5.91 miles per square mile are open and 1.49 miles per square mile are closed. The road density for the classified road system in this management area is 3.87 miles per square mile of open roads and 0.87 miles per square mile of closed roads.

The overall road density in Management Area 4.2 would be 4.74 miles per square mile. Of this, 4.09 miles per square mile are open and 0.65 miles per square mile are closed. The road density for the classified road system in this management area is 2.61 miles per square mile of open roads and 0.54 miles per square mile of closed roads.

Management Areas 8.1/9.1
The overall road density in Management Area 8.1 would be 3.06 miles per square mile. Of this, 3.01 miles per square mile are open and 0.05 miles per square mile are closed. The road density for the classified road system in this management area is 2.86 miles per square mile of open roads and 0.00 miles per square mile of closed roads.

The overall road density in Management Area 9.1 would be 5.84 miles per square mile. Of this, 5.84 miles per square mile are open and 0.00 miles per square mile are closed. The road density for the classified road system in this management area is 5.67 miles per square mile of open roads and 0.00 miles per square mile of closed roads.

4.9.7 Direct and Indirect Effects of Alternative 5

With this alternative, the following changes to the existing road network displayed in Alternative 1 would occur:

- 2.92 miles of new forest roads would be constructed.
- 10.03 miles of existing forest roads would be reconstructed.
- 27.61 miles of existing forest roads would be decommissioned.
- 2.22 miles of existing open roads would be closed.
- 24.07 miles of existing unclassified roads would be added to the classified road system.

4.9.7.1 Road Density

Total Road Density

The total road density resulting from Alternative 5 would be 4.59 miles per square mile. This includes all measurable roads within the project area, open and closed, classified and unclassified. There are 3.15 miles

per square mile of classified roads and 1.44 miles per square mile of unclassified. In terms of overall road density, Alternative 5 ranks 2nd of the five alternatives by reducing the overall project area density by 13%.

Open Road Density

The overall open road density resulting from Alternative 5 would be 3.03 miles per square mile. This includes all measurable open roads within the project area. There are 2.53 miles per square mile of open classified roads and 0.50 miles per square mile of open unclassified. Alternative 5 ranks 2nd of the five alternatives in terms of reducing the overall open road density of the project area by 10%.

4.9.7.2 Land Management Direction

Management Areas 1.1/1.2

Table 4.9-8 summarizes the changes in open road density by Management Area that would result from Alternative 5. This alternative would rank 2nd among the alternatives in moving the area toward the DFC's for open road densities by Management Area. Detailed discussion by Management follows.

Table 4.9-8 Change in Open Road Densities Resulting from Alternative 5

MA	Area	DFC open road density	Existing	Alt 5	Change
	(in Acres)	(in miles / mile^2)	(in miles / mile^2)	(in miles / mile^2)	%
1.1	3,468	≤ 4	4.34	3.92	-10%
3.1	4,509		3.18	2.95	-7%
4.1	390		6.08	5.78	-5%
1.2	1,170	≤ 2	1.58	1.46	-8%
3.2	9,436		2.96	2.49	-6%
4.2	2,564		4.27	4.08	-4%
8.1	631		3.33	3.01	-10%
9.1	82		5.84	5.84	0%

The overall road density in Management Area 1.1 would be 5.08 miles per square mile. Of this, 3.92 miles per square mile are open and 1.16 miles per square mile are closed. The road density for the classified road system in this management area is 2.44 miles per square mile of open roads and 0.33 miles per square mile of closed roads.

The overall road density in Management Area 1.2 would be 4.13 miles per square mile. Of this, 1.46 miles per square mile are open and 2.67 miles per square mile are closed. The road density for the classified road system in this management area is 1.33 miles per square mile of open roads and 2.08 miles per square mile of closed roads.

Management Areas 3.1/3.2

The overall road density in Management Area 3.1 would be 5.31 miles per square mile. Of this, 2.95 miles per square mile are open and 2.35 miles per square mile are closed. The road density for the classified road system in this management area is 1.88 miles per square mile of open roads and 1.67 miles per square mile of closed roads.

The overall road density in Management Area 3.2 would be 4.08 miles per square mile. Of this, 2.49 miles per square mile are open and 1.59 miles per square mile are closed. The road density for the classified road system in this management area is 1.85 miles per square mile of open roads and 1.16 miles per square mile of closed roads.

Management Areas 4.1/4.2

The overall road density in Management Area 4.1 would be 7.27 miles per square mile. Of this, 5.78 miles per square mile are open and 1.49 miles per square mile are closed. The road density for the classified road system in this management area is 3.87 miles per square mile of open roads and 0.87 miles per square mile of closed roads.

The overall road density in Management Area 4.2 would be 4.72 miles per square mile. Of this, 4.08 miles per square mile are open and 0.65 miles per square mile are closed. The road density for the classified road system in this management area is 2.61 miles per square mile of open roads and 0.54 miles per square mile of closed roads.

Management Areas 8.1/9.1
The overall road density in Management Area 8.1 would be 3.06 miles per square mile. Of this, 3.01 miles per square mile are open and 0.05 miles per square mile are closed. The road density for the classified road system in this management area is 2.86 miles per square mile of open roads and 0.00 miles per square mile of closed roads.

The overall road density in Management Area 9.1 would be 5.84 miles per square mile. Of this, 5.84 miles per square mile are open and none are closed. The road density for the classified road system in this management area is 5.67 miles per square mile of open roads and no closed roads.

4.9.8 Total Cumulative Effects of Alternative 1-5

The bounds of analysis for cumulative effects are the boundaries of the McCaslin project area. The rationale for using this boundary is that, upon preliminary analysis, it was found that all of the alternatives would have neutral or beneficial effects in moving the McCaslin Area toward the road density objectives given in the Nicolet Forest Plan. Since the proposed activities would not move any of the areas away from the objectives, it was not necessary to examine the area in a larger context.

4.9.8.1 Past Activities

There was an extensive network of railroads developed for the logging of this project area during the late 1800's and early 1900's. This network was needed due to the lack of a river and stream network for the movement of logs to area saw mills. Portions of this network are still visible today and include some of the unclassified roads within the project area. In addition, most of the collector, arterial and some local roads were developed during the CCC Era (1935-1942) resting on old railroad grades. Additional local roads were built in the late 1970's and 1980's. Some of the low standard local roads built in the late 1930's are now completely overgrown.

Since the approval of the Forest Plan in 1986, the Forest has continued to construct/reconstruct fewer local roads. A few years ago (1999) an administrative decision was made to minimize local road costs associated with the use of specified roads in the timber sale program by eliminating the purchaser credit for specified roads and incorporating alternative methods (pre-haul maintenance, reopening existing roads and temporary road construction) to achieve the same results.

4.9.8.2 Present Activities

There are no currently ongoing road management activities taking place within the McCaslin Project Area other than routine maintenance activities. No effects on road densities are anticipated.

4.9.8.3 Future Activities

The road network for this project is, for the most part, in place. Very little construction would be needed to access new areas for management activities in the future. There is no specific roadwork planned in the foreseeable future. There are unclassified roads that may be added to the system network for future entries. There are also many unclassified roads that may be decommissioned in the future which would move the Forest closer to its plan levels.

4.9.8.4 Summary

As a result of the McCaslin Project activities and other past, present, and reasonably foreseeable activities, overall road densities within the project area and associated MAs are expected to move towards and /or meet Forest Plan Objectives.

4.10 Recreation Resources

4.10.1 Summary

No major adverse effects on recreation resources are expected as a result of any of the alternatives in the McCaslin Project. Effects would be essentially the same across all action alternatives and would be limited to possible short term conflicts and inconveniences due to harvest operations near snowmobile trails and

dispersed campsites. The availability of open roads would decrease slightly (6%-13%) in the action alternatives, but this reduction would be limited mainly to shorter lengths and dead end spurs.

4.10.2 Introduction

The McCaslin Project Area was used as the bounds of analysis for direct, indirect, and cumulative effects on the recreation resource. Recreation opportunities in the forest environment are largely dependent on vegetation, water, access, wildlife, and fisheries. Refer to the Chapter 4 discussions for effects on these resources.

The primary measurement indicators for the effects on recreation will be the expected changes in recreational opportunities. Most of these are discussed qualitatively in the context of historic use patterns and the expected extent, intensity, and duration of effects. The density of open roads is also used as a means of effects comparison since most of the primary forms of recreation in the area rely on open roads.

4.10.3 Direct and Indirect Effects of Alternative 1

Alternative 1 would maintain the current landscape conditions and recreational opportunities would generally continue at the current types and levels. Dispersed recreational activities would remain constant or increase slightly.

There would be no potential impact on the existing snowmobile trails or dispersed campsites in the McCaslin Project Area.

Wildlife populations, including game species such as grouse, deer, and bear would continue at current levels (barring severe winter conditions) for the foreseeable future. Eventually, the process of forest maturation would likely result in the reduction of suitable habitat for grouse and deer (see section 4.7).

Fishing opportunities would continue at current levels.

Since there would be no road closures or new construction, there would be no change from the existing condition in the level and type of access within the project area.

4.10.4 Direct and Indirect Effects of all Action Alternatives

All action alternatives would have the same general effects on the recreation experience found in the project area.

Under the action alternatives, hunters, campers at dispersed campsites, and other recreationists may be displaced in the short term from areas being harvested. Logging equipment noise and increased truck traffic on Forest System, County, and State Roads would also increase during the life of the timber sales, which may have an effect on visitor satisfaction while recreating in the project area.

No effects are expected on fisheries resources (see Section 4.8) and so there are no anticipated concerns related to the effects on the quality of fishing in the area.

As a result of the action alternatives, it is expected that there would be favorable effects on grouse and deer habitat (see Section 4.7). These would be most noticeable in the Alternatives 4, 2, and 5 (in that order of importance) due to the degree of young forest types being regenerated (sections 4.5 and 5.7).

There would be no anticipated effects on the private campgrounds operating within the project area or on the swimming beach at Wheeler Lake since there are no activities in these areas.

Since there are 34 miles of snowmobile trails within the project area and a number of these trails coincide with roads needed for logging access, the Forest Service recognized the potential for conflict between harvest operations and snowmobile use during the winter season.

In response this concern and other recreation-related concerns in the McCaslin Project Area, the Forest Service developed the following mitigation measures and design features. These mitigation measures have been successfully used in past on similar projects on the Lakewood/Laona Ranger District.

The first, Mitigation Measure S, would be applied in all harvest areas (See Section 2.3 and Appendix A-Stand Treatment Tables):

S Harvest operations would post signs alerting recreationists of logging activities. This would be included in the timber sale contract and ensured during implementation by the Timber Sale Administrator.

The following mitigation measures (AA-FF) would be applied in the stands proposed for treatment in **Table 4.10-1** below:

AA On some portions of the snowmobile trails, timber hauling would occur. Harvesting operations could change the traditional use of the trail for snowmobiling on a temporary basis. Restrictions would be placed on harvest operations to not allow timber hauling from Friday noon until Sunday at midnight and also no hauling between Christmas Day and New Year's Day to reduce dual use of the trails during heavy snowmobile use periods. Trails with logging truck caution signs would be posted where simultaneous trail/road use by snowmobiles and logging trucks cannot be avoided. Snowmobile clubs and timber sale operators would be reminded about safety. This would be included in the timber sale contract and ensured during implementation by the Timber Sale Administrator.

BB To protect snow conditions and maintain sufficient shade along snowmobile trails, some trees would be retained on the south and west sides of specified stands for a distance of at least one tree length (or 15 feet, whichever is greater) from the trails.

CC Minimize simultaneous (unsafe) use of snowmobile trails by snowmobiles and logging trucks. Where possible, emphasize harvesting and hauling during snow-free periods when soil conditions are not wet or temporarily reroute the trail or logging road.

DD Remove slash and debris from the trail clearing (5 feet from the edge of the trail) as timber sale operations proceed.

EE The decking of logs along inside snowmobile trail curves would be prohibited. This would prevent safer operating conditions for snowmobilers where visibility could be obscured by log decks.

FF Satisfactory trail conditions would be maintained by requiring timber sale operators to retain at least 4 inches of packed snow on the trail surface when plowing snow for logging truck use.

Selection of any of the action alternatives could have an impact on use of the existing snowmobile trail system in the project area. **Table 4.10-1** below displays which treatment areas are in the vicinity of snowmobile trails by alternative. Mitigation Measures AA-FF would be applied in those alternative stands where treatment is proposed.

Table 4.10-1 Selected Stands Where Snowmobile Recreation Mitigation Measures AA-FF Would Be Applied.*

Compartment/ Stand	Alternative 2	Alternative 3	Alternative 4	Alternative 5
8001	Thin	Thin	Thin	Thin
8002	Thin	Thin	Thin	Thin
9013	Thin	Thin	Thin	Thin
9020	Clearcut		Clearcut	Clearcut
14006	Selection	Selection	Selection	Selection
15006	Thin	Thin	Thin	Thin
15007	Thin	Thin	Thin	Thin
15008	Selection	Selection	Selection	Selection
18007	Thin	Thin	Thin	Thin
18030	Shelterwood	Shelterwood	Clearcut	Shelterwood
18031	Thin	Thin	Thin	Thin
18032	Thin	Thin	Thin	Thin
18038	Overstory Removal		Overstory Removal	Overstory Removal

18042			Clearcut	Clearcut
18045	Thin	Thin	Thin	Thin
19018	Clearcut		Clearcut	Clearcut
20003	Thin	Selection	Clearcut	Thin
20006	Thin	Selection	Thin	Thin
20009	Clearcut		Clearcut	Clearcut
21001	Selection	Selection	Selection	Selection
21008	Selection	Selection	Clearcut	Thin
24012		Selection		
109015	Selection	Selection	Selection	Selection
109016	Selection	Selection	Selection	Selection

*Mitigation Measures AA-FF would not be applied in Alternatives where no treatment is proposed.

As noted in Mitigation Measure CC, harvesting and hauling would be emphasized in these areas during snow-free periods with dry soils. This would further reduce the potential for conflicts between snowmobile enthusiasts and active logging operations.

Of all harvest activities proposed around snowmobile trails, winter harvest is required in only one-Compartment 20, Stand 3. The potential for conflicts would be very limited in this area as a result of the mitigation measures outlined above. Therefore, the effects on recreational snowmobiling are expected to be minimal under all of the action alternatives and limited mainly to potential temporary inconveniences.

Road management activities have the potential to affect recreational opportunities. Some users prefer an extensive network of open roads that allow easy driving access to most areas. Others prefer a system of roads that are largely closed, but that provide many opportunities for hiking and biking. Still others prefer no roads at all and a more primitive experience. As explained in Chapter 1 and further discussed in Section 3.9, the Nicolet Forest Plan identifies the desired conditions related to open road densities. These desired future conditions were a major driver in the development of road-related proposed activities.

The following table (**4.10-2**) summarizes the expected changes to open road density in the McCaslin Area under each of the alternatives.

Table 10-2 Comparison of Expected Open Road Density by Alternative

	Alternative 1 (existing condition)	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Open road density (miles/sq. mile)	3.38	3.17	2.95	3.07	3.03
% change from existing condition	0	-6%	-13%	-9%	-10%

As **Table 4.10-2** shows, the open road density would be reduced under all action alternatives by a range of 6-13%. The majority of the roads proposed for closure under the action alternatives are infrequently used sections and are generally dead end spur roads. Many of these roads, while currently classified as “open” are, in reality, very difficult to travel on due to brush and competing vegetation.

The closures proposed under the action alternatives would not affect accessibility to the recreational sites described in Section 4.10.

New road construction proposed under Alternatives 2, 4, and 5 would be closed to vehicular access following harvest operations. These roads would be available for non-motorized access and would, thus, provide an additional opportunity. However, due to road decommissioning proposed under each alternative, the total road density is expected to decrease as shown in **Table 4.9-1**. For more information on the existing road system and the changes expected under each alternative, see Sections 3.9 and 4.9.

As a result of the changes in the road system under the action alternatives, no notable effects are expected on the recreation resource.

4.10.5 Cumulative Effects of All Alternatives on Recreation

Past actions within the project area that continue to have an influence on recreation resources include the construction and development of existing recreational opportunities, past vegetation management practices, road management actions, and fish and wildlife habitat projects. In short, these past actions have resulted in the existing conditions described in the respective resource sections in Chapter 3.

There are no other known actions planned or taking place that would result in any notable changes in recreation resources within the McCaslin Project Area.

As a result of all the alternatives being analyzed, there would be no anticipated cumulative effects on the recreation resource.

4.11 Visual Resources

4.11.1 Summary

Under the action alternatives, a number of proposed activities have the potential to conflict with visual quality objective guidance given in the Nicolet Forest Plan. During the analysis process, these site-specific concerns were identified and appropriate site-specific mitigation measures addressing the concerns were developed. If these activities and their prescribed mitigation measures are properly implemented, the McCaslin Project Area would continue to meet Visual Quality Objectives under all of the alternatives.

4.11.2 Introduction

The boundaries of this analysis for effects on scenic resources essentially coincide with the project area boundary. Due to the topography in the vicinity of the project there are no long distance views of the action alternatives from outside of the project area boundary. Potential impacts to the scenic resource were identified using GIS data and contributions from District personnel. All the activities identified in the alternatives were reviewed for their potential to impact the scenic resource. Due to the topography and vegetative cover in the project area, the analysis focused on the harvest proposals for their potential to create a noticeable visual impact to the forest setting. Specifically, a number of even-age regeneration proposals were identified within Forest areas managed under Retention and Partial Retention VQO's. The following analysis identifies areas of concern, methods of addressing those concerns and a summary of effects by alternative.

The Current Forest Plan incorporates Visual Quality Objectives as guidelines in the management of resources on the Forest's land base. Guidelines provide firm direction in forest management activities; they are indications or outlines of policy. Current Forest Plan guidelines allow for temporary openings (i.e. openings that are created as a result of timber harvest and are intended to become reforested). The actual size temporary openings may be as large as 40 acres but they are designed to appear smaller. In order to meet visual quality objectives, the open area that can be seen at any one point from a travelway, stream, use area, or water body should not exceed 10 acres for a Retention VQO, 20 acres for Partial Retention, and 40 acres for Modification. To effectively reduce or avoid potential impacts to the scenic resource (particularly in those Retention and Partial Retention VQO areas listed on p.50 of the current Forest Plan), a collection of mitigation measures was developed. These mitigation measures can be found in Chapter 2 and the stand treatment tables in Appendix A.

The direct and indirect effects associated with the alternatives are primarily a consequence of the mechanical treatments along high sensitivity travel routes in Forest areas assigned a VQO of Retention (e.g. State Highway 32 and Oconto County Highway F) as well as along travel routes in areas identified as having a VQO of Partial Retention (e.g. Forest County Highway C). The discussion of each alternative focuses only on the potential effects on the Retention and Partial Retention areas because guidelines for other areas of the

Forest, notably those areas managed under Modification or Maximum Modification, are readily compatible with even-aged regeneration harvest proposals.

4.11.3 Direct and Indirect Effects of Alternative 1

Since there are no actions proposed that have the potential to affect the scenic resource, there would be no anticipated direct effects associated with the No Action alternative. Despite the absence of any proposed management actions, there would still be changes seen in the project area over the course of time. Changes would be associated with the natural succession of trees species in the forest. Existing trees will age and eventually die; the forest's appearance will slowly change as new trees grow in their place. There also could be indirect effects associated with the potential for larger or more damaging wildfires due to fuels build-up in the project area. However, the likelihood of such fires in this area is considered low.

4.11.4 Direct and Indirect Effects of Alternative 2

Retention VQO Areas

Alternative 2 does include one 23-acre unit (unit 005-017) scheduled to be clear-cut along Oconto County Highway F that could have an apparent size of over 10 acres. Proposed mitigation measures for this unit, if effectively implemented, should satisfactorily reduce the apparent size of the unit to meet scenery management guidelines. Mitigation measures include the strategic placement of reserve/under plant buffer zones, and a strategically placed reserve island. The units along State Highway 32 and Oconto County Highway F that are scheduled for selection harvest and commercial thinning likely will meet the Retention VQO provided the mitigation measures and design features listed in Chapter 2 and **Table 4.11-2** are effectively implemented.

Partial Retention VQO Areas

Alternative 2 includes many units visible from travel routes located Partial Retention areas. Treatment methods include clear cutting, overstory removal, selection harvest, and commercial thinning. Of these treatment methods, the clear cuts and overstory removals would be the most potentially noticeable management activities. While the Alternative 2 does include many clear cuts, the vast majority of these units will meet current LRMP guidelines for an apparent size of less than 20 acres. Only two units in Alternative 2 (units 010-022 and 173-022) are greater than 20 acres in size (they are both 23 acres in size). Careful layout design of these cutting units incorporating the placement of reserve islands would yield an apparent size of less than 20 acres.

Similarly, if all contemporary Best Management Practices for Visual Quality and all listed mitigation measures are implemented, the cutting units scheduled for commercial thinning, selection harvest, or overstory removal should meet current LRMP Partial Retention VQO guidelines.

4.11.5 Direct and Indirect Effects of Alternative 3

Retention VQO Areas

Alternative 3 does not include any units scheduled to be clear-cut along State Highway 32 or Oconto County Highway F. The units along State Highway 32 and Oconto County Highway F that are scheduled for selection harvest and commercial thinning would meet the Retention VQO provided the mitigation measures and design features listed in Chapter 2 and the **Table 4.11-2** are effectively implemented.

Partial Retention VQO Areas

Alternative 3 includes many units visible from travel routes located in Partial Retention areas. Treatment methods include overstory removal, selection harvest, and commercial thinning. There are no proposed clear cuts in the Partial Retention VQO areas.

If all contemporary Best Management Practices for Visual Quality and all listed mitigation measures are implemented, the cutting units scheduled for commercial thinning, selection harvest, or overstory removal should meet current LRMP Partial Retention VQO guidelines.

4.11.6 Direct and Indirect Effects of Alternative 4

This alternative places an emphasis on aspen and early successional forests to increase aspen regeneration, reduce overall fragmentation, and produce larger areas of continuous habitat. Because of this, there are a number of adjacent units that, when combined, would exceed the recommended 40 acre temporary opening limit given in the Forest Plan (p.48). In accordance with Nicolet Forest Plan direction, these proposals will include 60 days public notice and a request for specific Regional Forester exemption. The stands listed in **Table 4.11-1** would be included in this request for exemption.

Table 4.11-1 Alternative 4 Temporary Openings in Excess of 40 Acres

Compartment/Stand Group	Treatment Acres
011007/011014	50
012010/012011/012012	60
019008/019010	44
019004/019025	128
024010/024012	51
168009/169001/169002/172009	103
173004/173005/174011	56
173011/173022/173025	50
174018/174025/174029	58
176008/176011/176012	63
176023/176025/177027	44
177001/177005/177010	99
169011/169013/169014	61
177012/177013	47

Retention VQO Areas

Alternative 4 does include two units (unit 005-017 and unit 005-037) that are scheduled to be clear-cut along Oconto County Highway F that could have an apparent size of over 10 acres. Proposed mitigation measures for these units, if effectively implemented, should satisfactorily reduce the apparent size of the unit to meet scenery management guidelines. Mitigation measures include the strategic placement of reserve/under plant buffer zones, and a strategically placed reserve island in unit 005-017. The units along State Highway 32 and Oconto County Highway F that are scheduled for selection harvest and commercial thinning likely will meet the Retention VQO provided the mitigation measures and design features listed in chapter 2 are effectively implemented.

Partial Retention VQO Areas

Alternative 4 includes many units visible from travel routes located in Partial Retention areas. Treatment methods include clear cutting, overstory removal, selection harvest, and commercial thinning. Of these treatment methods, the clear cuts and overstory removals would be the most potentially noticeable management activities. While the Alternative 4 does include many clear cuts, the vast majority of these units will meet current LRMP guidelines for an apparent size of less than 20 acres. Four units in Alternative 4 are greater than 20 acres in size (units 010-022, 176-015, 173-022, 177-005). Stand-specific mitigation measures (**Table 4.11-2**) include leaving reserve zones and islands to effectively reduce the apparent size of these clear cuts.

4.11.7 Direct and Indirect Effects of Alternative 5

In the southern portion of the area, Alternative emphasizes aspen and early successional forests with the goal of increasing aspen regeneration, reducing overall fragmentation, and producing larger areas of continuous habitat. Because of this, the following adjacent units have been proposed for even aged regeneration: Compartment 22, Stands 16 and 19 (49 acres); Compartment 19 Stand 19 and Compartment 22, Stand 15 (55 acres). As noted, these harvest units, when combined, would exceed the recommended 40 acre temporary opening limit given in the Forest Plan (p.48). In accordance with Nicolet Forest Plan direction, these proposals will include 60 days public notice and a request for specific Regional Forester exemption. The stands listed in **Table 4.11-1** would be included in this request for exemption.

RETENTION VQO AREAS

Alternative 5 includes two units scheduled to be clear-cut along Oconto County Highway F, (unit 005-017 and unit 005-037) that could have an apparent size of over 10 acres. Proposed mitigation measures for these units, if effectively implemented, should satisfactorily reduce the apparent size of the unit to meet scenery management guidelines. Mitigation measures include the strategic placement of reserve/under plant buffer zones, and a strategically placed reserve island in unit 005-017. The units along State Highway 32 and Oconto County Highway F that are scheduled for selection harvest and commercial thinning likely would meet the Retention VQO provided the mitigation measures and design features listed in chapter 2 are effectively implemented.

Partial Retention VQO Areas
Alternative 5 includes one clear-cut unit (010-007) that could have an apparent size of greater than 20 acres. Leaving an effectively sized reserve zone would mitigate this.

Table 4.11-2: Additional Stand-specific Mitigation Measures for Regeneration Harvests in Retention and Partial Retention Areas

Stand	Alternative 2	Alternative 3	Alternative 4	Alternative 5
005-017	Include retention strips and a reserve island along Cty Hwy F to reduce visible area of opening. Underplant the reserve strip with white pine to allow for eventual harvest of overaged jack pine.	No regeneration harvest	Include retention strips and a reserve island along Cty Hwy F to reduce visible area of opening. Underplant the reserve strip with white pine to allow for eventual harvest of overaged jack pine.	Include retention strips and a reserve island along Cty Hwy F to reduce visible area of opening. Underplant the reserve strip with white pine to allow for eventual harvest of overaged jack pine.
005-017	Maintain a reserve area on Cty. Hwy F to screen the jack pine regeneration area.	No regeneration harvest	Maintain a reserve area on Cty. Hwy F to screen the jack pine regeneration area.	Maintain a reserve area on Cty. Hwy F to screen the jack pine regeneration area.
010-022	Retain a reserve area to lessen the apparent opening along the Knowles Creek Road.	No regeneration harvest	Retain a reserve area to lessen the apparent opening along the Knowles Creek Road.	No regeneration harvest
176-015	No regeneration harvest	No regeneration harvest	Retain a reserve area to lessen the apparent opening along the Knowles Creek Road.	No regeneration harvest
177-005	No regeneration harvest	No regeneration harvest	Retain a reserve area to lessen the apparent opening along the Knowles Creek Road.	No regeneration harvest

4.11.8 Cumulative Effects of Alternative 1

The boundaries of this analysis for cumulative effects on scenic resources extend slightly beyond the project area to include those National Forest lands seen on either side of roads such as County C, County F, and Highway 32. The analysis was limited to National Forest lands because the Visual Quality Objectives are limited to National Forest lands. The analysis of cumulative effects on these lands included past, present, and reasonably foreseeable future actions both on National Forest land as well as adjacent non-Forest Service land. Again, potential impacts to the scenic resource were identified using GIS data and contributions from District personnel. All the activities identified in the alternatives were reviewed for their potential to impact the scenic resource. Due to the topography and vegetative cover in the project area, the analysis focused on vegetation management activities for their potential to create a noticeable visual impact to the forest setting. No actions were identified that would add to a cumulative impact

Past Actions
Past actions that have taken place within the analysis area have essentially resulted in the existing condition discussed in Chapter 3. This existing condition meets visual quality objectives (VQO's) for the McCaslin Area.

Present Actions
There are no known ongoing actions on National Forest System lands within the analysis area that would have any effect on the scenic quality of the area.

Future Actions
There are no known reasonably foreseeable future actions that are planned to take place on National Forest System lands in the area and that would affect scenic quality.

A review of past, present, and reasonably foreseeable future actions on lands adjacent to National Forest System lands was also conducted for context. No actions were identified that raised potential concerns regarding visual quality on adjacent National Forest System lands.

As a result of this review, there would be no expected cumulative effects from other connected or unconnected actions.

4.11.9 Cumulative Effects of Alternative 2-5
There are no expected cumulative effects associated with the action alternatives. The effects are limited to the direct and indirect effects described above.

4.12 Heritage Resources

4.12.1 Summary
Given the use of mitigation and design features to avoid impact to known heritage resource sites, there would be no adverse effects on heritage resources. In the event that previously unknown heritage resource sites would be found, they would be immediately protected and reviewed by the Heritage Resources staff. Evaluation of heritage sites within the project area and the installation of signs, benches, and interpretive trails would provide opportunities for the public to learn more about their cultural heritage.

4.12.2 Introduction
The action alternatives of the McCaslin Project include a number of activities that have the potential to have effects on heritage resources. In specific locations, timber harvest and road management activities have been proposed near known heritage sites. Also included in the action alternatives are the construction of interpretive signs, benches, and short trails at four identified sites following evaluation and nomination. For this discussion, the area of effects is the project and surrounding area.

4.12.3 Direct, Indirect, and Cumulative Effects on Heritage Resources

4.12.3.1 Effects of Alternative 1 on Heritage Resources
Implementation of Alternative 1 would result in the continuance of existing conditions at all sites in the foreseeable future. Conditions at each of the sites would change through natural aging processes and, potentially, could change by unintended damage by forest visitors. Vandalism, though a concern, is not been a big problem at heritage sites within the Chequamegon-Nicolet National Forest at present. We continue to monitor our sites for vandalism or evidence of collecting. If such evidence is found, the Forest Service will act appropriately.

4.12.3.2 Effects of Alternative 2 on Heritage Resources
Within the areas of proposed activities, there are thirteen sites that could be adversely affected under Alternative 2 if no mitigation measures or design criteria were used. Two of the potentially affected sites have been evaluated for National Register of Historic Places eligibility. One was found eligible and one was found ineligible. Equipment travel and tree skidding could substantially damage each of these sites if they are left unprotected during harvest or road construction. However, during the alternative development process, all potential treatment areas were reviewed for possible heritage resource sites. Where they were present, site-specific buffer areas were identified to eliminate the risk of impact. This would meet the guidelines of the Memorandum of Agreement the Forest Service has with the Wisconsin State Historic Preservation Officer (SHPO) whereby potentially eligible unevaluated sites that are removed from potential impact areas through project redesign or modification are considered as “no effect”.

As part of this alternative, up to 26 heritage sites would eventually be evaluated through low impact excavation and sampling techniques. All of these sites would be protected until evaluation is completed and many would remain in protected state following evaluation. Any of these sites that appear to meet eligibility criteria would be nominated for listing in the National Register of Historic Places to the State Historic Preservation Office. Four specific sites are believed to have potential for public interpretation. Following evaluation and inventory of these sites the Forest Service proposes to post interpretive signs, benches, and short trails (less than 50 feet at each site) for interpretive purposes. At each of the sites, the location and design of the signs, benches and trails would be done to avoid impact to the resources.

4.12.3.3 Effects of Alternative 3 on Heritage Resources

Within the areas of proposed activities, there are eleven sites that could be adversely affected under Alternative 3 if no mitigation measures or design criteria were used. Two of the potentially affected sites have been evaluated for National Register of Historic Places eligibility. One was found eligible and one was found ineligible. Equipment travel and tree skidding could substantially damage each of these sites if they are left unprotected during harvest or road construction. However, during the alternative development process, all potential treatment areas were reviewed for possible heritage resource sites. Where they were present, site-specific buffer areas were identified to eliminate the risk of impact. This would meet the guidelines of the Memorandum of Agreement the Forest Service has with the Wisconsin State Historic Preservation Officer (SHPO) whereby potentially eligible unevaluated sites that are removed from potential impact areas through project redesign or modification are considered as “no effect”.

As part of this alternative, up to 26 heritage sites would eventually be evaluated through low impact excavation and sampling techniques. All of these sites would be protected until evaluation is completed and many would remain in protected state following evaluation. Any of these sites that appear to meet eligibility criteria would be nominated for listing in the National Register of Historic Places to the State Historic Preservation Office. Four specific sites are believed to have potential for public interpretation. Following evaluation and inventory of these sites the Forest Service proposes to post interpretive signs, benches, and short trails (less than 50 feet at each site) for interpretive purposes. At each of the sites, the location and design of the signs, benches and trails would be done to avoid impact to the resources.

4.12.3.4 Effects of Alternative 4 on Heritage Resources

Within the areas of proposed activities, there are fifteen sites that could be adversely affected under Alternative 4 if no mitigation measures or design criteria were used. Two of the potentially affected sites have been evaluated for National Register of Historic Places eligibility. One was found eligible and one was found ineligible. Equipment travel and tree skidding could substantially damage each of these sites if they are left unprotected during harvest or road construction. However, during the alternative development process, all potential treatment areas were reviewed for possible heritage resource sites. Where they were present, site-specific buffer areas were identified to eliminate the risk of impact. This would meet the guidelines of the Memorandum of Agreement the Forest Service has with the Wisconsin State Historic Preservation Officer (SHPO) whereby potentially eligible unevaluated sites that are removed from potential impact areas through project redesign or modification are considered as “no effect”.

As part of this alternative, up to 26 heritage sites would eventually be evaluated through low impact excavation and sampling techniques. All of these sites would be protected until evaluation is completed and many would remain in protected state following evaluation. Any of these sites that appear to meet eligibility criteria would be nominated for listing in the National Register of Historic Places to the State Historic Preservation Office. Four specific sites are believed to have potential for public interpretation. Following evaluation and inventory of these sites the Forest Service proposes to post interpretive signs, benches, and short trails (less than 50 feet at each site) for interpretive purposes. At each of the sites, the location and design of the signs, benches and trails would be done to avoid impact to the resources.

4.12.3.5 Effects of Alternative 5 on Heritage Resources

Within the areas of proposed activities, there are fifteen sites that could be adversely affected under Alternative 5 if no mitigation measures or design criteria were used. Two of the potentially affected sites have been evaluated for National Register of Historic Places eligibility. One was found eligible and one was found ineligible. Equipment travel and tree skidding could substantially damage each of these sites if they are left unprotected during harvest or road construction. However, during the alternative development

process, all potential treatment areas were reviewed for possible heritage resource sites. Where they were present, site-specific buffer areas were identified to eliminate the risk of impact. This would meet the guidelines of the Memorandum of Agreement the Forest Service has with the Wisconsin State Historic Preservation Officer (SHPO) whereby potentially eligible unevaluated sites that are removed from potential impact areas through project redesign or modification are considered as "no effect".

As part of this alternative, up to 26 heritage sites would eventually be evaluated through low impact excavation and sampling techniques. All of these sites would be protected until evaluation is completed and many would remain in protected state following evaluation. Any of these sites that appear to meet eligibility criteria would be nominated for listing in the National Register of Historic Places to the State Historic Preservation Office. Four specific sites are believed to have potential for public interpretation. Following evaluation and inventory of these sites the Forest Service proposes to post interpretive signs, benches, and short trails (less than 50 feet at each site) for interpretive purposes. At each of the sites, the location and design of the signs, benches and trails would be done to avoid impact to the resources.

4.12.3.6 Cumulative Effects of All Alternatives on Heritage Resources

All heritage resources, including unknown, unevaluated, and evaluated sites determined eligible, or potentially eligible, for nomination to the National Register of Historic Places, would be protected. Protection of heritage resources in accordance with all Federal laws and regulations and Forest Service policy would continue. The use of design criteria, outlined under the guidelines of the Memorandum of Agreement the Chequamegon-Nicolet National Forest has with the Wisconsin SHPO and 36 CFR 800, would protect the integrity of know and unknown heritage resources within the project area from any adverse cumulative effects.

Based on the above information, no direct, indirect, or cumulative effects to heritage resources are anticipated from the alternatives outlined in this document. Past vegetation management activities avoided impacts to known sites through the use of no-treatment buffers. There are no known impacts to the sites from past activities. No other activities are planned within the areas in the present or foreseeable future. Future entries for timber management activities would incorporate the same design criteria used in this project.

Sensitivity of Site Information

In accordance with provisions outlined under Section 304(a) NHPA of 1966 (16 USC 470w-3), as amended, release of information regarding the location, condition, or any other sensitive data relating to heritage sites to the general public is prohibited. Only the Chequamegon-Nicolet National Forest Heritage Resource Program Manager can release sensitive site information regarding heritage sites. When disclosed to contracting parties and program or project leaders, sensitive heritage resource site information is to be kept strictly confidential. Strict penalties or fines could be levied against violators. To request information about procedures and policies regarding the disclosure of sensitive site data please contact the Heritage Resources Program Manager at the Chequamegon-Nicolet National Forest Supervisor's Office in Rhinelander, Wisconsin.

4.13 Economic and Social Effects

4.13.1 Summary

The following table summarizes the comparative economic efficiency and economic impacts that would be expected under each alternative.

Table 4.13-1 Summary of Economic Efficiency and Impact Indicators

Economic Efficiency Indicators					
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Present Value-Benefits	$0.00	$3,345,369.50	$2,587,943.21	$3,768,819.19	$3,170,265.57
Present Value - Costs	$0.00	-$1,410,820.68	-$1,055,162.27	-$1,727,343.48	-$1,329,908.65
Present Net Value	$0.00	$1,934,548.83	$1,532,780.94	$2,041,475.71	$1,840,356.92
Benefit-Cost Ratio	0	2.37	2.45	2.18	2.38

Economic Impact Indicators					
	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Commodities Produced	0	44.4 MMBF	30.5 MMBF	51.4 MMBF	40.9 MMBF
Income generated	$0.00	$44,788,500.36	$30,451,735.11	$51,896,919.30	$40,942,206.94
Jobs created	0	737	501	854	674
Payments to Counties	$0.00	$940,740.17	$712,802.63	$1,059,817.06	$886,154.13

4.13.2 Introduction

Comments received during the public scoping period revolved around three general issues. The first of these was a call for the Forest Service to determine the relative economic efficiency of the proposal and alternatives to the proposal. This has been done and will be discussed in the section that follows. For this portion of the economic analysis, the Quick-Silver Forestry Investment Analysis program (Vasievich, 1998) to address economic efficiency by calculating the present value of costs, the present value of benefits, the present net value, and benefit/cost ratio of implementing each alternative. The geographic extent of this analysis will be the area within the project boundary since this is the extent of the area where the actions will take place. The timeframe for the economic efficiency analysis will be the present time through the completion of activities proposed in this analysis.

It was not an objective of this portion of the analysis to analyze the "below-cost" issue of national forest timber sales. Since that is a programmatic concern, it is more appropriately addressed at the forest or national level because many of the costs are spread out across multiple units. The economic efficiency analysis will provide a reasonable and consistent comparison of costs and benefits for which to compare the alternatives.

The second general issue raised was a call for the Forest Service to determine the relative economic impacts of the proposal and alternatives to the proposal. Indicators that are used to estimate these impacts include: commodity production, payments to counties, income generated, and jobs created/sustained. These values were determined based on the volumes and values of timber anticipated. Estimates of the number of jobs created/sustained and income to local communities were calculated using averages from the 1998 Chequamegon/Nicolet National Forest TSPIRS report (Timber Sale Program Information Reporting System). 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 Oconto, Forest, and Marinette Counties. This is a most reasonable 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 "tri-county" 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 third general group of comments suggested that the Forest Service include an assessment of non-commodity costs and benefits in the economic analysis for this project. Some examples of such non-commodity benefits could include the value of a standing forest in terms of its recreational or aesthetic value, the value of a particular area to birdwatchers or hunters, or the value of an area with no roads present. While the Forest Service recognizes that such areas have special values, it is not always reasonable to assign monetary values to them. It has been our experience that traditional forest management practices (including timber harvesting) have been compatible with the recreation and non-consumptive activities that are popular in this area. This is consistent with the findings of a statewide study) that investigated the economic impacts of woodland use for recreation and timber (Marcoullier and Mace, 1999 p.ii). Recreational use and tourism has been on the increase in the project area and the Forest Service has not experienced any notable number of complaints related to timber management activities. Given these considerations, 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 highly speculative tradeoff, but, rather, to consistently and reasonably compare the costs, benefits, and efficiencies between the alternatives. Environmental resource tradeoffs are disclosed in other parts of this chapter.

4.13.3 Direct and Indirect Effects of Alternative 1

4.13.3.1 Economic Efficiency

Under this alternative, none of the proposed actions (or alternatives to them) would be implemented within the McCaslin 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.

The Present Value of Benefits is an economic indicator that is computed by adding the values of all discounted benefits throughout the analysis period. For this analysis, the discount rate used was 4% (in accordance with Forest Service Handbook direction). Since no direct or indirect benefits would be realized in Alternative 1, the Present Value of Benefits would be $0.00.

The Present Value of Costs is an economic indicator that is computed by adding the values of all discounted costs throughout the analysis period. Since there would be no direct or indirect costs associated with Alternative 1, the Present Value of Costs would be $0.00.

The Present Net Value is the sum of all discounted costs and benefits. That is, the sum of the Present Value of Benefits and the Present Value of Costs. Since there would be no direct or indirect costs or benefits associated with Alternative 1, the Present Net Value would be $0.00

Benefit-Cost Ratio is a measure of economic efficiency that is computed by dividing the total discounted primary economic benefits by the total discounted primary economic costs. Since there would be no direct costs or benefits as a result of Alternative 1, the Benefit-Cost Ratio would be 0.0.

4.13.3.2 Economic Impact

Commodity Production

There would be no direct or indirect commodities produced as a result of Alternative 1.

Payments to Counties

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. Since there would be no money generated from the sale of National Forest Timber under Alternative 1, there would be no payments to counties as a result of this alternative.

Income Generated

Raw timber is a source of considerable income to the local economy. 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. A multiplier of $1,009,065/million board feet of timber is being used in this analysis to estimate the expected income generated under each alternative. The source of this multiplier is the 1998 TSPIRS Report for the Chequamegon-Nicolet National Forest.

Since there would be no timber volume harvested as a result of Alternative 1, there would be no anticipated income generated in the McCaslin economic analysis area.

Jobs Created/Sustained

As noted above, the harvest of timber generates income in the local community. Logically following this, it also generates employment. The 1998 TSPIRS Report for the Chequamegon-Nicolet National Forest estimates that approximately 16.6 jobs/ million board feet of timber are created/sustained. This is the most recent available report as a source for an employment multiplier.

Since there would be no timber volume harvested as a result of Alternative 1, there would be no anticipated jobs created/sustained in the McCaslin economic analysis area.

4.13.4 Direct and Indirect Effects of Alternative 2

4.13.4.1 Economic Efficiency

Under Alternative 2, the Present Value of Benefits would be approximately $3.35 million. This would result from expected undiscounted bid values totaling $3.76 million.

Under Alternative 2, the Present Value of Costs would be approximately $1.41 million. This would result from estimated undiscounted costs of approximately $1.57 million.

The Present Net Value of Alternative 2 is estimated by the Quicksilver program to be approximately $1.93 million. The undiscounted value of costs and benefits is estimated at $2.2 million.

The expected Benefit-Cost Ratio of Alternative 2 is 2.37. This means that the direct and indirect monetary benefits of implementing this alternative are 2.37 times the monetary costs of implementation.

4.13.4.2 Economic Impact

Commodity Production

As a result of Alternative 2, there would be a total of approximately 44.4 million board feet (MMBF) harvested as a result of the proposed timber management activities. This would consist of about 84% pulp material and 16% sawtimber.

Payments to Counties

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. As a result of harvest activities proposed under Alternative 2, there would be approximately $940,740 in payments to counties.

Income Generated

Raw timber is a source of considerable income to the local economy. 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. A multiplier of $1,009,065 / MMBF is being used in this analysis to estimate the expected income generated under each alternative. The source of this multiplier is the 1998 TSPIRS Report for the Chequamegon-Nicolet National Forest.

Under Alternative 2, it is expected that approximately $44,788,500 would be generated in the tri-county area of Forest, Oconto, and Marinette Counties. This would contribute approximately 2.8% of the total annual economic output attributed to the $1.59 billion/ year wood-based sector of the Northeast Wisconsin Region.

Jobs Created/Sustained

As noted above, the harvest of timber generates income in the local community. It logically follows that employment is also generated. The 1998 TSPIRS Report for the Chequamegon-Nicolet National Forest estimates that approximately 16.6 jobs/ million board feet of timber are created/sustained. This is the most recent available report as a source for an employment multiplier.

Under Alternative 2, it is estimated that approximately 737 jobs would be created/sustained as a direct and indirect result of the harvest activities that are proposed.

4.13.5 Direct and Indirect Effects of Alternative 3

4.13.5.1 Economic Efficiency

Under Alternative 3, the Present Value of Benefits would be approximately $2.59 million. This would result from expected undiscounted bid values totaling $2.91 million.

Under Alternative 3, the Present Value of Costs would be approximately $1.06 million. This would result from estimated undiscounted costs of approximately $1.17 million.

The Present Net Value of Alternative 3 is estimated by the Quicksilver program to be approximately $1.53 million. The undiscounted value of costs and benefits is estimated at $1.74 million.

The expected Benefit-Cost Ratio of Alternative 3 is 2.37. This means that the direct and indirect monetary benefits of implementing this alternative are 2.37 times the monetary costs of implementation.

4.13.5.2 Economic Impact

Commodity Production

As a result of Alternative 3, there would be a total of approximately 30.5 million board feet (MMBF) harvested as a result of the proposed timber management activities. This would consist of about 78% pulp material and 22% sawtimber.

Payments to Counties

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. As a result of harvest activities proposed under Alternative 3, there would be approximately $712,803 in payments to counties.

Income Generated

Raw timber is a source of considerable income to the local economy. 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. A multiplier of $1,009,065 / MMBF is being used in this analysis to estimate the expected income generated under each alternative. The source of this multiplier is the 1998 TSPIRS Report for the Chequamegon-Nicolet National Forest.

Under Alternative 3, it is expected that approximately $30,451,735 would be generated in the tri-county area of Forest, Oconto, and Marinette Counties. This would contribute approximately 1.9% of the total annual economic output attributed to the $1.59 billion/ year wood-based sector of the Northeast Wisconsin Region.

Jobs Created/Sustained

As noted above, the harvest of timber generates income in the local community. It logically follows that employment is also generated. The 1998 TSPIRS Report for the Chequamegon-Nicolet National Forest estimates that approximately 16.6 jobs/ million board feet of timber are created/sustained. This is the most recent available report as a source for an employment multiplier.

Under Alternative 3, it is estimated that approximately 501 jobs would be created/sustained as a direct and indirect result of the harvest activities that are proposed.

4.13.6 Direct and Indirect Effects of Alternative 4

4.13.6.1 Economic Efficiency

Under Alternative 4, the Present Value of Benefits would be approximately $3.77 million. This would result from expected undiscounted bid values totaling $4.24 million.

Under Alternative 4, the Present Value of Costs would be approximately $1.73 million. This would result from estimated undiscounted costs of approximately $1.91 million.

The Present Net Value of Alternative 4 is estimated by the Quicksilver program to be approximately $2.04 million. The undiscounted value of costs and benefits is estimated at $2.33 million.

The expected Benefit-Cost Ratio of Alternative 4 is 2.18. This means that the direct and indirect monetary benefits of implementing this alternative are 2.18 times the monetary costs of implementation.

4.13.6.2 Economic Impact

Commodity Production

As a result of Alternative 4, there would be a total of approximately 51.4 million board feet (MMBF) harvested as a result of the proposed timber management activities. This would consist of about 85% pulp material and 15% sawtimber.

Payments to Counties

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. As a result of harvest activities proposed under Alternative 4, there would be approximately $1,059,817 in payments to counties.

Income Generated

Raw timber is a source of considerable income to the local economy. 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. A multiplier of $1,009,065 / MMBF is being used in this analysis to estimate the expected income generated under each alternative. The source of this multiplier is the 1998 TSPIRS Report for the Chequamegon-Nicolet National Forest.

Under Alternative 4, it is expected that approximately $51,896,919 would be generated in the tri-county area of Forest, Oconto, and Marinette Counties. This would contribute approximately 3.3% of the total annual economic output attributed to the $1.59 billion/ year wood-based sector of the Northeast Wisconsin Region.

Jobs Created/Sustained

As noted above, the harvest of timber generates income in the local community. It logically follows that employment is also generated. The 1998 TSPIRS Report for the Chequamegon-Nicolet National Forest estimates that approximately 16.6 jobs are created/sustained per million board feet of timber that is harvested. This is the most recent available report as a source for an employment multiplier.

Under Alternative 4, it is estimated that approximately 854 jobs would be created/sustained as a direct and indirect result of the harvest activities that are proposed.

4.13.7 Direct and Indirect Effects of Alternative 5

4.13.7.1 Economic Efficiency

Under Alternative 5, the Present Value of Benefits would be approximately $3.17 million. This would result from expected undiscounted bid values totaling $3.57 million.

Under Alternative 5, the Present Value of Costs would be approximately $1.33 million. This would result from estimated undiscounted costs of approximately $1.47 million.

The Present Net Value of Alternative 5 is estimated by the Quicksilver program to be approximately $1.84 million. The undiscounted value of costs and benefits is estimated at $2.09 million.

The expected Benefit-Cost Ratio of Alternative 5 is 2.38. This means that the direct and indirect monetary benefits of implementing this alternative are 2.38 times the monetary costs of implementation.

4.13.7.2 Economic Impact

Commodity Production

As a result of Alternative 5, there would be a total of approximately 40.6 million board feet (MMBF) harvested as a result of the proposed timber management activities. This would consist of about 82% pulp material and 18% sawtimber.

Payments to Counties

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. As a result of harvest activities proposed under Alternative 5, there would be approximately $886,154 in payments to counties.

Income Generated
Raw timber is a source of considerable income to the local economy. 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. A multiplier of $1,009,065 / MMBF is being used in this analysis to estimate the expected income generated under each alternative. The source of this multiplier is the 1998 TSPIRS Report for the Chequamegon-Nicolet National Forest.

Under Alternative 5, it is expected that approximately $40,942,207 would be generated in the tri-county area of Forest, Oconto, and Marinette Counties. This would contribute approximately 2.6% of the total annual economic output attributed to the $1.59 billion/ year wood-based sector of the Northeast Wisconsin Region.

Jobs Created/Sustained
As noted above, the harvest of timber generates income in the local community. It logically follows that employment is also generated. The 1998 TSPIRS Report for the Chequamegon-Nicolet National Forest estimates that approximately 16.6 jobs are created/sustained per million board feet of timber that is harvested. This is the most recent available report as a source for an employment multiplier.

Under Alternative 5, it is estimated that approximately 674 jobs would be created/sustained as a direct and indirect result of the harvest activities that are proposed.

4.13.8 Environmental Justice Concerns
As discussed in section 3.13.4, the minority and low-income populations of Forest, Oconto, and Marinette Counties are 2.6% and 46% respectively. These percentages are not equal to or greater than twice the statewide minority and low-income percentages. Even if the minimum population of these socio-economic groups were exceeded, none of the action alternatives would have a disproportional effect on these groups. Management of the Chequamegon-Nicolet National Forest supports people in a variety of backgrounds directly and indirectly through employment in timber and recreation-related industries, as well as through the provision of forest products and recreation opportunities. In addition, access to the McCaslin Area is available to everyone, regardless of race, color, national origin, sex, religion, age, disabilities, political beliefs, sexual orientation, or marital or family status. Therefore, there is no reason to believe that any of the alternatives would involve environmental justice concerns.

4.13.9 Economic and Social Cumulative Effects of All Alternatives
Economic and Social cumulative effects are perhaps best analyzed at the scale of the Chequamegon-Nicolet National Forest. As discussed in section 3.13.3, regional economics are tied closely to the harvest of timber. Over the 10 year period from 1992- 2001, the average annual Forest timber output has been 133.5 MMBF. The average value during the same period is 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.

4.14 Forest Plan Revision

4.14.1 Summary
The following summary lists the main limitations of Plan Revision options that would result from implementing the McCaslin Project Alternatives:

- Alternative 1 would not result in any changes of available management options for the Plan Revision management area direction.
- Alternative 2 would reduce interior habitat management options within Plan Revision Management Areas 2A, B, and C, by creating 260 acres of temporary openings.
- Alternative 3 would result in no major changes of available management options for the Plan Revision management area direction.

- Alternative 4 would reduce interior habitat management options within Plan Revision Management Areas 2A, B, and C, by creating 585 acres of openings.
- Alternative 5 would result in no major changes of available management options for the Plan Revision management area direction.
- All alternative actions would have neutral or beneficial effects in moving open road density toward Plan Revision DFC's.

4.14.2 Introduction

At the time of this writing, the Chequamegon-Nicolet Forest Plan Revision effort is in the process of developing a Draft Environmental Impact Statement. As part of the process, the Plan Revision Team has developed preliminary alternatives that assign management areas and prescriptions to all National Forest lands. Concerns were raised that implementation of the McCaslin Project would have the potential to reduce management options available to the Revised Forest Plan. The McCaslin Project ID Team recognizes this concern. This section will explore the potential Revision option limitations resulting from implementing the McCaslin alternatives.

For the discussion of direct and indirect effects, the area of analysis is limited to National Forest System lands within the bounds of the McCaslin Project Area. For the larger context and cumulative effects discussion, potential changes are viewed at the forest level.

The McCaslin Project has the potential to affect Plan Revision options in three primary ways. First, project activities could modify vegetation composition to the point that other long-term options are precluded. For example, a hardwood stand could be converted to aspen in an area where the Plan Revision goal is large block northern hardwood management.

The second way could be by modifying vegetation structure in a way that is inconsistent with Forest Plan Revision goals for that area. This would usually be by creating a temporary opening (through regeneration harvest) in an area with a revision goal of continuous canopy.

The third way would be to change open road densities counter to Plan Revision Desired Future Conditions.

The following table (**4.14-1**) displays a brief description of the Draft Management Prescriptions currently proposed within the McCaslin Project Area:

Table 4.14-1: Description of Draft Forest Plan Revision Management Prescriptions Proposed within the McCaslin Project Area

Forest Plan Revision Management Area	Description	Composition Objectives	Desired Open Road Density
1C.4	Early Successional-Aspen/Hardwood	• Early Successional 35-80% • Red/White Pine 5-20% • Hardwoods 15-50% • Other 1-14%	≤ 4 miles/sq. mile
2A.2	Uneven-aged Northern Hardwoods	• Early Successional 5-30% • Red/White Pine 5-20% • Hardwoods 40-75% • Other 0-16%	≤ 2 miles/sq. mile
2A.4	Same as 2A.2, but with open road density of ≤ 4miles/sq. mile		
2B.2	Uneven-aged Northern Hardwoods-Interior	• Early Successional 0-17% • Red/White Pine 0-10% • Hardwoods 50-83% • Other 0-16%	≤ 2 miles/sq. mile
2B.4	Same as 2B.2, but with open road density of ≤ 4miles/sq. mile		

2C.2	Uneven-aged Northern Hardwoods-Mixed Forest	• Early Successional 15-40% • Red/White Pine 10-30% • Hardwoods 30-60% • Other 1-17%	≤ 2 miles/sq. mile
3B.4	Even-aged Hardwood Oak-Pine	• Early Successional 5-28% • Red/White Pine 10-25% • Hardwoods 30-95% • Other 0-12%	≤ 4 miles/sq. mile
3C.4	Even-aged Hardwood: Oak-Aspen	• Early Successional 20-60% • Red/White Pine 5-15% • Hardwoods 30-65% • Other 0-8%	≤ 4 miles/sq. mile

As shown in the above table, all draft Revision prescriptions allow for a certain percentage of early successional forest. However, Draft prescriptions for Management Areas 2A, 2B, and 2C try to limit temporary open patches, especially within large areas of northern hardwoods. Therefore, it is in these management areas that the creation of openings would have the most potential for limiting future management options.

Within the McCaslin Project Area, the seven Forest Plan Revision action alternatives prescribe 3 sets of management prescriptions. The following table (**4.14-2**) displays the proposed management prescriptions by Plan Revision Alternative within each Plan Revision land management polygon. A map of these areas is in the project file at the Lakewood Ranger Station.

Table 4.14-2 Forest Plan Revision Alternative Management Prescriptions Within the McCaslin Project Area

Land Polygon Number	Forest Plan Revision Alternatives 2,4,7,and 9	Forest Plan Revision Alternatives 3 and 5	Forest Plan Revision Alternative 6
63	1C.4	1C.4	1C.4
68	2C.2	2B.2	2A.2
69	1C.4	1C.4	1C.4
72	2A.4	2B.4	2A.4
93	3C.4	3B.4	3C.4

Since several of the Plan Revision Alternatives treat the McCaslin Project Area in similar ways, the discussion of effects will be grouped accordingly.

4.14.3 Methodology

The primary method of estimating potential limitations of Plan Revision options resulting from the McCaslin Project was to compare the management area maps and management area prescriptions of the current Nicolet Forest Plan , the Chequamegon-Nicolet Forest Plan Revision, and the McCaslin Alternative treatment activities.

A quick look shows that many of the Plan Revision management area boundaries differ widely from the existing Forest Plan management area boundaries. Also, in some areas, the management prescriptions proposed in the Plan Revision may represent a change in emphasis from the existing Forest Plan direction.

Therefore, several questions needed to be answered:

- Under the Forest Plan Revision, what is the emphasis of each proposed management area?
- Within each Plan Revision management area, what is the existing Forest Plan management direction?
- How do these two management prescriptions compare? Are the goals similar? Greatly different?
- For each area analyzed, what activities are proposed in the McCaslin Project that would move structure and composition and road density conditions away from desired future conditions?
- What would be the resulting changes and how extensive would they be?

A matrix was developed that concisely displays the answers to these questions for each grouping of Forest Plan Revision Alternatives. This matrix compares each of the action alternatives for the McCaslin Project to the 7 potential action alternatives of the Forest Plan Revision. (Since Alternative 1 of the Plan Revision assumes a continuation of current plan direction, it was not included for comparison). The resulting set of tables can be found in the McCaslin analysis file at the Lakewood Ranger Station. A summary of the effects is displayed in the following discussion.

In the McCaslin Area, Forest Plan Revision open road density objectives either remain the same or are less restrictive across the entire analysis area. There are no areas where the Plan Revision DFC's are more restrictive than those found in the current Forest Plan. A review was done to see whether any alternative actions moved open road densities away from desired conditions. The finding was that all actions either maintain existing conditions or reduce open road densities; none of them would increase open road density. Therefore, there will be no additional analysis in the following effects discussion.

4.14.4 Direct and Indirect Effects of Alternative 1

Since Alternative 1 of the McCaslin Project proposes no actions that would result in direct or indirect changes in forest composition or structure or open road densities, there would be no limitations in Forest Plan Revision management options.

4.14.5 Total Cumulative Effects of all Actions (including Alternative 1)

Past activities that have influenced the vegetation structure and composition on National Forest lands within the McCaslin Area include past timber sales and vegetation management activities described in section 4.5. The existing condition described in section 3.5 is the result of these past actions.
Likewise, past activities affecting open road density have resulted in the existing condition or the transportation system. This is described in Section 3.9.

There are no other present or foreseeable future actions taking place on the National Forest lands in the project area that would influence vegetation structure and composition or open road density.
Since there are no expected changes in vegetation or road density resulting from Alternative 1 as well as any other present or foreseeable future actions, there would be no cumulative effects in terms of changing management options in the Forest Plan Revision effort.

4.14.6 Direct and Indirect Effects of Alternatives 2, 3, 4, and 5

4.14.6.1 Effects of the McCaslin Action Alternatives on Forest Plan Revision Options- Plan Revision Alternatives 2,4,7, and 9.

The following **Table 4.14-3** summarizes the potential tradeoffs between the McCaslin Project action alternatives (2-5) and the Chequamegon-Nicolet Forest Plan Revision Alternatives 2,4,7, and 9:

Table 4.14-3 Summary of Tradeoffs between McCaslin Project and Plan Revision Alternatives 2,4,7, and 9

McCaslin Alternative	Effects Summary
Alternative 2	• Minor compositional changes unlikely to be measurable at forest or project scale. • Within Revision MA 2.C, about 260 acres of openings would not be consistent with goal of managing for large patches of northern hardwoods
Alternative 3	• Minor compositional changes unlikely to be measurable at forest or project scale. • No limited options related to openings.
Alternative 4	• Minor compositional changes unlikely to be measurable at forest or project scale. • Within Revision MA 2.C, about 585 acres of openings would not be consistent with goal of managing for large patches of northern hardwoods
Alternative 5	• Minor compositional changes unlikely to be measurable at forest or project scale. • Creation of openings would not be inconsistent with Plan Revision guidelines.

4.14.6.2 Effects of the McCaslin Action Alternatives on Forest Plan Revision Options- Plan Revision Alternatives 3 and 5.

The following **Table 4.14-4** summarizes the potential tradeoffs between the McCaslin Project action alternatives (2-5) and the Chequamegon-Nicolet Forest Plan Revision Alternatives 3 and 5:

Table 4.14-4 Summary of Tradeoffs between McCaslin Project and Plan Revision Alternatives 3 and 5

McCaslin Alternative	Effects Summary
Alternative 2	• Minor compositional changes unlikely to be measurable at forest or project scale. • Within Revision MA 2.B, about 260 acres of openings would not be consistent with goal of managing for interior habitat northern hardwoods.
Alternative 3	• Minor compositional changes unlikely to be measurable at forest or project scale. • No limited options related to openings.
Alternative 4	• Minor compositional changes unlikely to be measurable at forest or project scale. • Within Revision MA 2.B, about 585 acres of openings would not be consistent with goal of managing for interior habitat northern hardwoods
Alternative 5	• Minor compositional changes unlikely to be measurable at forest or project scale. • Creation of one 17-acre opening would be inconsistent with the goal of managing for interior habitat northern hardwoods.

4.14.6.3 Effects of the McCaslin Action Alternatives on Forest Plan Revision Options- Plan Revision Alternative 6

The following **Table 4.14-5** summarizes the potential tradeoffs between the McCaslin Project action alternatives (2-5) and the Chequamegon-Nicolet Forest Plan Revision Alternative 6:

Table 4.14-5 Summary of Tradeoffs between McCaslin Project and Plan Revision Alternative 6

McCaslin Alternative	Effects Summary
Alternative 2	Minor compositional changes unlikely to be measurable at forest or project scale. Within Revision MA 2.A, about 260 acres of openings would not be consistent with goal of managing for large patches of northern hardwoods
Alternative 3	Minor compositional changes unlikely to be measurable at forest or project scale. No limited options related to openings.
Alternative 4	Minor compositional changes unlikely to be measurable at forest or project scale. Within Revision MA 2.A, about 585 acres of openings would not be consistent with goal of managing for large patches of northern hardwoods
Alternative 5	Minor compositional changes unlikely to be measurable at forest or project scale. Creation of openings would not be inconsistent with Plan Revision guidelines.

4.14.7 Cumulative Effects of all Actions (including Alternatives 2, 3, 4, 5)

Past activities that have influenced the vegetation structure and composition on National Forest lands within the McCaslin Area include past timber sales and vegetation management activities described in section 4.5. The existing condition described in section 3.5 is the result of these past actions. Similarly, past actions

influencing road densities within the project area are essentially included in the existing conditions for the transportation system discussion in section 3.9.

There are no other present or foreseeable future actions taking place on the National Forest lands in the project area that would influence vegetation structure and composition or open road density.

Since there are no known short or long-term effects from any other present or foreseeable future actions, there would be no expected cumulative effects on Forest Plan Revision management options beyond the direct/indirect effects already described in the preceding section.

4.15 Monitoring

The following items were identified as a result of public and internal scoping of the proposed action for the McCaslin Project. They have been grouped by resource area. Each monitoring issue is listed as a question and is followed by a paragraph, which explains how the concern will be tracked and evaluated.

Soil and Water

- Were mitigation measures designed to minimize adverse soil impacts (compaction, displacement, erosion, and rutting) properly implemented?
- Were impacts to the soil resource within acceptable limits?

This monitoring would take place during and after timber harvest implementation. The Sale Administrators and, upon request, Soil Scientists would review the treatment areas to determine whether impacts are within acceptable limits. This would be done by visual examination and documentation in the harvest inspection reports. If impacts appear to exceed threshold values, more detailed sampling would be done as per regional soil quality standards to quantify the degree of the impact and the potential need for amelioration.

- Were harvest timing restrictions on soils and slash retention mitigation measures implemented as identified in the treatment tables?

These measures would be included in the timber sale contract by the pre-sale forester and would be reviewed by the timber management assistant and District Ranger prior to acceptance and advertisement. Following the award of the sale, the Timber Sale Administrator would enforce the restrictions and document harvest activities.

- Were Wisconsin Best Management Practices for Water Quality implemented? Did they avoid/reduce impacts?

Best Management Practices would be implemented and monitored by the timber sale preparation specialists during layout and design and by road engineering crews during construction and maintenance activities. BMP implementation would also be spot checked by specialists such as the silviculturist, soil scientist, supervising engineer, or fisheries biologist. The timber sale administrator would actively review the implementation and effectiveness of BMPs and document any problems on inspection reports.

Vegetation Management

- Did stand harvest activities reduce densities to the desired levels?
- Were forest type conversions successful?

Prior to sale advertisement, Foresters, a certified Silviculturist, Timber Management Assistant, and/or Forestry Technicians would review timber sale units to determine whether marking was in accordance with the prescribed guidelines. Periodic reviews of harvested areas would be conducted by resource managers from a range of disciplines to determine consistency with management direction and to monitor quality of implementation. Results of these reviews would be incorporated to improve subsequent harvest activities.

A Forester would review activity areas before, during, and following the prescribed treatments. The response of vegetation could be monitored through a combination of field notes, photo plots, observations, and periodic stand examinations.

- Were regenerated and underplanted areas adequately stocked following treatment?
- Were hemlock and butternut regeneration opportunities furthered as a result of the treatments?

This monitoring would be done primarily by the reforestation technician and the district silviculturist following harvest activities. The area would be monitored over a number of years following the harvest since natural regeneration of these species tend to be gradual over time.

- Did areas treated with prescribed fire meet desired objectives? Were prescriptions met?
- Did prescribed burns result in unexpected increases in fuel profiles due to scorch of previously green material?
- Did prescribed burns result in improved regeneration?

This monitoring would take place periodically following implementation of the various treatments. Fire managers and other resource specialists would review prescribed burn areas to determine whether resource objectives were met. Monitoring results of initial treatments would be evaluated and, if needed, adjustments would be made to subsequent treatments to improve the results of each successive action.

Biodiversity

- Did wildlife populations change as predicted in the effects analysis?

This would be monitored through continuing surveys conducted by private, state, and federal biologists. Some examples would include: breeding bird surveys conducted in cooperation between the University of Wisconsin at Green Bay and the USDA-Forest Service; raptor nest surveys conducted by private experts; DNR deer population estimates and other wildlife surveys. Identifying trends and effects, and validating assumptions would occur through long term surveys.

- Were conservation measures implemented for bald eagles, red-shouldered hawks, goshawks, loons, and ospreys ?
- Were conservation strategies for elm, hemlock, and butternut properly implemented?

These measures are identified from the environmental document by the pre-sale forester and pre-sale forestry technicians. Sale prep crews would then mark the areas in accordance with the above mitigation measures. Following layout and marking, a meeting is held between all the people involved in sale and contract preparation to ensure inclusion. Relevant provisions would be included in the timber sale contract by the pre-sale forester and would be reviewed by the timber management assistant, wildlife biologist, and District Ranger prior to acceptance and advertisement. Following the award of the sale, the Timber Sale Administrator would enforce the restrictions and document harvest activities. Further monitoring may be done periodically by biologists and technicians and at random in post-harvest timber reviews.

- Were the appropriate numbers and sizes of snags retained in harvest units?
- Were reserve island guidelines followed as identified in the mitigation measures?

These measures are identified by the timber sale preparation crew from the environmental documents to ensure that they are included in the layout considerations of a sale. Numbers of retention trees and snag guidelines are included as part of the Silvicultural prescriptions and marking guides by the District Silviculturist. Treatment areas are then marked by Forest Service staff or by contract markers under Forest Service supervision.
Timber sale administrators supervise harvest operations to ensure that these trees are maintained in accordance with project-level objectives.

Following harvest activities, wildlife biologists and technicians will randomly check treated areas to ensure compliance with the guidelines listed in the McCaslin EIS.

- Were rare plant protection areas implemented? Were they effective?
- Were the mitigation measures implemented for lowland conifer buffer areas? Were they effective?

Rare plant and lowland conifer buffer areas have been identified in the ID team process. The locations of these sites would be passed along to timber sale preparation staff, who would mark each site according to specific mitigation measures. These sites would be specifically identified in the sale package and contract to avoid unintentional damage by timber sale purchasers. At this stage, the timber sale administrator would work closely with the purchaser to enforce compliance.

Post-harvest monitoring of the rare plant protection areas would be done by the plant ecologist or other designated personnel. They would ensure compliance with guidelines listed in the McCaslin EIS and would identify whether any unanticipated changes to the sites took place.

- Locations of and preventing spread of noxious weeds.

As part of this monitoring plan, continued surveys would be done to further identify and evaluate noxious weed populations. Potential control methods may be identified at this time. Monitoring would also be done to assess whether McCaslin Project activities have aided the spread of noxious weeds. This would be done by District and Forest botany staff before, during, and after planned activities.

Heritage Resources
- Avoidance of heritage sites.

This would be monitored through the heritage resource paraprofessional and through sale administration. No sites would be used as landings for harvested timber or for storage of equipment or machinery used in harvesting unless approved by the Forest Archaeologist.

Recreation and Visual Resources
- Were snowmobile trail mitigation measures implemented as planned?
- Were visual quality mitigation measures implemented as planned?

These measures are identified from the environmental document by the pre-sale forester and pre-sale forestry technicians. Sale prep crews would then mark the areas in accordance with the above mitigation measures. Following layout and marking, a meeting is held between all the people involved in sale and contract preparation to ensure inclusion. Relevant provisions would be included in the timber sale contract by the pre-sale forester and would be reviewed by the timber management assistant and District Ranger prior to acceptance and advertisement. Following the award of the sale, the Timber Sale Administrator would enforce the restrictions and document harvest activities. Further monitoring may be done at random in a post-harvest timber review.

Roads
- Were roads planned for closure effectively closed?

Road closures would potentially be administered by a number of people. First, following harvest activities, the Sale Administrator would be responsible for ensuring closure of roads identified on the sale area map. Other closures may be done through contracts or through the Forest Service engineering department. These closures would be administered either by the Contracting Officer's Representative for the road closure contract or by the supervising engineer. Further monitoring of road closures may be done in random post-harvest reviews and day-to-day inspections by Forest Service staff.

4.16 Other Required Disclosures

NEPA at 40 CFR 1502.25(a) directs "to the fullest extent possible, agencies shall prepare draft environmental impact statements concurrently with and integrated with …other environmental review laws and executive orders."

Section 319 and 404 of the Clean Water Act (CWA), as amended in 1977 (33 USC 1344)

The Federal Water Pollution Control Act of 1972, as amended, is commonly referred to as the Clean Water Act. This was enacted to restore and maintain the chemical, physical, and biological integrity of the Nations waters. Section 319 for the 1977 amendments requires each state to develop and implement a program to control silviculture-related and other non-point sources of water pollution to the maximum extent practicable. Non-point sources of water pollution are controlled by the use of "best management practices". Wisconsin developed Forestry Best Management Practices for Water Quality in 1995 (WDNR 1995). These practices are used as mitigation measures to prevent non-point sources of water pollution from forest management activities.

Under Section 404, the U.S. Army Corps of Engineers has been given responsibility to regulate the discharge of dredged and fill material into waters of the United States, including wetlands (33 CFR 323.3). Normal silvicultural activities, including harvesting for the production of forest products or upland soil and water conservation practices, are exempt from Section 404 permits (33 CFR 323.4). Construction and maintenance of forest roads for normal silviculture are also exempt provided best management practices are applied (33 CFR 323.4; Wisconsin's Forestry Best Management Practices for Water Quality). Where a Section 404 permit is required, a Section 401 water quality certification from the State of Wisconsin may be required (33 CFR 325.2; NR 103 Water Quality Standards for Wetlands). Appropriate Federal and state permits are obtained prior to implementation of projects involving wetlands.

Chap 30 (Wisconsin State Statute) and Trans 20 (Wisconsin Administrative Code) Permits

Portions of the Clean Water Act were delegated to the states for implementation. Federal agencies are required to obtain state permits when they relate to water quality protection. In Wisconsin, Chapter 30 and Trans 207 permits are required for the construction of a ford or installation of a culvert or bridge across a state navigable (perennial or intermittent) stream. These permits also include provisions to protect water quality from sedimentation or other types of non-point sources of water pollution. A Section 30 or Trans 207 permit for replacement of culverts will be obtained before implementing any in stream work.

LITERATURE CITED

Ahlgren, C.E.; Ahlgren, I.F. 1983. The human impact on northern forest ecosystems. In: Flader, S.L. ed., The Great Lakes Forest, an environmental and social history. University of Minnesota Press, Minneapolis, Mn. p 33-51.

Alban, D.H.; Perala, D.A. 1990. Impact of aspen timber harvesting on soils. In: Gessel, S.P.; Lacate, D.S.; Weetman, G.F.; Powers, R.F. eds. Sustained productivity of forest soils: 7th North American forest soils conference; 1988 July 24-28; Vancover, BC. University of British Columbia:377-391.

Alban, D.H.; Perala, D. A. 1992. Carbon storage in Lake States aspen ecosystems. Can. J. For. Res. 22: 1107-1110.

Alverson, W.S., D.M. Waller, and S.L. Solheim. 1988. Forests Too Deer: Edge Effects in Northern Wisconsin. Conservation Biology 2:348-358.

Andren, H. 1995. Effects of Landscape Composition on predation rates at habitat edges. Pages 225-255 in L. Hansson, L. Fahrig, and G. Merriam, editors. Mosaic landscapes and ecological processes. Chapman and Hall, London, United Kingdom.

Askins, R. A.1993. Population trends in grassland, shrubland, and forest birds in eastern North America. Current Ornithology. Volume 11.

Armentano, T.V.,; Ralston, C.W. 1980. The role of temperate zone forests in the world carbon cycle. Can. J. For. Res. 10:53-60.

Bayne, E.M., and K.A. Hobson. 1997. Comparing the Effects of Landscape Fragmentation by Forestry and Agriculture on Predation of Artificial Nests. Conservation Biology 11:1418-1429.

Balgooyen, C.P., and D.M. Waller. 1995. The Use of Clintonia borealis and Other Indicators to Guage Impacts of White-tailed Deer on Plant Communities in Northern Wisconsin, USA. Natural Areas Journal 15.4:308-318.

Benchley, Elizabeth, D., 1993. Investignation of the Influence of Late 19th Century Logging on Fluvial Geomorphology and Fisheries Habitat on the Indian River. Hiawatha National Forest, Michigan. Report of Investigations, No. 113. Pages 117-119.

Benyus, J.M., R.R. Buech, and M.D. Nelson. 1992. Wildlife of the Upper Great Lakes Region: a community profile. USDA Forest Service, North Central Forest Experiment Station, Research Paper NC-301, St. Paul, MN. 27 pp.

Birdsey, R.A.; Heath, L.S. 1997. A forest carbon budget of the United States. In: Birdsey, R.; Mickler, R.; Sandberg, D.; Tinus, R.; Zerbe, J.; O'Brian, K. eds. USDA Forest Service global change research program highlights 1991-1995. GTR-NE-237, USDA Forest Service, Northeastern Forest Experiment Station, Radnor, PA

Boag, D.A., S.G. Reebs, and M.A. Schroeder. 1984. Egg loss among spruce grouse inhabiting lodgepole pine forests. Canadian Journal of Zoology 62: 1034-1037.

Brittingham, M.C. and S.A. Temple. 1983. Have cowbirds caused forest songbirds decline? Bioscience 33:31-35.

Bouwman, A.F.; Leemans, R. 1995. The role of forest soils in the global carbon cycle. In: Mcfee; Kelly eds. Carbon forms and functions in forest soils. Soil Sci. Soc. Am., Madison, WI.

Bremner, J. M. 1967. Nitrogenous compounds. In A. D. McLaren and G. H. Peterson (eds.), Soil Biochemistry, p. 19-66. Marcel Dekker, Inc., New York.

Buckley, D. S., T. R. Crow, E. A. Nauertz, K. E. Schultz. 2003. Influence of skid trails and haul roads on understory plant richness and composition in managed forest landscapes in Upper Michigan, USA. Forest Ecology and Management. 175, 509-520.

Chasko, G.G. and J.E. Gates. 1982. Avian habitat suitability along a transmission line corridor in an oak hickory forest region. Wildlife Monographs No. 82.

Cordone, A. J. and D. W. Kelly, 1961. The Influences of Inorganic Sediment on the Aquatic Life of Streams. California Fish and Game 47:189-228.

Crow, T.R., A. Haney, and D.M. Waller. 1994. Report on the Scientific Roundtable on Biological Diversity convened by the Chequamegon and Nicolet National Forest. North Central Forest Experiment Station. General Technical Report NC-166.

DeGraaf, R.M. 1991. Breeding Bird Assemblages in Managed Northern Hardwood Forest in New England. Pages 152-171 in Rodiek, J.E., and E.G. Bolen, Editors. Wildlife and Habitats in Managed

Landscapes. Island Press, Washington, DC.

DeGraaf, R., M. Yamasaki, W.B. Leak, and J.W. Lanier. 1992. New England wildlife: management of forested habitats. USDA Northeastern Forest Experiment Station. Forest Service,

DeGraaf, R.M., M. Yamasaki, and W.B. Leak. 1993. Management of New England Northern Hardwoods, Spruce-fir, and Eastern White Pine for Neotropical Migratory Birds. Pages 363-373 in Finch D.M., and P.W. Stangel, Editors. Status and Management of Neotropical Migratory Birds. Gen. Tech. Rept. RM-229 USDA Forest Service, Rocky Mt. Forest and Range Experiment Station.

Dessecker R.D. and D. G. McAuley. 2001. Importance of early successional habitat to ruffed grouce and American woodcock. Wildlife Society Bulletin. 29(2): 456-465.

Detweiler, R.P. 1986. Land use change and the global carbon cycle: The role of tropical soils. Biogeochemistry 2:67-93.

Dissmeyer, G.E.; Foster, G.R. 1980. A guide for predicting sheet and rill erosion on forest land. Tech. Pub. SA-TP 11. UDSA Forest Service, Atlanta, Georgia.

Dobiesz, Norine. 1998. Nicolet National Forest Bird Information Retrieval and Display program, V3.04. Corel Paradox Version 7.0. Paradox Runtime.

ECOMAP. 1993. National Hierarchical Framework of Ecological Units. Washington, DC:USDA-Forest Service. 21 p.

Epstein, E., Judziewicz, E., Spencer, E. 2001. The Wisconsin Natural Heritage Inventory's recognized Natural Communities – Working Document. http://www.dnr.state.wi.us/org/land/er/rare/natcomm_descripts.htm

Euskirchen, E.S., Chen, J., and R. Bi. 2001. Effects of edges on plant communities in a managed landscape in northern Wisconsin. Forest Ecology and Management. 148 (2001) 93-108.

Finley, R.W. 1976. Original vegetation cover of Wisconsin. Map compiled from U.S. General Land Office Notes. University of Wisconsin Extension.

Flaspohler, D. J., S. A. Temple, and R. N. Rosenfield. 2001. Species-specific edge effects on nest success and breeding bird densities in a forested landscape. Ecological Applications 11(1): 32-46.

Forman, R.T. and M. Godron. 1986. Landscape Ecology. John Wiley and Sons, New York.

Frelich, L.E. 1995. Old Forests in the Lake States Today and Before European Settlement. Natural Areas Journal. 15: 157-167.

Frelich, L.E., and C.G. Lorimer. 1991. Natural Disturbance Regimes in Hemlock-Hardwood Forests of the Upper Great Lakes Region. Ecological Monographs 61:145-164.

Green, J. C. 1995. Birds and Forests; a Management and Conservation Guide. State of Minnesota, Department of Natural Resources.

Grigal, D.F.; Ohmann, L.F., 1992. Carbon storage in Upland Forests of the Lake States. Soil Sci. Soc. Am. J. 56:935-943.

Hanski, I.K., Fenske, T.J., and G.J. Niemi. 1996. Lack of edge effect in nesting success of breeding birds in managed forest landscapes. The Auk. 113(3): 578-585, 1996.

Hendrickson, O.Q., Chatarpaul L., and Burgess, D. 1989. Nutrient cycling following whole-tree and conventional harvest in northern mixed forest. Can. J. For. Res. 19: 725-735.

Hewlett, J. D. and W. L. Nutter, 1969. An Outline of Forest Hydrology. University of Georgia Press, Athens, GA. 137 p.

Higgins, 1999. Aquatic Assessment for Chequamegon-Nicolet NF, Erosion and Sedimentation, 10 pgs.

Hindall, S. M. and R. F. Flint, 1970. Sediment Yields of Wisconsin Streams. Hydrologic Investigations

Hindall, S. M., 1972. Sediment Yields of Wisconsin Streams. Open-File Report, USDI Geological Survey, Madison, WI.

Hindall, S. M., 1976. Measurement and Prediction of Sediment Yields in Wisconsin Streams. U.S. Geological Survey Water-Resources Investigations 54-75. 33 p.

Holt, William, 1948. A Wisconsin Lumberman Looks Backward. Pages 24-25 and 30-31.

Howe, R.W., Temple, S.A., and M.J. Mossman. 1992. Forest Management and birds in northern Wisconsin. The Passenger Pigeon, Vol. 54, No. 4.

Howe, R. W., G. Niemi, and J. R. Probst. 1996. Management of western Great Lakes forests for the conservation of Neotropical migratory birds. From Management of Midwestern Landscapes for the Conservation of Neotropical Migratory Birds. Edited by Frank R. Thompson III, North Central Forest Experiment Station, General Technical Report NC-187.

Howe, R.W. 2001. Consultation with Chequamegon-Nicolet NF regarding depth of edge effect.

Communication documented in McCaslin Analysis File.

Hunter, W. C., D. A. Buehler, R. A. Canterbury, J. L. Confer, and P. B. Hamel. 2001. Conservation of disturbance dependent birds in eastern North America. Wild. Soc. Bull. 29(2): 440-455.

Johnson, C.E. 1995. Soil nitrogen status 8 years after whole-tree clear-cutting. Can. J. For. Res. 25: 1346-1355

Johnson, D.W. 1992. Effects of forest management on soil carbon storage. Water Air Soil Pollution. 64:83-120.

King, D.I., Griffen, C.R., and R.M. DeGraaf. 1996. Effects of Clearcutting on Habitat Use and Reproductive Success of Ovenbird in Forested Landscapes. Conservation Biology, Vol. 10, No. 5. pp. 1380-1386.

Kotar, J.; Kovach, J.A.; Burger, T.L.. 2002. A Guide to Forest Communities and Habitat Types of Northern Wisconsin. Department of Forest Ecology and Management. University of Wisconsin Madison.

Kubisiak, J.F. and K. R. McCaffery. 1985. Species management guidelines, Wildlife: Chapter 42 Ruffed Grouse. Dep. Nat. Resour. Fish and Wildlife Comprehensive Plan.

Manolis, J.C. 1999. Clearcut edge effects on avian nesting success in extensively forested, northern hardwood-conifer landscapes. Dissertation, University of Minnesota, St. Paul, USA.

Manolis, J.C., Anderson, D.E., and F.J. Cuthbert. 2000. Patterns in clearcut edge and fragmentation effect studies in northern hardwood-conifer landscapes: retrospective power analysis and Minnesota results. Wildlife Society Bulletin 28(4): 1088-1101.

Martin, 2001. Consultation with Chequamegon-Nicolet NF regarding depth of edge effect. Communication documented in McCaslin Analysis File.

Mason, D. J., and T. C. Moermond. 1992. Changes in hardwood communities along aspen edges: the effect of aspen succession. A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at the University of Wisconsin, Madison.

McCaffery, Keith R. 2000a. Deer baiting and feeding issue. Paper presented to Midwest and northeast deer groups. Hillman, MI. August 21, 2000. pp. 6.

McCaffery, Keith R. 2000b. Estimating deer carry capacity and impacts. Presentation at Aspen Summit. Ottawa National Forest. April 05, 2000.

McCaffery, Keith R. 2001. Winter severity index 2000-01. In Wisconsin Wildlife Surveys April 2001 Vol. 11 Issue 05. Wisconsin Department of Natural Resource. Bureau of Integrated Science Service. Ecological Inventory and Monitoring Section.

McBride, J. 1857. Survey Notes for Township T33N R16E, 4th Principal Meridian. On file at Lakewood Ranger Station.

McRae, B. 1995. Effects of landscape composition on edge-sensitive songbirds in a forest-dominated landscape. A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science (Land Resources) at the University of Wisconsin, Madison.

Miller, R.O.; Heyd, R.; Rummer, R.; Jerome, D. 2001. Gentle Logging System Evaluation (Quantitative Measurement Report). Michigan State University, Upper Peninsula Tree Improvement Center. Escanaba, Mi.

Mladenhoff, D.J. and Stearns, F. 1993. Eastern hemlock regeneration and deer browsing in the Northern Great Lakes Region: A re-examination and model simulation. Conservation Biology 7(4):889-899.

Mladenoff, D.J. 1990. The Relationship of the Soil Seed Bank and Understory Vegetation in Old-growth Northern Hardwood-Hemlock Treefall Gaps. Can. J. Bot. 68: 2714-2721.

Natural Resources Research Institute (NRRI). 2002. An online document, Forest birds of Minnesota – species accounts. (http://oden.nrri.umn.edu/mnbirds/speciesaccounts.htm)

NatureServe: An online encyclopedia of life, 2000. Species - Barred owl. Version 1.0. Arlington, VA: Association for Biodiversity Information (http://natureserve.org).

Niemi, G.J., J.M. Hanowski, A. Lima, T. Nichols, and N. Weiland. A critical analysis of the use of indicator species in management. J. Wildl. Manage. 61 (4): 1997. 13 p

Nicolet National Forest. 1986. Final Environmental Impact Statement for the Nicolet National Forest Land and Resource Management Plan.

Oschwald, W. R., 1972. Sediment-Water Interactions. J. of Environmental Quality 1:360-366.

Patric, J.H. 1976. Soil erosion in the eastern forest. J. of Forestry. 74 (10):571-577

Paulis, Andy. 2002. Results from two years of owl surveys in the Chequamegon/Nicolet National Forest. A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science at the

University of Wisconsin - Green Bay. 59 p.

Pecore, M. 2001. Personal communication with John Lampereur at Menominee Reservation, May, 2001.

Perala, D.A.; Rollinger, J.L.; Wilson, D.M. 1995. Comparison between soil and biomass carbon in adjacent hardwood and red pine forests. In: The proceedings of Global Warming 6 Conference. World Resources Review. 7(2): 231-243

Pritchett, W.L.; Fisher, R.F. 1987. Properties and Management of Forest Soils. John Wiley and Sons. New York.

Powers, P.F.; Tiarks, A.T.; Boyle, J.R. 1998. Assessing soil quality: practicable standards for sustainable forest productivity in the United States. Soil Sci. Soc. Am. Special Publication no. 53. Madison, WI. 28p

Rich, A.C., and D.S. Dobkin. 1994. Defining Forest Fragmentation by corridor width: the influence of narrow forest-dividing corridors on forest-nesting birds in southern New Jersey. Conservation Biology. 1109-1121. Vol. 8, No. 4. December, 1994.

Ritchie, J. C., 1972. Sediment, Fish, and Fish Habitat. J. of Soil and Water Conservation 27:124-125.

Robinson, S. K., F. R. Thompson III, T. M. Donovan, D. R. Whitehead, and J. Faaborg, 1995. Regional forest fragmentation and the nesting success of migratory birds. Science, Volume 267 (March 1995): 1987-1990.

Robinson, S. K. 1996. Threats to breeding Neotropical migratory birds in the Midwest. From Management of Midwestern Landscapes for the Conservation of Neotropical Migratory Birds. Edited by Frank R. Thompson III, North Central Forest Experiment Station, General Technical Report NC-187

Rolley, R.E. 2002. White-tailed deer population status 2001. In Wisconsin Wildlife Surveys April 2002 Vol. 12 Issue 02. Wisconsin Department of Natural Resource. Bureau of Integrated Science Service. Ecological Inventory and Monitoring Section.

Rollinger, J.L.; Strong. T.F. 1995. Carbon storage in managed forests of the northern Great Lake States. In: Hom, J.; Birdsey, R.; O'Brian, K. eds. Proceedings, 1995 meeting of the Northern Global Change program; Gen. Tech. Rep. NE-214. Radnor, PA: USDA-Forest Service, NE Forest Experiment Station: 203-207.

Rosgen, D. L., 1994. A Classification of Natural Rivers. Catena 22:169-199. Atlas HA-376, USDI Geological Survey, Washington, D.C, pages 186, 193-195.

Rudnicky, T.C. and M.L. Hunter. 1993. Avian nest predation in clearcuts, forests, and edges in a forest-dominated landscape. Journal of Wildlife Management 57: 358-364.

Runkle, J.R. 1982. Patterns of Disturbance in Some Old-Growth Mesic Forests of Eastern North America. Ecology, 63(5) pp. 1533-1546.

Sallabanks, R., A. Edwart, T.B. Wigley and L. Irwin. 2001. Accommodating birds in managed forests of North America: A review of bird-forestry relationships. National Council for Air and Stream Improvement. Tech. Bull. No. 822. p. 50.

Schimel, D.S.; Braswell. B.H.; Holland, E.A.; Mckeown, R.; Ojima, D.S.; Painter,T.H.; Parton, W.J.; Townsend, A.R. 1994. Climatic, edaphic, and biotic controls over storage and turnover of carbon in soils. Global Biogeochemical Cycles. 8(3):279-293.

Schumacher, P. 2002. Personal field observations memo. Observations and measurements made in the field while performing USDA Forest Service timber sale administration duties from 1992 through present.

Silkworth, D.R.; Grigal, D.F. 1982. Determining and evaluating nutrient losses following whole-tree harvesting of aspen. Soil Sci. Soc. Am. J. 46:626-631

Small, M.F. and M.L. Hunter. 1988. Forest Fragmentation and avian nest predation in forested landscapes. Oecologia 76: 62-64.

Smith, D.M. 1986. The Practice of Silviculture, Eighth Edition. John Wiley & Sons. 527 pp.

Spangenberg, N. E. and R. McLennan, 1983. Effect of Silvicultural Practices on Water Quality in Northern Wisconsin. Technical Report WIS WRC 83-07, Water Resources Center, University of Wisconsin, Madison, WI. 17 p.

Stone, D.M.; Elioff, J.D. 1998. Soil properties and aspen development five years after compaction and forest floor removal. Can. J. Soil Sci.78:51-58.

Stone, D.M.; Gates, J.a.; Elioff, J.D. 1999. Are we maintaining aspen productivity on sand soils? In proceedings: Zumbahlen, B.; Ek, A.R. (comp.) Improving Forest Productivity for Timber – A Key to Sustainability. Dec. 1998; Duluth, Mn. St. Paul, Mn: Department of Forest Resources, University

of Minn.:177-184

Storch, I. 1991. Habitat fragmentation, nest site selection and avian nest predation risk in Capercaillie. Ornis Scandinavica 22: 213-217.

Strong, Terry F. 1997 Harvesting intensity influences the carbon distribution in a northern hardwood ecosystem. Res. Pap. NC-329. St. Paul, MN: U.S. Dept. of Agri., Forest Service, North Central Forest Experiment Station. 7 p.

Thompson, F.R., III, J.R. Probst, and M.G. Raphael. 1995. Impacts of Silviculture: Overview and Management Recommendations. Pages 201-219 in Martin, T.E., and D.M. Finch, Editors. Ecology and Management of Neotropical Migratory Birds. Oxford University Press, New York.

USDA Forest Service 1986a. Nicolet National Forest Land and Resource Management Plan; Forest Plan. 1986. Rhinelander, WI.

USDA Forest Service 1986b. Nicolet National Forest Land and Resource Management Plan; Final Environmental Impact Statement. Forest Plan. 1986. Rhinelander, WI.

USDA Forest Service. 1991. Soil Quality Monitoring. In: Soil Management Handbook, FSH 2509.18 Sec. 2.05. USDA Forest Service, Washington, DC.

USDA-Forest Service. 1996. The End-of-the-Decade Monitoring Report, Chequamegon-Nicolet National Forest, Implementing the Forest Plans 1986-1996. 76 pages.

USDA Forest Service, 1998. Soils Assessment of the Chequamegon-Nicolet National Forest. Unpublished. Chequamegon-Nicolet NF, Rhinelander, WI. 18p.

USDA Forest Service. 2000. Timber Sale Activity Review Report for the Lakewood-Laona Ranger District. Lakewood, WI.

USDA Forest Service. June 2000. Forest Roads: A Synthesis of Scientific Information. http://www.fs.fed.us/eng/road_mgt/science.pdf

USDA Forest Service. 2001. Elevation Sale soil resource impact findings. Lakewood-Laona Ranger District. USDA Forest Service, Rhinelander, WI. 2p.

USDA Forest Service. 2001 Draft. Soil Quality Monitoring. In: Soil Management Handbook, R9 Supplement, FSH 2509.18 Sec. 2.2. USDA Forest Service, Milwaukee, WI.

USDI Fish and Wildlife Service. Oct. 2000. National Biological Opinion for the Canada Lynx. Letter to Kathleen A. McAllister, National Interagency Lynx Steering Committee, U.S. Forest Service. Author Ralph O. Morgenweck, Regional Director USFWS

Vasievich, J.M. 1998. Quicksilver Investment Analysis Program, version 5.003. North Central Forest Experimental Station, East Lansing, MI.

Verry, E. S., 1972. Effect of aspen clearcutting on Water Yield and Quality in Northern Minnesota. In: Watersheds in Transition Symposium Proceedings, American Water Resources Association, Urbanna, Ill. p. 276-284.

Verry, S. et al., 2000. Riparian Management in Forests of the Continental Eastern United States. 402 pages.

Waters, T. F., 1995. Sediment in Streams: Sources, Biological Effects, and Control. Monograph 7, American Fisheries Society, Bethesda, Maryland. 251 p

Weiland, N. 2002. Lynx habitat suitability assessment for the Chequamegon-Nicolet National Forest. Forest Service document, non-published. 22 p.

Wilcove, D. S., C.H. McLellan and A.P. Dobson. 1986. Habitat fragmentation in the temperate zone. Pages 237-256 in M.E. Soule, ed. Conservation Biology: The Science of Scarcity and Diversity. Sinauer, Sunderland, MA.

Wisconsin Department of Natural Resources, 1980. Wisconsin Trout Streams, Publication 6-3600(80). Wisconsin Department of Natural Resources. Madison, Wisconsin. 120 pages.

Wisconsin Department of Natural Resources, 1995. Wisconsin's Forestry Best Management Practices for Water Quality. Wisconsin Department of Natural Resources, Bureau of Forestry, Publication FR093, Madison, WI. 76 p.

Wisconsin Department of Natural Resources, 1997. Wisconsin's Forestry Best Management Practices for Water Quality. The 1995-1997 BMP Monitoring Report, Wisconsin Department of Natural Resources, Bureau of Forestry, Publication FR-145-99 Madison, WI.

Wisconsin Department of Natural Resources. 1998. Wisconsin's deer management program: Issues involved in decision

Wisconsin Department of Natural Resources, 2001. Exotic species information, distribution and status reports. www.dnr.state.wi.us/org/water/wm/glwsp/exotics/

Wisconsin Department of Natural Resources, 2001. Wisconsin Lakes, 180 pages.
Wisconsin Department of Natural Resources, 2001. Summary Report of Pre and Post Trout Stream Habitat Restoration, North Otter Creek Project. Unpublished, 6 pages.
Wisconsin Department of Natural Resource. 2001a. *An online document*, Rare, Endangered and Threatened Species and Natural Communities of Wisconsin.Wisconsin Department of Natural Resource. 2001a. An online document, Rare, Endangered and Threatened Species and Natural Communities of Wisconsin
Wisconsin Department of Natural Resource. 2001b. *An online document*, Deer Management for 2000 and beyond; A Wisconsin Conservation Congress Initiative.(http://www.dnr.state.wi.us/org/land/wildlife/hunt/deer/deer2000/)
Wollum A. G., II and Davey, C. B. 1975. Nitrogen accumulation, transformation, and transport in forest soils. In B. Bernier and C. H. Winget (eds.) Forest Soils and Forest Land Management, Proceedings of the Fourth North American Soils Conference, August 1973. University of Laval Press, Quebec, Canada.
World Resources Institute. 1992. Global trendsenvironment and development. World Resources Institute, Washington, DC.
Yahner, R.H. 1991. Avian nesting ecology in small even-aged aspen stands. Journal of Wildlife Management 55: 155-159.
Yahner, R.H. and A.L. Wright. 1985. Depredation on artificial ground nests: Effect of edge and plot age. Journal of Wildlife Management 49: 508-513.
Yahner, R.H. and C.G. Mahan. 1997. Effects of logging roads on depredation of artificial ground nests in a forested landscape. Wildlife Society Bulletin 25: 158-162.
Yahner, R.H. and D.P. Scott. 1988. Effects of forest fragmentation on depredation of artificial nests. Journal of Wildlife Management 52: 158-161.

CONSULTATION AND COORDINATION

Preparers

Interdisciplinary Team- Core Members:
John Lampereur, Interdisciplinary Team Leader
Scott Anderson, Wildlife Biologist
Dave Hoppe, Soil Scientist
Mike Miller, Transportation Planner
Tom Moris, Fisheries Biologist
Steve Janke, Plant Ecologist
Walt Ruckheim, Silviculturist
Deb Sigmund, Hydrologist

Distribution of the Environmental Impact Statement

This environmental impact statement has been distributed to individuals who submitted substantive comments on the draft environmental impact statement and who specifically requested a copy of the document. Some individuals requested a summary of the EIS. Others who did not respond to the Forest Service's request for format preference also received a summary. In addition, copies have been sent to the following Federal agencies, federally recognized tribes, State and local governments, individuals, and organizations representing a wide range of views.

USDI Fish and Wildlife Service
Wisconsin Department of Natural Resources
US Environmental Protection Agency
USDA –Forest Service, Washington Office
U.S. Department of the Interior
USDA Office of Civil Rights
Great Lakes Indian Fish and Wildlife Commission
Menominee Tribe
Stockbridge-Munsee Tribe
Oneida Tribe
Ho Chunk Nation
Forest County Potawatomi
Red Cliff Band, Lake Superior Chippewa
Sokaogon Chippewa Community
St. Croix Band of Lake Superior Chippewa
Lac Vieux Desert Band of Lake Superior Chippewas
Lac du Flambeau Band of Lake Superior Chippewas
Lac Courte Oreilles Band of Lake Superior Chippewas
Keweenaw Bay Community of Lake Superior Chippewas
Fond du Lac Band of Lake Superior Chippewas
Bay Mills Community of Lake Superior Chippewas
Mille Lacs Band of Lake Superior Chippewas
Bad River Tribe of Lake Superior Chippewas
The Nature Conservancy
The Wildlife Management Institute
The Sierra Club
American Lands Alliance
Superior Wilderness Action Network
The Ruffed Grouse Society
Defenders of Wildlife
Pine River Lumber
Lake State Timber Producers
David and Ginger Szykowny, Lakewood, WI
David Oberstar
Dave Peterson, Plover, WI
Greg Trebtoski, Crandon, WI
Doug Cornett, Marquette, MI
Daniel Holschback, Shawano, WI
Lois Norrgard, Bloomington, MN
Billy Stern, Madison, WI
John Krause, Phillips, WI
Don and Ann Peotter, Appleton, WI
Tom Rooney, Madison, WI
Robert and Emily Spoerri, Lakewood, WI
Todd Walker, S. Milwaukee, WI
David Zaber, Monona, WI
Richard Ives, Oshkosh, WI
Steve and Jennie Kuske, Waupun, WI
Scott and Susan Solverson, Grafton, WI
Barbara Eisenberg, Milwaukee, WI
Neil Paulson, Drummond, WI
Robert Dufek, Green Bay, WI
Mark Schuh, Appleton, WI
David Eby, Madison, WI
Gerald Ottone, Milwaukee, WI
David and Lenore Younkle, DePere,WI
Nancy Davlantes, Greendale, WI
Steve Garske, Marenisco, MI
Don D'Alessio, Madison, WI
Jean Hindson, LaCrosse, WI
Karolyn Redoutey, Minneapolis, MN
Wayne and Debra Bennett, Lakewood, WI
Joan Elias, Saxon, WI
James Olson, Eau Claire, WI
Joe Dermody, Terre Haute, IN
Roberta Jennings-Barham, Blanchardville, WI
Jane Silberstein, Ashland, WI
Henry Bruse, Wisconsin Rapids, WI
Tim Kabat, Madison, WI
Rosalyn Dahlke, Janesville, WI
Robert Donner, Briggsville, WI
Robert Gross, Chicago, WI
Jan Hinkle, Kokomo, IN
Dave Bartz, Sturgeon Bay, WI
Frank Mainczyk, Oak Lawn, IL
Jack and Dave Bailey, Lakewood, WI
Clark Forestry, Baraboo, WI
Ken Doane, Oakland, CA
Ray Fenner, Sandstone, MN
Karen Grubb, Fairmont, WV
Frank Neu, Townsend, WI
Gregory Bungo, Elmhurst, IL
Philip Coe, Wimberly, TX
Mark Donham, Brookport, IL
Eugene Behnke, Shawano, WI
Douglas Erdmann, Marinette, WI
Dorothy Green, Thiensville, WI
Tom Herschelman, Sheboygan Falls, WI
Mark Koplick, Albany, NY

Larry Wilson, Madison, WI
Paul and Mildred Lemke, Kaukauna, WI
Marv Roberson, Flint, MI
Robert Rutkowski, Topeka, KS
Richard Spotts, Ashland, WI
Barbara Warner, Lebanon, KY
Chris Nehrbass, Stevens Point, WI
Elizabeth Rogers, Iron River, MI
William Hunt, Eau Claire, WI
Richard Scherubel, St.Joseph, MO
Susan St. Peter, Neenah, WI
James Whisnant, Rutherfordton, NC
Elliot Jeranek, Lakewood, WI
Marie Antobenedetto, Natick, MA
Richard Chamberlin, Monona, WI
Richard Hogue. Clam Lake, WI
Tom Kitslaar, Green Bay, WI

In addition to those listed above, approximately 400 landowners and interested parties were contacted. A complete listing of individuals can be found in the project file.

INDEX

A

access, 6, 7, 8, 11, 15, 16, 17, 18, 20, 23, 27, 28, 55, 59, 61, 62, 65, 66, 67, 70, 77, 78, 84, 87, 94, 111, 120, *123*, 129, 136, 137, 138, 139, 151
age class distribution, 2, 5, 37, 42, 44, 89, 90, 92, 95, 96, 98, 99, 101, 102, 104
archaeological evaluation, *see also heritage resources*, 7, 8, 14, 15, 16, 17, 18
aspen, *i*, 3, 5, 10, 13, 25, 36, 37, 38, 39, 40, 41, 42, 44, 45, 49, 50, 53, 55, 66, 67, 68, 76, 78, 79, 80, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 108, 110, 111, 114, 115, 116, 117, 119, 120, 121, 122,

B

beaver, 51, 58, 60
benefit cost ratio, 11
Best Management Practices, *see also BMPs*, 19, 21, 34, 56, 77, 81, 82, 83, 85, 113, 125, 141, 156, 157, 159, 164
biodiversity, 46
BMPs, 81, 83, 157
breeding birds, 54, 161
browse, 10, 15, 16, 17, 18, 41, 55, 92, 114
buffer, 18, 52, 85, 122, 126, 140, 141, 142, 144, 145, 158
burning, 11, 14, 32, 34, 74, 75, 77, 78, 81, 82, 87, 114
butternut, 5, 6, 9, 15, 16, 17, 18, 19, 26, 41, 49, 90, 91, 94, 95, 98, 100, 103, 157

C

campgrounds, 65, 137
Canada lynx, *see also lynx*, 51, 52
canopy gaps, 15, 16, 17, 18, 91, 94, 95, 98, 101, 104, 121
cavities, 45, 90, 93, 97, 102, 116, 121
clearcut, 8, 14, 15, 17, 18, 21, 38, 54, 55, 66, 79, 85, 95, 96, 100, 102, 105, 110, 111, 115, 116, 119, 121, 122, 123, 138, 162, 164
coarse woody debris, *see also woody debris*, 45, 90, 92, 93, 97, 99, 105
compaction, 10, 19, 21, 29, 30, 31, 32, 74, 75, 77, 78, 79, 82, 156, 163
compliance with NFMA, *see also laws*, 91
cribs, 60
crown closure, 15, 16, 17, 18, 41, 44, 92, 94

D

decommissioning, 23, 42, 62, 101, 103, 129

deer, 5, 10, 15, 16, 17, 18, 41, 42, 51, 53, 55, *56*, 66, 92, 94, 113, 114, 115, 123, 136, 137, 157, 162, 163, 164, 165
den trees, 116
design features, i, 8, 9, 10, 18, 21, 23, 32, 76, 77, 78, 81, 90, 116, 124, 137, 140, 141, 142, 143
disease, 5, 19, 41, 45, 48, 92, 114, 116, 121
disturbance, 11, 20, 23, 29, 41, 42, 47, 48, 49, 56, 74, 77, 79, 82, 86, 91, 92, 93, 94, 107, 112, 114, 116, 117, 119, *123*, 124, 162
diversity, 3, 5, 6, 9, 24, 38, 49, 51, 53, 54, 55, 60, 91, 92, 98, 106, 111, 117, 119, 120, 121
DNR, see also WDNR, iv, 52, 57, 60, 72, 105, 157

E

eagle, 20, 51, 112, 113
early successional habitat, 89, 102, 107, 112, 115, 116, 121, 161
economics, 12, 152
ecosystem, 3, 32, 47, 48, 50, 62, 80, 81, 82, 164
edge, 10, 20, 22, 27, 46, 47, 49, 54, 55, 56, 107, 108, 109, 110, 111, 112, *114*, 115, 119, 120, 121, 122, 137, 161, 162, 165
ELT, 30, 31, 75, 76, 77, 78, 79, 80, 81
ELTP, 31
erosion, 6, 10, 15, 16, 17, 18, 19, 29, 30, 31, 32, 33, 59, 60, 74, 75, 76, 77, 79, 81, 82, 83, 85, 86, 124, 125, 127, 156, 161, 162
erosion control, 6, 8, 15, 16, 17, 18
even-age, 3, 13, 36, 37, 46, 47, 68, 95, 97, 98, 99, 101, 102, 103, 105, 106, 111, 115, 119, 123, 140, 142, 165
exotic species, 59, 60, 124, 125, 127
exposed soil, 76, 77

F

fire, 5, 15, 16, 17, 18, 29, 32, 34, 35, 38, 39, 47, 49, 66, 75, 77, 78, 79, 80, 121, 147, 157
fish, *112*
fisheries, iv, 7, 11, 13, 34, 51, 52, 56, 57, 58, 59, 60, 67, 82, 83, 85, 112, 113, 124, 125, 126, 127, 136, 137, 139, 157
fishing, 7, 57, 65, 123, 137
Forest Plan, iii, iv, v, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 23, 28, 29, 34, 36, 37, 38, 39, 42, 44, 45, 50, 51, 52, 53, 60, 61, 62, 67, 68, 73, 74, 82, 85, 88, 89, 90, 91, 92, 96, 99, 102, 103, *112*, 120, 128, 129, 135, 136, 138, 139, 140, 141, 142, 152, 153, 154, 155, 156, 162, 164, 6
Forest Plan revision, iii, iv, v, 11, 12, 29, 50, 73, 74, 152, 153, 154, 155, 156
fragmentation, 10, 13, 23, 46, 47, 49, 54, 55, 56, 97, 108, 111, 112, 119, 120, 121, 122, 123, 141, 142, 162, 163, 164, 165

G

game species, 3, 113, 115, 123, 136
genetic, 41
goblin fern, 19
goshawk, 20

H

habitat types, 30, 51, 53, 120
harvest, i, 5, 6, 7, 8, 10, 11, 13, 14, 15, 17, 18, 20, 21, 22, 23, 24, 27, 30, 31, 33, 38, 41, 42, 43, 44, 45, 46, 51, 54, 55, 56, 57, 60, 66, 69, 70, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 86, 87, 90, 91, 93, 95, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 109, 110, 111, 112, 113, 114, 115, 116, 117, 119, 120, 121, 122, 123, 124, 126, 128, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 148, 149, 150, 151, 152, 156, 157, 158, 159, 161, 165
hemlock, 5, 6, 9, 15, 16, 17, 18, 20, 37, 41, 42, 48, 49, 50, 57, 90, 91, 92, 94, 95, 98, 100, 103, 120, 121, 124, 157, 162

heritage resources, 13, 18, 21, 68, 69, 143, 145
hunting, 7, 55, 56, 65, 66, 122, 123

I

indicator, iv, v, 32, 46, 52, 61, 65, 107, 108, 136, 147, 162
insect, 45, 92, 121
interior habitat, i, 13, 46, 47, 54, 55, 97, 102, 107, 108, 109, 112, 115, 116, 117, 122, 152, 155
issue, *i*, 9, 10, 13, 24, 34, 90, 146, 156, 162
issues, i, vi, 9, 10, 12, 13, 29, 34, 37, 46, 50, 54, 55, 70, 72, 97, 107, 124, 146

L

LAD, iv, 45, 49, 50, 107, 108, 109, 110
landscape, i, 9, 10, 11, 20, 29, 32, 39, 42, 44, 46, 47, 48, 49, 51, 53, 54, 55, 56, 67, 68, 81, 92, 93, 95, 98, 101, 104, 105, 106, 107, 108, 109, 110, 111, 112, 119, 122, *123*, 136, 161, 162, 163, 165
laws, vi, 23, 24, 68, 145, 159
local economy, 11, 70, 71, 148, 149, 150, 151
long-lived species, 6
LTA, 29, 30, 31, 49, 50
lynx, see also Canada lynx, 52

M

management areas, 6, 73, 91, 94, 98, 152, 153
management areas, *see also MAs*, 3, 23, 36, 39, 62, 64, 65, 88, 128, 130, 131, 132, 133, 134, 135, 152, 153
MAs, 60, 136
mesic, 30, 31, 38, 41, 49, 50
mid-age forest, 42, 43
MIS, iii, v, 10, 27, 51, 52, 53, 56, 60, 112, 117, 118, 119, 122, 123, 124
mitigation measures, i, vi, 9, 10, 11, 18, 21, 22, 32, 52, 56, 68, 69, 74, 75, 76, 77, 78, 80, 82, 84, 85, 86, 102, 105, 112, 124, 137, 138, 139, 140, 141, 142, 143, 144, 145, 156, 157, 158, 159
monitoring, iv, 33, 34, 52, 57, 60, 78, 82, 84, 156, 157, 158, 162, 163, 164
motorized recreation, 72

N

National Environmental Policy Act, *see also NEPA*, ii, vi, 2, 68
National Forest Management Act, *see also NFMA*, 50, 52, 73
National Registration of Historic Places, 7
Neotropical, 10, 51, 53, 119, 161, 163, 164
NEPA, vi, 9, 23, 68, 159
NNIS, 41, 42, 90, 91, 92, 95, 98, 101, 103
noise, 137
Notice of Intent, 2, 9

O

Oconto River, 6, 7, 8, 15, 16, 17, 18, 33, 41, 46, 50, 52, 57, 59, 66, 67, 87, 113, 124, 125, 126, 127
old forest, 42, 43, 45, 89, 93, 96, 99, 102, 105, 106, 161
old growth, 39, 46, 50, 51, 107, 109, 110
opportunity area, *see also OA*, 48
organic matter, 32, 75, 79, 80, 81

P

patches, 13, 38, 41, 45, 46, 47, 49, 54, 94, 112, 115, 153, 155, 156
plantation, 23, 40, 44, 45
planting, 8, 14, 20, 23, 26, 32, 41, 84, 85, 93, 94, 97, 98, 100, 101, 102, 103, 114, 124, 125

preferred alternative, i
prescribed burning, 8, 11, 15, 17, 18, 23, 75, 77, 78, 79
present net value, *see also PNV*, 146
pre-settlement, 41
private land, 24, 43, 58, 62, 105, 106, 111, 113, 122, 123, 127
proposed action, *i*, vi, 8, 9, 10, 11, 12, 14, 15, 16, 34, 69, 75, 76, 77, 81, 82, 86, 129, 147, 156
pulpwood, 3, 4, 25, 40, 89
purpose and need, i, vi, 12, 23, 24

R

red-shouldered hawk, 20, 157
regeneration, 5, 10, 13, 15, 16, 17, 18, 38, 41, 42, 44, 47, 49, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 114, 115, 119, 120, 140, 141, 142, 152, 157, 162
Regional Foresters Sensitive Species, *see also RFSS*, 41
removal harvest, 8, 15, 17, 18, 96, 114, 116
Research Natural Areas, *see also RNAs*, 49, 107
retention, 21, 22, 68, 77, 81, 142, 156, 158
RFSS, iii, 26, 41, 51, 52, 112, 113, 123, 124
riparian, 6, 21, 23, 82, 84, 85, *112*
road closures, 136, 159
road construction, 8, 10, 11, 19, 22, 23, 33, 41, 77, 79, 82, 85, 86, 92, 98, 101, 107, 108, 109, 110, 111, 112, 121, 122, *123*, 129, 136, 139, 144, 145
road decommissioning, *see also decommissioning*, 78, 95, 139
road density, 3, 6, 11, 60, 61, 62, 64, 65, 128, 129, 130, 131, 132, 133, 134, 135, 138, 139, 152, 153, 154, 156
road reconstruction, 8, 19, 22, 23, 41, 42, 75, 77, 78, 82, 85, 86, 92, 95, 98, 101, 103, 108, 109, 122, *123*, 129
road/stream crossings, 34, 59, 75, 86, 125, 126
roads, v, 3, 6, 8, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 27, 28, 30, 31, 32, 33, 34, 41, 45, 46, 47, 54, 55, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 75, 76, 77, 78, 79, 81, 82, 83, 85, 86, 87, 88, 92, 95, 98, 101, 105, 107, 108, 109, 110, 111, 112, 114, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 143, 144, 145, 147, 152, 153, 154, 156, 157, 159, 160, 164, 165
rutting, *see also soils*, 10, 21, 29, 30, 31, 32, 59, 74, 75, 77, 78, 79, 82, 156

S

sale administrator, 19, 78, 157, 158
sale layout, 19, 20, 21, 23
sawtimber, 3, 4, 25, 40, 89, 148, 149, 150, 151
Scientific Roundtable on Biological Diversity, 41, 90, 119, 160
sediment, 11, 19, 33, 59, 60, 75, 81, 82, 83, 85, 86, 124, 125, 126, 159
selection, 7, 14, 15, 16, 17, 18, 24, 38, 42, 43, 79, 84, 85, 95, 96, 97, 98, 101, 103, 104, 106, 109, 110, 111, 113, 114, 115, 117, 120, 121, 123, 140, 141, 142, 164
sensitive plant viability, 9
shelterwood, 8, 14, 15, 16, 17, 18, 95, 96, 111
SHPO, 7, 69, 70, 144, 145
site prep, 112
site preparation, 112
slash, 21, 22, 38, 45, 46, 76, 78, 79, 82, 83, 122, 137, 156
snags, 21, 45, 90, 93, 97, 99, 102, 105, 116, 119, 121, 158
snowmobile, 22, 66, 123, 136, 137, 138, 158
soil productivity, 75, 79, 80, 81
special management areas, *see also SMAs*, 50
species of concern, 41, 91, 94, 98, 100, 103
State Historic Preservation Office, *see also SHPO*, 7, 15, 16, 17, 18, 69, 144, 145
stocking, 79, 97, 100, 102, 105
streams, iv, 19, 21, 26, 33, 34, 45, 56, 57, 58, 59, 60, 65, 66, 67, 75, 82, 83, 84, 85, 86, 113, 124, 125, 126
structure, ii, 3, 9, 26, 35, 37, 39, 42, 43, 44, 45, 46, 49, 51, 55, 68, 79, 89, 90, 92, 95, 98, 101, 103, 104, 106, 107, 113, 115, 117, 119, 121, 125, 126, 127, 129, 152, 154, 156

structure and composition, iii, 29, 35, 74, 88

T

TES, iii, 10, 26, 51, 52, 112, 113, 123, 124
thinning, 8, 14, 15, 16, 17, 18, 20, 24, 38, 40, 45, 76, 79, 80, 81, 84, 85, 86, 93, 94, 95, 97, 98, 101, 104, 106, 110, 111, 112, 114, 115, 117, 122, 140, 141, 142
threatened and endangered, *see also TES*, 52
timber, 2, 5, 7, 10, 11, 14, 19, 20, 21, 22, 23, 24, 30, 32, 33, 34, 39, 42, 43, 50, 69, 70, 71, 72, 74, 81, 82, 83, 86, 87, 91, 105, 107, 111, 112, 113, 114, 115, 116, 117, 119, 122, 123, 124, 126, 135, 137, 140, 143, 145, 146, 147, 148, 149, 150, 151, 152, 154, 156, 157, 158, 160, 163
timber harvest, 2, 5, 11, 14, 23, 24, 34, 70, 83, 86, 87, 105, 111, 122, 123, 126, 137, 146, 147, 148, 149, 150, 151, 154, 156
tourism, 70, 71, 72, 147
tribal, 43, 47, 86, 87, 111

U

underplant, 25, 94, 98
understory, 5, 6, 8, 38, 45, 55, 66, 80, 93, 94, 95, 98, 101, 104, 114, 115, 116, 119, 123, 160
uneven-aged, 5, 37, 46, 95, 98, 101, 104, 116
USFWS, 51, 52, 164

V

visual quality objectives, 66, 68, 140, 143

W

water quality, 11, 19, 33, 34, 81, 82, 83, 86, 123, 126, 127, 159
WDNR, 19, 21, 33, 34, 51, 52, 53, 55, 56, 57, 60, 81, 83, 112, 113, 114, 123, 159
wetlands, 19, 46, 82, 84, 85, 86, 113, 123, 126, 159
white pine, 6, 15, 16, 17, 18, 20, 23, 38, 40, 42, 45, 48, 50, 53, 91, 93, 94, 98, 101, 103, 120, 121, 123, 124, 142
wildlife, *i*, 3, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 23, 26, 37, 41, 42, 45, 46, 47, 51, 52, 54, 55, 56, 69, 82, 85, 92, 95, 105, 112, 113, 116, 122, *123*, 136, 139, 157, 158, 161, 165
wildlife opening, i, 8, 13, 15, 16, 17, 18, 19, 26, 123
wildlife openings, i, 8, 13, 15, 16, 17, 18, 19, 26, *123*
wolves, 51, 52, 122
wood products, 28, 72, 148, 149, 150, 151
woody debris, 45, 93, 97, 116
woody debris, *see also coarse woody debris*, 6, 7, 45, 57, 60, 85, 93, 113, 121, 124, 125, 126

Y

young forest, 42, 43, 89, 90, 92, 95, 99, 101, 104, 106

APPENDICES

Appendix A - Stand Treatment Tables
Appendix B - Road Activity Tables
Appendix C - Maps
Appendix D – Additional Wildlife Information
Appendix E – Habitat Type Information
Appendix F – Supplemental Vegetative Structure and Composition Tables
Appendix G – Road Density Tables by Forest Plan Management Area

GLOSSARY

affected environment- The natural environment that exists at the present time in an area being analyzed.

age class- An age grouping of trees according to an interval of years, usually 20 years. A single age class would have trees that are within 20 years of the same age, such as 1-20 years or 21-40 years.

basal area- The area of the cross section of a tree trunk near its base, usually 4 and 1/2 feet above the ground. Basal area is a way to measure how much of a site is occupied by trees. The term basal area is often used to describe the collective basal area of trees per acre.

biological diversity- The number and abundance of species found within a common environment. This includes the variety of genes, species, ecosystems, and the ecological processes that connect everything in a common environment.

biomass- The total weight of all living organisms in a biological community.

board foot (bf)- A measurement term for lumber or timber. It is the amount of wood contained in an unfinished board 1 inch thick, 12 inches long, and 12 inches wide.

browse- Twigs, leaves, and young shoots of trees and shrubs that animals eat. Browse is often used to refer to the shrubs eaten by big game, such as elk and deer.

buffer- A land area that is designated to block or absorb unwanted impacts to the area beyond the buffer. Buffer strips along a trail could block views that may be undesirable. Buffers may be set aside next to wildlife habitat to reduce abrupt change to the habitat.

canopy- The part of any stand of trees represented by the tree crowns. It usually refers to the uppermost layer of foliage, but it can be use to describe lower layers in a multi-storied forest.

canopy gap- A break in the uppermost layer of foliage large enough to allow sunlight to reach the forest floor. These gaps allow plant species to flourish that do not grow well in the shade.

cavity- A hole in a tree often used by wildlife species, usually birds, for nesting, roosting, and reproduction.

classified road- Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service (36 CFR 212.1).

clear cut- A harvest in which all or almost all of the trees are removed in one cutting.

climax- The culminating stage in plant succession for a given site. Climax vegetation is stable, self-maintaining, and self-reproducing.

coarse woody debris Includes snags and down logs that provide structural diversity.

collector roads- These roads serve small land areas and are usually connected to a Forest System Road, a county road, or a state highway.

composition- What an ecosystem is composed of. Composition could include water, minerals, trees, snags, wildlife, soil, microorganisms, and certain plant species,

conifer- A tree that produces cones, such as a pine, spruce, or fir tree.

connectivity (of habitats)- The linkage of similar but separated vegetation stands by patches, corridors,or "stepping stones" of like vegetation. This term can also refer to the degree to which similar habitats are linked.

corridor- Elements of the landscape that connect similar areas. Streamside vegetation may create a corridor of willows and hardwoods between meadows where wildlife feed.

cover- Any feature that conceals wildlife or fish. Cover may be dead or live vegetation, boulders, or undercut streambanks. Animals use cover to escape from predators, rest, or feed.

cover type (forest cover type)- Stands of a particular vegetation type that are composed of similar species. The aspen cover type contains plants distinct from the jack pine cover type.

cultural resource- The remains of sites, structures, or objects used by people in the past; this can be historical or pre-historic.

cumulative effects - Effects on the environment that result from separate, individual actions that, collectively, become significant over time.

dbh (diameter at breast height)- The diameter of a tree 4 and 1/2 feet above the ground on the uphill side of the tree.

DFC – see desired future condition.

DEIS (Draft Environmental Impact Statement)- The draft version of the Environmental Impact Statement that is released to the public and other agencies for review and comment

desired future condition- Land or resource conditions that are expected to result if goals and objectives are fully achieved.

dispersed recreation- Recreation that does not occur in a developed recreation site, such as hunting, backpacking, and scenic driving.

disturbance- Any event, such as wind, forest fire, herbivory, or insect infestations that alter the structure, composition, or functions of an ecosystem.

ELT (Ecological Landtype)- a subdivision of a land type association, in which similar ecological conditions related to soil moisture, nutrients, drainage, slope, and other conditions are found.

ecology- The interrelationships of living things to one another and to their environment, or the study of these interrelationships.

ecosystem- An arrangement of living and non-living things and the forces that move among them. Living things include plants and animals. Non-living parts of ecosystems may be rocks and minerals. Weather and wildfire are two of the forces that act within ecosystems.

edge- The margin where two or more vegetation patches meet, such as a meadow opening next to a mature forest stand, or a ponderosa pine stand next to an aspen stand.

endangered species- A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.

environmental assessment- A brief version of an Environmental Impact Statement. (See Environmental Impact Statement.)

Environmental Impact Statement- A statement of environmental effects of a proposed action and alternatives to it. The EIS is released to other agencies and the public for comment and review.

erosion- The wearing away of the land surface by wind or water.

Even-aged management- Timber management actions that result in the creation of stands of trees in which the trees are essentially the same age.

felling- Cutting down trees.

flora- The plant life of an area.

forage- All browse and non-woody plants that are eaten by wildife and livestock.

forb- A broadleaf plant that has little or no woody material in it.

forest cover type- See cover type.

Forest Roads and Trails- Roads and trails under the jurisdiction of the Forest Service.

fragmentation- The splitting or isolating of patches of similar habitat, typically forest cover, but including other types of habitat. Habitat can be fragmented naturally or from forest management activities, such as clearcut logging.

game species- Any species of wildlife or fish that is harvested according to prescribed limits and seasons.

GIS (geographic information systems)- GIS is both a database designed to handle geographic data as well as a set of computer operations that can be used to analyze the data. In a sense, GIS can be thought of as a higher order map.

habitat- The area where a plant or animal lives and grows under natural conditions.

habitat type- A way to classify land area . A habitat type can support certain climax vegetation, both tree and undergrowth species. Habitat typing can indicate the biological potential of a site.

hand release- see release. The cutting of competing vegetation to release desired trees. Normally practiced in plantation seedlings or saplings.

hiding area/cover- Vegetation capable of hiding 90% of an adult elk or deer from human's view at a distance of 200 feet or less.

indicator species- A plant or animal species related to a particular kind of environment. Its presence indicates that specific habitat conditions are also present.

indigenous (species)- Any species of wildlife native to a given land or water area by natural occurrence.

individual tree selection- The removal of individual trees from certain size and age classes over an entire stand area. Regeneration is mainly natural, and an uneven aged stand is maintained.

interdisciplinary team- A team of individuals with skills from different disciplines that focuses on the same task or project.

intermediate cut- The removal of trees from a stand sometime between the beginning or formation of the stand and the regeneration cut. Types of intermediate cuts include thinning, release, and improvement cuttings.

intermittent stream- A stream that flows only at certain times of the year when it receives water from streams or from some surface source, such as melting snow.

irretrievable- One of the categories of impacts mentioned in the National Environmental Policy Act to be included in statements of environmental impacts. An irretrievable effect applies to losses of production or commitment of renewable natural resources. For example, while an area is used as a ski area, some or all of the timber production there is irretrievably lost. If the ski area closes, timber production could resume; the loss of timber production during the time that the area was devoted to winter sports is irretrievable. However, the loss of timber production during that time is not irreversible, because it is possible for timber production to resume if the area is no longer used as a ski area.

irreversible- A category of impacts mentioned in statements of environmental impacts that applies to non-renewable resources, such as minerals and archaeological sites. Irreversible effects can also refer to effects of actions that can be renewed only after a very long period of time, such as the loss of soil productivity.

LTA (land type association)- ecological unit delineated on the basis of similar patterns of glacial landforms, topography, soil complexes, and associated patterns of vegetation and succession, within climatic regions.

landing- Any place where cut timber is assembled for further transport from the timber sale area.

landscape- A large land area composed of interacting ecosystems that are repeated due to factors such as geology, soils, climate, and human impacts. Landscapes are often used for coarse grain analysis.

landscape pattern The arrangement of species and communities in a natural setting.

logging residue (slash)- The residue left on the ground after timber cutting. It includes unutilized logs, uprooted stumps, broken branches, bark, and leaves. Certain amounts of slash provide important ecosystem roles, such as soil protection, nutrient cycling, and wildlife habitat.

M- Thousand. Five thousand board feet of timber can be expressed as 5M board feet.

MA (management area)- an area of National Forest that has a specific management direction given in that Forest's Land and Resource Management Plan (Forest Plan).

management action- Any activity undertaken as part of the administration of the National Forest.

matrix- The least fragmented, most continuous pattern element of a landscape; the vegetation type that is most continuous over a landscape.

MBF- Thousand Board Feet (See board feet.)

MIS (management indicator species)- A wildlife species whose population will indicate the health of the ecosystem in which it lives and, consequently, the effects of forest management activities to that ecosystem. MIS species are selected by land management agencies. (See "indicator species".)

mitigation- Actions taken to avoid, minimize, or rectify the impact of a land management practice.

MM- Million

MMBF- Million Board Feet (See board feet.)

monitoring and evaluation- The periodic evaluation of forest management activities to determine how well objectives were met and how management practices should be adjusted. See "adaptive management".

mortality- Trees that were merchantable and have died within a specified period of time. The term mortality can also refer to the rate of death of a species in a given population or community.

mosaic- Areas with a variety of plant communities over a landscape, such as areas with trees and areas without trees occurring over a landscape.

natural disturbance- See disturbance.

natural range of variability- See range of variability

natural resource- A feature of the natural environment that is of value in serving human needs.

NEPA (National Environmental Policy Act) - Congress passed NEPA in 1969 to encourage productive and enjoyable harmony between people and their environment. One of the major tenets of NEPA is its emphasis on public disclosure of possible environmental effects of any major action on public lands. Section 102 of NEPA requires a statement of possible environmental effects to be released to the public and other agencies for review and comment.

NFLRMP (National Forest Land and Resource Management Plan) - Also called the Forest Plan or just the Plan, this document guides the management of a particular National Forest and establishes management standards and guidelines for all lands of that National Forest.

NFMA (National Forest Management Act) - This law was passed in 1976 and requires the preparation of Regional Guides and Forest Plans.

NNIS (Non-Native Invasive Species) Plant species that are not native to the natural communities of the Northwest Howell area and are so aggressively invasive, that they pose a threat of harm to those natural communities and existing native species

no action alternative- The most likely condition expected to exist in the future if management practices continue unchanged.

notice of intent- A notice in the federal register of intent to prepare an environmental impact statement on a proposed action.

old growth- Old forests often containing several canopy layers, variety in tree sizes and species, decadent old trees, and standing and dead woody material.

overstory- The upper canopy layer; the plants below comprise the understory.

overstory removal- The removal of the remaining overstory trees to release desireable understory crop trees.

partial retention- A visual quality objective which, in general, means man's activities may be evident but must remain subordinate to the characteristic landscape.

patch- An area of homogeneous vegetation, in structure and composition.

perennial stream- A stream that flows throughout the year and from source to mouth.

pole/sapling- The stage of forest succession in which trees are between 3 and 7 inches in diameter and are the dominant vegetation.

pole timber- Trees at least 5 inches in diameter, but smaller than the minimum size for sawtimber.

PNV- See present net value.

precommercial thinning- Removing some of the trees from a stand that are too small to be sold for lumber or house logs, so the remaining trees will grow faster.

prescribed fire- Fire set intentionally in wildland fuels under prescribed conditions and circumstances. Prescribed fire can rejuvenate forage for livestock and wildlife or prepare sites for natural regeneration of trees.

prescription- Management practices selected to accomplish specific land and resource management objectives.

present net value (PNV), also called present net worth- The measure of the economic value of a project when costs and revenues occur in different time periods. Future revenues and costs are "discounted " to the present by an interest rate that reflects the changing value of a dollar over time. The assumption is that dollars today are more valuable than dollars in the future. PNV is used to compare project alternatives that have different cost and revenue flows.

public involvement- The use of appropriate procedures to inform the public, obtain early and continuing public participation, and consider the views of interested parties in planning and decision making.

range of variability (Also called the historic range of variability or natural range of variation.)- The components of healthy ecosystems fluctuate over time. The range of sustainable conditions in an ecosystem is determined by time, processes (such as fire), native species, and the land itself. For instance, ecosystems that have a 10 year fire cycle have a narrower range of variation than ecosystems with 200-300 year fire cycle. Past management has placed some ecosystems outside their range of variability. Future management should move such ecosystems back toward their natural, sustainable range of variation.

Ranger District- The administrative sub-unit of a National Forest that is supervised by a District Ranger who reports directly to the Forest Supervisor.

raptor- A bird of prey, such as a eagle or hawk.

reforestation- The restocking of an area with forest trees, by either natural or artificial means, such as planting.

regeneration- The renewal of a tree crop by either natural or artificial means. The term is also used to refer to the young crop itself.

release cutting- Removal of competing vegetation to allow desired tree species to grow.

removal cut- The removal of the last seed bearers or shelter trees after regeneration is established.

residual stand- The trees remaining standing after an event such as selection cutting.

Responsible official- The Forest Service employee who has been delegated the authority to carry out a specific planning action.

Record of Decision (ROD)- A official document in which a deciding official states the alternative that will be implemented from a prepared EIS.

Recreation Opportunity Spectrum (ROS)- The land classification system that categorizes land by its setting and the probable recreation experiences and activities it affords.

riparian area- The area along a watercourse or around a lake or pond.

road.- A motor vehicle travelway over 50 inches wide, unless designated and managed as a trail. A road may be classified, unclassified, or temporary (36 CFR 212.1).

road construction - Activity that results in the addition of forest classified or temporary road miles (36 CFR 212.1).

road decommissioning - Activities that result in the stabilization and restoration of unneeded roads to a more natural state (36 CFR 212.1), (FSM 7703).

road maintenance - The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objective (FSM 7712.3).

road reconstruction- Activity that results in improvement or realignment of an existing classified road.

road improvement.- Activity that results in an increase of an existing road's traffic service level, expands its capacity, or changes its original design function.

road realignment- Activity that results in a new location of an existing road or portions of an existing road and treatment of the old roadway (36 CFR 212.1).

rotation- The number of years required to establish and grow timber crops to a specified condition of maturity.

run-off- The portion of precipitation that flows over the land surface or in open channels.

sapling- A loose term for a young tree more than a few feet tall and an inch or so in diameter that is typically growing vigorously.

sawtimber- Trees that are 9 inches in diameter at breast height or larger that can be made into lumber.

scale- In ecosystem management, it refers to the degree of resolution at which ecosystems are observed and measured.

scoping- The ongoing process to determine public opinion, receive comments and suggestions, and determine issues during the environmental analysis process. It may involve public meetings, telephone conversations, or letters.

selection harvest- See individual tree selection.

sensitive species- Plant or animal species which are susceptible to habitat changes or impacts from activities. The official designation is made by the USDA Forest Service at the Regional level and is not part of the designation of Threatened or Endangered Species made by the US Fish and Wildlife Service.

shelterwood- A cutting method used in a more or less mature stand, designed to establish a new crop under the protection of the old.

silvicultural system- The cultivation of forests; the result is a forest of a distinct form. Silvicultural systems are classified according to harvest and regeneration methods and the type of forest that results.

silviculture- The art and science that promotes the growth of single trees and the forest as a biological unit.

single tree selection- See individual tree selection.

site preparation- The general term for removing unwanted vegetation, slash, roots, and stones from a site before reforestation. Naturally occurring wildfire, as well as prescribed fire can prepare a site for natural regeneration.

size class- One of the three intervals of tree stem diameters used to classify timber in the Forest Plan data base. The size classes are: Seedling/Sapling (less than 5 inches in diameter); Pole Timber (5 to 7 inches in diameter); Sawtimber (greater than 7 inches in diameter)

skidding- Hauling logs by sliding, not on wheels, from stump to a collection point.

Slash (logging residue)- The residue left on the ground after timber cutting or left after a storm, fire, or other event. Slash includes unused logs, uprooted stumps, broken or uprooted stems, branches, bark, etc.

snag- A standing dead tree. Snags are important as habitat for a variety of wildlife species and their prey.

soil compaction- The reduction of soil volume. For instance, the weight of heavy equipment on soils can compact the soil and thereby change it in some ways, such as in its ability to absorb water.

soil productivity- The capacity of a soil to produce a specific crop. Productivity depends on adequate moisture and soil nutrients, as well as favorable climate.

stand- A group of trees that occupies a specific area and is similar in species, age, and condition.

standards and guidelines- Requirements found in a Forest Plan which impose limits on natural resource management activities, generally for environmental protection.

stocking level- The number of tree in an area as compared to the desirable number of trees for best results, such as maximum wood production.

structure- How the parts of ecosystems are arranged, both horizontally and vertically. Structure might reveal a pattern, or mosaic, or total randomness of vegetation.

sustainability- The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.

sustainable- The yield of a natural resource that can be produced continually at a given intensity of management is said to be sustainable.

thinning- A cutting made in an immature stand of trees to accelerate growth of the remaining trees or to improve the form of the remaining trees.

threatened species- Those plant or animal species likely to become endangered throughout all or a specific portion of their range within the foreseeable future as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act of 1973.

Traffic service level. Describes the significant characteristics and operating conditions of a road (FSH 7709.56, ch.4).

TSI (Timber Stand Improvement)- Actions to improve growing conditions for trees in a stand, such as thinning, pruning, prescribed fire, or release cutting.

type conversion- The conversion of the dominant vegetation in an area from forested to non-forested or from one species to another.

unclassified roads- Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR 212.1).

underburn- A burn by a surface fire that can consume ground vegetation and "ladder" fuels.

understory- The trees and woody shrubs growing beneath the overstory in a stand of trees.

uneven-aged management - Actions that maintain a forest or stand of trees composed of intermingling trees that differ markedly in age. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

vegetation management- Activities designed primarily to promote the health of forest vegetation for multiple-use purposes.

visual quality objective- A set of measurable goals for the management of forest visual resources.

visual resource- A part of the landscape important for its scenic quality. It may include a composite of terrain, geologic features, or vegetation

watershed- The entire region drained by a waterway (or into a lake or reservoir. More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at that point.

water table- The upper surface of groundwater. Below it, the soil is saturated with water.

wetlands- Areas that are permanently wet or are intermittently covered with water.

wildfire- Any wildland fire that is not a prescribed fire.

windthrow- Trees uprooted by wind.