Appendix F
Glacier Project

Kawishiwi Ranger District, Superior National Forest

Biological Evaluation of the Draft EIS

Region 9 Regional Forester Sensitive Species

Wildlife Evaluation and Assessment:

Prepared by: /s/ Susan Catton Date: 12/14/2007
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Aquatic Species Evaluation and Assessment:

Prepared by: /s/ Jason Butcher Date: 11/28/2007
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Botanical Evaluation and Assessment:

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EXECUTIVE SUMMARY

Federally listed species

All alternatives may effect but are not likely to adversely affect the Canada lynx because vegetative habitat is maintained with adequate amounts of snowshoe hare and red squirrel habitat. There would be adequate denning habitat, although less denning habitat under Alternatives 2 and 3 than under Alternative 1. The acres of unsuitable habitat would increase under Alternatives 2 and 3 but would remain below Forest Plan limits. Connectivity would be maintained between and within Lynx Analysis Units, including the Fernberg Corridor that is bordered on the north and south by the BWCAW because of areas not impacted by harvest. The project has minimal effect on the road density, because few roads are being added to the system and few would be decommissioned. However, all temporary roads would be closed to public use and would be decommissioned upon completion of work. See the Glacier project Biological Assessment (BA) of the Draft EIS for detailed analysis.

Sensitive Species

Terrestrial Wildlife

Alternative 1 would have no impact on terrestrial species. Alternatives 2 and 3 may impact (direct, indirect or cumulative effects) individuals of heather vole, gray wolf, northern goshawk, boreal owl, olive-sided flycatcher, LeConte's sparrow, yellow rail, black-throated blue warbler, bay-breasted warbler, bald eagle, Connecticut warbler, three-toed warbler, great gray owl, tiger beetle, mancinus alpine butterfly, Nabokov's blue butterfly, jutta artic butterfly, and Freija's grizzled skipper, but are not likely to result in a trend towards federal listing or a loss of viability. No impacts to all other terrestrial species are expected.

Aquatic Wildlife

Alternative 1 would have no direct, indirect, or cumulative effects to northern brook lamprey, creek heelsplitter and black sandshell mussels, and Quebec emerald dragonfly. Due to the potential habitat in the area and the presence of some vegetation and transportation management activities in the project area, both action alternatives may impact (direct, indirect or cumulative effects)-individuals of northern brook lamprey, black sandshell and creek heelsplitter mussels and Quebec emerald dragonfly, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.

Vascular plants, lichens, and byrophytes

Alternative 1 would have no direct, indirect, or cumulative effects to alpine milkvetch, swamp beggar-ticks, floating marsh-marigold, Katahdin sedge, linear-leaved sundew, neat spike rush, moor rush, auricled twayblade, fall dropseed muhly, American shoregrass, dwarf water lily, club-spur orchid, northern bur-reed, awlwort, lance-leaved violet, *Cladonia wainoi*, large-leaved sandwort, Appalachian fir clubmoss, *Arctoparmelia centrifuga*, *Arctoparmelia subcentrifuga*, small shinleaf, cloudberry, fairy slipper, ram's head ladyslipper, *Caloplaca parvula, Certraria aurescens, Menegazzia terebrata, Ramalina thrausta, Sticta fuliginosa*, *Usnea longissima, Pseudocyphellaria crocata*, *Frullania selwyniana,* western Jacob's ladder, New England sedge, Canada yew, barren strawberry, Canada ricegrass, or *Peltigera venosa*.

Alternatives 1, 2, and 3 may impact individuals of pointed moonwort, common moonwort, Michigan moonwort, pale moonwort, ternate grapefern, and least moonwort but are not likely to cause a trend to federal listing or loss of viability.

The proposed activities in Alternatives 2 and 3 may impact individuals of alpine milkvetch, swamp beggar-ticks, floating marsh-marigold, Katahdin sedge, linear-leaved sundew, neat spike rush, moor rush, auricled twayblade, fall dropseed muhly, American shoregrass, dwarf water lily, club-spur orchid, northern bur-reed, awlwort, lance-leaved violet, *Cladonia wainoi*, large-leaved sandwort, Appalachian fir clubmoss, *Arctoparmelia centrifuga*, *Arctoparmelia subcentrifuga*, small shinleaf, cloudberry, fairy slipper, ram's head ladyslipper, *Caloplaca parvula, Certraria aurescens, Menegazzia terebrata, Ramalina thrausta, Sticta fuliginosa*, *Usnea longissima, Pseudocyphellaria crocata*, *Frullania selwyniana,* western Jacob's ladder, Canada yew, barren strawberry, Canada ricegrass, or *Peltigera venos* but are not likely to cause a trend to federal listing or loss of viability.

BIOLOGICAL EVALUATION

INTRODUCTION:

This Biological Evaluation (BE) evaluates the effects of the proposed Glacier project on Regional Forester-listed (R9) sensitive species (U.S. Department of Agriculture (USDA) Forest Service Manual sections 2670.3, 2670.5 (3), 2672.4). The species evaluated in this report include all species on the R9 sensitive species list (January 10, 2007) known or thought to occur on the forest.

Forest Plan management objective is to maintain viable and well-distributed representation of all native species that occur on the Superior National Forest (National Forest Management Act Regulation 219.19 and 219.26, Secretary of Agriculture Regulation 9500-4, USDA Forest Service Manual 2670.12, 2670.22, and 2670.32, Forest Plan p. 3-4). The following working definitions were used for viability and well-distributed from Iverson and René (1997):

> viability--the likelihood that habitat conditions will support persistent and well-distributed populations over time;
> well-distributed--species and habitat distribution are based on the current and historic natural distribution and dispersal capabilities of individual species, and dispersal includes the concepts of metapopulation dynamics and gene flow.

Forest plan management direction related to all Regional Forester's Sensitive species is list below. Species specific direction is in found in the analysis of effect for each species.

- Populations: Provide ecological conditions to sustain viable populations of native and desired non-native species and to achieve objectives for management indicator species and management indicator habitats. (O-WL-1)
- Habitats: Move terrestrial and aquatic habitats in the direction of desired conditions and objectives for all native and desired non-native wildlife. (O-WL-2)
- Maintain, protect and improve habitat for all sensitive species, using both course filter and fine filter strategies (O-WL-18)
- Avoid or minimize negative impacts to known occurrences and disturbance of nesting pairs. (G-WL-11 and -12)
- Management activities must not result in a loss of species viability forest-wide or create significant trends toward federal listing. (S-WL-5)

The Glacier project area is east/southeast of Ely, MN in Lake and St. Louis Counties. The scope of this project is primarily vegetation management actions and connected road management actions. The Glacier project area encompasses about 97,000 acres of land of which 47,000 acres are National Forest System land.

The area covered by the analysis of direct, indirect and cumulative effects includes all lands administered by the Superior National Forest within the Glacier project area (see Glacier Project Draft EIS for map). This is appropriate because the area's large size contains known or potential populations, individuals, and enough habitats of many sensitive species to evaluate the effects of proposed activities. The analysis boundary includes that area to which direct and indirect effects would occur. Habitats and sensitive species located within the Boundary Waters Wilderness are generally not included in this analysis (with the exception of a few species such as the bald eagle). This is because species and habitats within the wilderness are allowed to naturally fluctuate and should not influence nor be influenced by this project.

The time scale used for the analysis of direct, indirect and cumulative effects is 10 year (or the year 2017). This time scale is chosen because it is reasonable to assume that all proposed projects would be implemented by this time and expected effects have occurred. This is also an appropriate time

scale for cumulative effects because it allows for the most realistic prediction of reasonably foreseeable future projects. Past actions are taken into account in the existing condition. Present and foreseeable future (10 years) actions are considered (see the Glacier Project Draft EIS appendix C: Past, Present and Reasonably Foreseeable Future Activities).

The overall objective of the Glacier Project is to maintain and improve forest health by moving the vegetative component towards the Landscape Ecosystem objectives described in the 2004 Superior National Forest Land and Resource Management Plan (Forest Plan p. 2-23, O-VG-1). The Draft EIS considers three alternatives: 1) no action 2) Vegetation management on 13,208 ac by a variety of methods 3) Vegetation management on 11,043 acres by a variety of harvest methods (see table 2-1 in the Draft EIS). See the maps and tables in the Draft EIS for site-specific locations and more detailed information.

There are a variety of other activities (see Tables 2-2 and 2-3 in the Draft EIS) besides timber harvest that are included in this project. They will be discussed for each species that utilize habitat that will be affected by the activities. Below is a list of the other activities and the habitat they would affect.

- Prescribed Burning – This would have the potential to affect both lowland and upland habitat types.
- Gravel Pits - This would have the potential to affect many different upland habitat types.
- Reforestation/Restoration – This would have the potential to the vegetative composition of forested upland stands
- Roads – Some new roads would be built as temporary or long term, some roads would be added to the system and some would be decommissioned. This would have the potential to affect both upland and lowland habitats.

EFFECTS ANALYSIS

Table 1 displays all Region 9 Regional Foresters Sensitive Species (RFSS) known or expected to occur on the Superior National Forest (listed dated January 10, 2007). Species listed that do not have potential habitat present and are not known to occur within the Glacier project area will not receive further discussion in this evaluation.

Table 1: Sensitive Species Known or Suspected Occurrence in the Glacier Project Area

Regional Forester's Sensitive Species			
Common name ***Scientific name***	**Potential Habitat Present in project area**	**Known Species Presence in project area**	**Habitat Summary**
TERRESTRIAL WILDLIFE			
Gray wolf *Canis lupus*	Yes	Yes	Variety of habitats, adequate prey, low human disturbance
Heather vole *Phenacomys intermedius*	Yes	No	Forest, brushland or clearcuts with *Vaccinium* spp. and rocks.
Northern goshawk *Accipiter gentilis*	Yes	Yes	Large patch of older trees with closed canopy and open understory. One known territory within the project area.
Boreal owl *Aegolius funereus*	Yes	Yes	Secondary cavity nester. Old boreal forest (inc. aspen) next to lowland conifer foraging areas. Detected during owl surveys.
LeConte's sparrow *Ammodramus leconteii*	No	No	Uplands and lowlands with dense, tall, grass/sedge vegetation and thick ground litter. No impact to habitat and no records in project area.
Olive-sided flycatcher *Contopus cooperi*	Yes	Yes	Snags, low density conifer lowlands, riverine/riparian areas. NRRI bird plot detections and personal observation
Yellow rail *Conturnicops noveboracensis*	No	No	Lowland sedge meadows with specific characteristics such as overhead mat of dead sedge. Nearest detection Zim bog.
Black-throated blue warbler *Dendroica caerulescens*	Yes	Yes	Large contiguous mature forests, probably associated with small canopy gaps and a well-developed shrub understory. NRRI bird plot detections.
Bay-breasted warbler *Dendroica castanea*	Yes	Yes	Mature upland and lowland spruce/fir forests.
Peregrine falcon *Falco peregrinus anatum*	No	No	Nest: cliff/ledges; Hunt: forest openings, lakes, wetlands
Bald Eagle *Haliaeetus leucocephalus*	Yes	Yes	Large lakes & rivers with large trees for nesting and roosting. There are 14 known nests within the project area or within ½ mile of the boundary.
Connecticut warbler *Oporornis agilis*	Yes	Yes	Jack pine or lowland conifer with a thick ericaceous understory. Personal observations
Three-toed woodpecker *Picoides tridactylus*	Yes	Yes	Coniferous forests with snags. Personal observation

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Great gray owl *Strix nebulosa*	Yes	Yes	Nesting habitat of mature trees on wet soil with >60% canopy closure near open foraging areas. Detected during owl surveys. Nesting documented
Sharp-tailed grouse *Tympanuchus phasianellus*	No	No	Brushland complexes (>5,000 acres) with open areas, brush and small trees, as well as large open agricultural hay or pasture with associated brush habitat.
Wood turtle *Clemmys insculpta*	Yes	No	Upland and lowland habitats with suitable shade and insects for forage. Riparian habitats with open sandy areas for nesting. Nearest known location in the Partridge river southwest of the project area
AQUATIC WILDIFE			
Lake sturgeon *Acipenser fulvescens*	No	No	On SNF: Large lakes and rivers in the Hudson Bay drainage. No habitat present.
Shortjaw cisco *Coregonus zenithicus*	No	No	Lake Superior, Saganaga and Gunflint Lakes, possibly others. No habitat present.
Northern brook lamprey *Ichthyomyzon fossor*	Yes	No	Warm, medium-sized, low-gradient streams with sections of higher gradient reaches suitable for spawning. Ammocoete's require organically enriched, sandy substrate until metamorphosis.
Creek heelsplitter *Lasmigona compressa*	Yes	No	Headwaters of larger rivers. St. Louis river and tributaries. Lake of the Woods tributaries.
Black sandshell *Ligumia recta*	Yes	No	Medium to large rivers.
INSECTS			
Tiger beetle sp. *Cicindela denikei*	Yes	Yes	Sandy or rocky openings in northern hardwood forest communities.
Mancinus alpine *Erebia disa mancinus*	Yes	No	Shady black spruce swamp. Found in McNair management area adjacent to project area and near Greenwood Lake.
Taiga (Red-disked) alpine *Erebia discoidalis discoidalis*	Yes	No	Black spruce areas. Closest known location in McNair management area
Nabokov's (or Northern) blue *Lycaeides idas nabokovi*	Yes	No	*Vaccinium cespitosum* host in open sandy jack pine areas. Found in McNair management area.
Jutta arctic *Oeneis jutta ascerta*	Yes	No	Moderately forested black spruce bogs with sedges. Found in McNair management area.
Freija's grizzled skipper *Pyrgus centaureae freija*	Yes	No	Upland acidic meadow Found in McNair management area.
Quebec Emerald dragonfly *Somatochlora brevicincta*	Yes	No	Predominantly bogs, fens, and heaths.

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Vascular Plants (Note: Unless cited otherwise, habitat descriptions are derived from information provided by the Minnesota Natural Heritage and Non-game Research Program [MNDNR 2006])			
Moschatel *Adoxa moschatellina*	No	No	Shaded damp cliffs and slopes in upland mature northern hardwood forest on North Shore
Long-leaved arnica *Arnica lonchophylla*	No	No	Cool & moist cliffs and ledges on North Shore. Arctic disjunct
Maidenhair spleenwort *Asplenium trichomanes*	No	No	In crevices of moist, mostly east-facing cliffs, ledges, and talus, Rove formation
Alpine milkvetch *Astragalus alpinus*	Yes	No	Sandy, gravelly fluctuating shorelines with sparse vegetation. Inland strand beach - sparse vegetation
Swamp beggar-ticks *Bidens discoidea*	Yes	No	Wet habitats: silty shores, hummocks in floating mats and swamps, partly submerged logs
Pointed moonwort *Botrychium acuminatum*	Yes	No	Open habitats such as old log landing, old dirt roads, borrow pits
Triangle grape-fern *Botrychium lanceolatum* var *angustisegmentum*	No	No	Northern hardwood forest, oldfields, old logging roads, trails
Common moonwort *Botrychium lunaria*	Yes	No	Open habitats such as old log landings, sawmill sites, old building sites
Michigan moonwort *Botrychium michiganense (hesperium)*	Yes	Yes	Open habitats such as old log landing, old dirt roads, gravel pits, powerline corridors, borrow pits. Also beach ridges, old fields, trails, and dredge spoil dumps (Walton 2000a)
Goblin fern *Botrychium mormo*	No	No	Mesic northern hardwood forest with thick leaf litter layer
Pale moonwort *Botrychium pallidum*	Yes	No	Open, disturbed habitats, log landings, roadsides, dunes, sandy gravel pits.
Ternate grape-fern *Botrychium rugulosum (=ternatum)*	Yes	No	Generally open habitats, such as old log landings and edges of trails.
Least moonwort *Botrychium simplex*	Yes	Yes	Generally open habitats, such as old log landings, roadside ditch, trails, open fields, base of cliff, railroad rights of way
Floating marsh-marigold *Caltha natans*	Yes	No	Perennial herb; shallow water of pools, ditches, sheltered lake margins, slow moving creeks, sloughs and oxbows, pools in shrub swamps
Fairy slipper *Calypso bulbosa*	Yes	Yes	Hummocks in northern white cedar swamps, moist to wet lowland conifer swamps, and to lesser extent in upland coniferous forests (Smith 1993)
Katahdin sedge *Carex katahdinensis*	Yes	No	In seasonally moist, gravelly/sandy soil; along shores of large and small lakes; margins of ephemeral pools; associated with seasonal flooding

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Common name ***Scientific name***	**Potential Habitat Present in project area**	**Known Species Presence in project area**	**Habitat Summary**
New England sedge *Carex novae-angliae*	Yes	No	Moist woods with sugar maple, also with birch, aspen, tall shrubs; yellow birch and white spruce dominated forest
Ross' sedge *Carex rossii*	No	No	Rocky summits, dry exposed cliff faces, rocky slopes, in east Border Lakes subsection
Douglas's hawthorn *Crataegus douglasii*	No	No	North Shore rocky, gravelly streambeds/banks and open areas; and rocky borders of woods
Ram's-head lady's slipper *Cypripedium arietinum*	Yes	No	Wide variety of forests, both upland and lowland, but in MN predominantly in white cedar swamps; also in forests dominated by jack pine, red pine, or white pine
Rough-fruited fairy bells *Disporum trachycarpum*	No	No	Semi-open jack pine forest with aspen, birch, shallow rocky soils, in east Border Lakes subsection
Linear leaved sundew *Drosera linearis*	Yes	No	Minerotrophic water tracks in patterned peatlands
Neat spike-rush *Eleocharis nitida*	Yes	No	Mineral soil of wetlands, often w/ open canopy and disturbance, such as logging roads/ditches through wetlands
Appalachian fir club moss *Huperzia appalachiana*	Yes	No	Shelves and crevices on cliff/talus/rock outcrops, and shrub dominated talus piles
Moor rush *Juncus stygius*	Yes	No	Shallow pools in non-forested peatlands, often in a sedge-dominated community
Creeping rush *Juncus subtilis*	No	No	Sandy lakeshore – only known occurrence in BWCAW (Gerdes 2005a)
Auricled twayblade *Listera auriculata*	Yes	No	On alluvial or lake-deposited sands or gravels, with occasional seasonal flooding, associated with riparian alder or spruce/fir forest
American shore-grass *Littorella uniflora*	Yes	Yes	Shallow margins of nutrient-poor lakes, seepage lakes, sandy substrate, may have fine gravel/organic soil. Fluctuating water level up to about 1 meter.
Large-leaved sandwort *Moehringia macrophylla*	Yes	Yes	Cliffs/rock outcrops, talus, conifer sites on shallow soils, pine plantation with rocky outcrops; usually semi-open shrub or tree canopy
Fall dropseed muhly *Muhlenbergia uniflora*	Yes	No	Wet sandy beaches, floating peat mats
Dwarf water-lily *Nymphaea leibergii*	Yes	No	Slow moving streams, rivers, beaver impoundments 1-2 m deep. Occurs at outer margin of emergent vegetation.
Chilean sweet cicely *Osmorhiza berteroi*	No	No	Northern hardwood forest dominated by sugar maple on North Shore.

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Common name ***Scientific name***	**Potential Habitat Present in project area**	**Known Species Presence in project area**	**Habitat Summary**
Sticky locoweed *Oxytropis borealis* var *viscida (=oxytropis viscida* var *viscida*	No	No	Slate cliffs and talus slopes in east Border Lakes subsection. Arctic/alpine disjunct
Canada Rice Grass *Piptatherum canadense (=Oryzopsis canadensis)*	Yes	No	Sandy/gravelly soil; red pine/jack pine plantations, borders, edges, trailsides, openings (Gerdes 2005)
Club spur orchid *Platanthera clavellata*	Yes	Yes	Floating bog mats, sphagnum, stunted conifer swamp, mixed spruce tamarack, borrow pits, winter logging roads
Western Jacob's ladder *Polemonium occidentale ssp. lacustre*	Yes	No	Primarily white cedar swamps, also mixed conifer swamps; thrives in openings (Carlson and Sather 2001)
Braun's holly fern *Polystichum braunii*	No	No	Cool, shady cliffs and slopes in northern hardwoods in North Shore Highlands subsection
Lesser wintergreen or Small shinleaf *Pyrola minor*	Yes	No	Black spruce swamps, and ecotone between uplands and lowland alder/conifer swamp, prefers closed canopy.
Cloudberry *Rubus chamaemorus*	Yes	Yes	Black spruce/sphagnum forest, acidic. Superior NF at southern edge of species range
Nodding saxifrage *Saxifraga cernua*	No	No	Cliffs, ledges, diabase cliff (calcium based feldspars). Arctic/alpine disjunct. One location in MN on open cliff.
Encrusted saxifrage *Saxifraga paniculata*	No	No	Cliffs, sheltered crevices, and ledges of north-facing cliffs; Arctic/alpine disjunct
Northern bur-reed *Sparganium glomeratum*	Yes	No	Floating muck mats in emergent wetland habitat such as moats, pond margins, road ditches
Awlwort *Subularia aquatica*	Yes	Yes	Beach zone of sandy nutrient-poor lakes. Shallow lake margins. Submerged or emerged, or stranded. 15-45 cm deep water, but can occur deeper. Can flower while stranded, or under other conditions.
Canada yew *Taxus canadensis*	Yes	Yes	Wide variety of uplands and lowlands, including cedar/ash swamps, talus and cliffs, northern hardwoods, aspen/birch forest (USDA Forest Service 2006)
False-asphodel *Tofieldia pusilla*	No	No	Sedge mats at edges of shoreline rock pools along Lake Superior. Arctic disjunct.
Lance-leaved violet *Viola lanceolata*	Yes	No	Sandy to peaty lakeshores; borders of marshes and bogs, damp sand ditches (USDA Forest Service 2004g)
Barrenstrawberry *Waldsteinia fragarioides*	Yes	No	Upland coniferous and deciduous forests, in recently harvested areas, established plantations, and areas with no recent harvest

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Common name ***Scientific name***	**Potential Habitat Present in project area**	**Known Species Presence in project area**	**Habitat Summary**
Smooth woodsia *Woodsia glabella*	No	No	Moist, north-facing cliffs along Lake Superior. Arctic disjunct.
LICHENS AND BRYOPHYTES (Habitat information taken from USDA Forest Service 2000a, and Wetmore 2000 and 2001, and as cited below)			
A lichen sp. *Arctoparmelia centrifuga*	Yes	No	Lichen; Sunny rocks and open talus slopes (USDA Forest Service 2002a)
A lichen sp. *Arctoparmelia subcentrifuga*	Yes	No	Lichen; Sunny rocks and open talus slopes
a lichen sp. *Caloplaca parvula*	Yes	No	Smooth bark of young black ash in moist, humid old growth black ash stand (USDA Forest Service 2002c)
a lichen sp. *Cetraria aurescens*	Yes	Yes	Conifer bark in lowland conifer swamps (old cedar/black spruce - USDA Forest Service 2002d)
a lichen sp. *Cladonia wainoi (= pseudorangiformis)*	Yes	No	On rock outcrops and thin soil – exposed sites with lots of light (USDA Forest Service 2002e)
A liverwort sp. *Frullania selwyniana*	Yes	No	Lowland cedar swamps on bark of white cedar (Janssens 2002)
Port-hole lichen *Menegazzia terebrata*	Yes	No	Cedar swamps, especially old growth; base of cedar trees (USDA Forest Service 2002h)
a Dog lichen *Peltigera venosa*	Yes	No	Soil and moist cliffs, exposed root wads (USDA Forest Service 2002i)
a lichen sp. *Pseudocyphellaria crocata*	Yes	Yes	Mossy rocks, trees in partially shaded, moist, frequently foggy habitats (USDA Forest Service 2002j)
A lichen sp. *Ramalina thrausta*	Yes	No	Cedar swamps, especially old growth (USDA Forest Service 2002k)
a lichen sp. *Sticta fuliginosa*	Yes	Yes	On hardwoods in humid, old growth cedar or ash bogs (USDA Forest Service 2002l)
a lichen sp. *Usnea longissima*	Yes	No	On old conifers in moist situations, often in or near a conifer or hardwood swamp (USDA Forest Service 2002m)

DESCRIPTION OF AFFECTED SPECIES:

TERRESTRIAL WILDLIFE

GRAY WOLF

Existing Condition

Population and trend: Gray wolf populations in northern Minnesota are stable or increasing as are subpopulations in Wisconsin and Michigan. As a result of the increasing Minnesota population and the development of viable populations in neighboring states, the U.S. Fish and Wildlife Service recently removed Endangered Species Act protection for the Gray Wolf Western Great Lakes Distinct Population Segment. The final rule to delist this Distinct Population Segment was published in the Federal Register on February 8, 2007 and took effect on March 12, 2007 (http://www.fws.gov/midwest/wolf/2007delisting/2007delist_fs.pdf). Management of the wolf is now governed by the Minnesota Wolf Management Plan of 2001 (MnDNR 2000).

Wolves in the Glacier project area are a part of the Western Great Lakes Distinct Population Segment. The Minnesota wolf population has grown from fewer than 750 animals in the 1950s to the current estimate of 3,020. Management objectives for gray wolves on the Superior National Forest have changed from seeking to recover the species to seeking to maintain, protect and enhance its habitat and prevent federal listing.

Habitat needs and limiting factors: Wolves are habitat generalists; they can live anywhere prey is sufficiently abundant. Their main diet is large ungulates (deer and moose) and they supplement their diet with a variety of smaller animals, such as snowshoe hares (*Lepus americanus*) and beavers (*Castor canadensis*). Wolf packs in Minnesota and elsewhere live in territories that are home ranges defended constantly against intrusion by other packs. Territories may be as small as 25 square miles or as large as 200 square miles, depending on pack size and the density of ungulates (i.e., amount of food available).

Unless food is very abundant, up to one-half of wolf pups die before they reach 6 months of age. Mortality of adults also is relatively high with about 35 percent of adult wolves die each year. The most common natural causes of mortality to both pups and adults are starvation and intraspecific strife (i.e., wolves killing other wolves). This happens when food is scarce and when wolves must "trespass" into adjacent wolves' territories to hunt. Infrequently, disease may also be an important adult wolf mortality factor. Infrequently, motor vehicles or trains accidentally hit and kill wolves. Wolves are also deliberately (illegally) killed by humans, but the frequency of these illegal actions is unknown. In addition, about 150 wolves are killed each year by Federal depredation control activities.

Forest Plan direction

In addition to O-WL-1, O-WL-2, O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to gray wolf:

- Provide for the protection of known active gray wolf den sites during denning season. (G-WL-10)

Analysis Indicators

1) **Impacts to prey habitat**. This is measured by
   1a. acres and percent of Young Upland Forest (MIH 1 young) resulting from each alternative. This is a measure of potential foraging areas for deer and moose

1b. acres and percent Upland Conifer (spruce and pine) Forest, greater than 9 years old (MIH 5 pole +) resulting from each alternative. This is a measure of potential thermal cover for deer and moose

2) Impacts of Human Access/disturbance. This is measured by miles of Forest Service low standard roads (OML 1) and temporary roads resulting from each alternative

Direct/Indirect Effects

Alternatives 1-3

One objective of this project was to improve habitat conditions for deer and moose. The action alternatives may lead to positive benefits for wolves by creating foraging habitat for these prey species. Alternatives 2 and 3 would create more foraging habitat for deer and moose than Alternative 1 on federal lands (Table BE-Wolf-1, indicator1a). Under Alternative 1 – the no action –natural disturbance events and previously planned management activities would continue to provide new growth in vegetation and foraging habitat. Under all alternatives, thermal cover for moose and deer, provided by mature spruce-fir forest types would remain well distributed across the area and is believed to be adequate (Table BE-Wolf-1, indicator 2b). In addition, this project area contains the Garden Lake Deer Yard which will continue to provide winter food for wolves. Moose and deer populations are not expected to be limiting factors for wolves under the Revised Forest Plans (USDA 2004a).

The larger impact to wolves would come from human access/disturbance. Alternatives 2 and 3 would result in an increased potential for negative wolf/human interactions with 2 mile increase in low standard roads and 35-45 mile increase in temporary roads (Table BE-Wolf-1, indicator 2). The impact of this increase in low standard roads is expected to be short term. New low standard system roads and temporary roads are not intended for public access. All temporary roads needed to access harvest units would be obliterated and allowed to return to a more natural state once reforestation objectives have been met and new system roads would be closed to motorized uses when not needed for land management activities. Alternative 1 results in the lowest risk of disturbance since no new roads or harvest units are proposed. Alternative 2 has slightly more miles of temporary road than Alternative 3 but neither of the action alternatives are expected to negatively affect wolf populations. No changes in access or level of use by off-highway vehicles in the project area would be expected and no change in effects is expected with the designation of existing multi-use trails in the Kawishiwi Triangle area.

Prescribed fire, brush disposal, relocation of road to Smitty's resort, use and expansion of gravel pint and improvement of stream crossings would have little to no effect on wolves.

Table BE – Gray Wolf-1. Effecst to Suitable Habitat

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3	
Prey Habitat	acre	%	acre	%	acres	%	acres	%
1a. young upland forest <10 years old	1,293	4	508	1	5,835	16	4,340	12
1b. upland conifer (spruce and pine) > 9 years old on all uplands	12,314	33	13,681	37	12,374	33	13,040	35
	Miles		Miles		Miles		Miles	
2. Miles of temp (su-t) and OML 1 roads	(0, 15) 15		(0, 15) 15		(45, 17) 62		(35, 17) 52	

Data source: Existing conditions for vegetation indicators are based on frozen August 2007 CDS data project, and all alternatives are based on projected CDS data in the year 2017. Roads indicator data for Existing Condition and alternatives are based on Aug 2006 road arcs coverage data and Glacier project roads shapefile created by Dan Hernessmaa and edited by David Hernandez.
Other Footnotes: Percentages are the percent of total upland forest on federal lands in the project area (37,185 acres). Indicator 1a = MIH 1 young, Indicator 1b = MIH 5 pole +.

Cumulative Effects

There are no past, present or reasonably foreseeable Forest Service vegetation management actions in the project area that would significantly affect prey habitat for wolves or lead to high levels of disturbance (see draft EIS appendix C). Additional impacts could occur on lands outside of National Forest jurisdiction. Increases in the potential for human access into wolf territory would occur as people buy, subdivide, and develop private parcels of land. New road construction would be needed to access this property. Harvesting on State, county, and private land may also require additional road development. Not all of these roads would be effectively closed following harvest. Proposed Travel Management Project on the SNF, once signed and implemented, would further reduce the number or open roads on federal lands. The density of higher standard roads (OML 3-5) in the project area is currently near 1 mile/square mile which is recommended for minimizing wolf mortality.

Timber harvesting, restoration and fuel reduction activities are expected to improve foraging conditions for moose and deer. Nonfederal lands (48% of project area) would continue to provide foraging and thermal habitat for deer and moose. Overall, more than adequate deer habitat is available in north central and northeastern Minnesota. This condition is not expected to change. Trends in edge habitat appear to be increasing (Wolter and White 2002).

Shooting, trapping, or other harassment of wolves would most likely continue to occur on all land ownerships at a minimal level. Additional mortality associated with vehicle collision would continue, especially if design speeds on non-federal roads increase. However, based on increasing wolf populations over the past two decades, cumulative impacts to wolf related to changes in habitat and human disturbance are not expected to have major impacts on wolf populations.

Determination

The proposed resource management activities planned in the project area *may impact individuals but are not likely to cause a trend to federal listing or loss of viability* in gray wolves. Habitat conditions for deer and moose are likely to improve with all of these activities and lead to more prey opportunities for wolves. Project activities are not expected to lead to any changes in OHV use, and only slight changes in permanent roads therefore only minor direct, indirect or cumulative effects are expected. Temporary roads are proposed and disturbance to wolves from these would occur but be short term because they would be decommissioned after use. Habitat will remain well-distributed in the project and cumulative effects area and I expect no negative trend in viability to wolf populations with any of the proposed activities.

Mitigations

- If a gray wolf dens or rendezvous site is found during planning layout or operations, activities would be temporarily halted in the area and the District Biologist should be notified. The biologist would assess the risk to species and where appropriate; mitigation measures would be implemented prior to restarting operations. The Forest Plan, recovery plans and conservation strategies will be used when making mitigation recommendations.

- Monitor temporary roads and new OML 1 roads for effectiveness of closures.

HEATHER VOLE

Existing Condition

Population and trend: In eastern North America, the range of the heather vole reaches its southern most point in the Upper Midwest on the Superior National Forest (Jannett 2006). A long-term (1995-2006) study of small mammal populations has documented 64 heather voles, all on the Superior National Forest. The nearest known heather vole location is 12 miles south of the project area off of the Tomahawk road (MN NHP 2006).

Small mammal surveys were also coordinated by the 1854 Authority have been conducted each fall since 2002 in an attempt to track trends in small mammal populations within the forested and transition zones in northern Minnesota. Nine of the trapping routes are conducted on the SNF, none in the Glacier project area. Population trends are unknown.

Habitat needs and limiting factors: Coffin and Pfannmuller (1988) and McAllister and Hofmann (1988) state that heather vole is found in a wide variety of northern habitats, including coniferous forests, and forest borders, heath shrublands, willow thickets, rocky hillsides, and moist meadows. *Vaccinium* species are often present where they are found. Naylor and Spires (1985) found high densities of heather voles in Ontario in jack pine monocultures with a dense, relatively continuous understory of ericaceous shrubs. Upland forests and openings with ericaceous ground cover and not far from water appear to be preferred habitat. Any activities that encourages grasses encourages meadow voles, which are detrimental to the heather vole (SNF Annual Monitoring Report 2006).

Habitat trend: Fires suppression has likely had a large negative impact to habitat conditions from historical conditions. Timber harvest potentially perpetuates habitat for this species, however an increase of aspen and a decrease of jack pine has likely reduced the amount of suitable habitat for the species (SNF Annual Monitoring Report 2006). Mature Jack Pine forest habitat currently has very patchy distribution throughout the Glacier area and makes up only about 8% of the upland forests. It is primarily limited to the southern portion of the area (near Harris and Heart Lakes) and the end of the Fernberg road.

Forest Plan Direction

In addition to O-WL-1, O-WL-2, O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to heather vole:

- none

Analysis Indicators

Impacts to suitable habitat. This is measured by

1. acres and percent of mature jack pine (MIH 8 mature +) that would remain with each alternative

2. acres of final harvest (Clearcut, seed tree, PC-30, and Shelterwood) on ELT 1, 2, and 14. These soil types are most vulnerable to the establishment of grass after natural or human caused disturbance.

No management activities are proposed that will improve or restore habitat for heather vole so no indictor was chosen to address this.

Direct/Indirect Effects

Roads, temporary or permanent, allow for the potential of direct mortality of heather voles. Gravel pits may provide future habitat after rehabilitation efforts have been completed by providing sparse, rocky cover. Prescribed burning could pose a direct threat to individuals but it could enhance the habitat for heather voles considerably by stimulating the growth of the understory.

There is a relatively small difference between alternatives with regards to suitable habitat (indicator 1), with alternative 1 providing the most and alternative 2 the least. Alternative 2 would have the greatest risk of increasing grass and potential composition by meadow voles (indicator 2). There is a large amount of acres in ELT 1, 2, and 14 which is susceptible to grass establishment after harvest. However, this project only will impact approximately 9% of these ELTs with final harvest. Leave trees and reserve areas should help reduce the establishment of grass by providing some shade. The reserve areas would also provide refugia for heather voles if grass does become established and meadow voles increase. A goal of project alternatives is to increase Jack pine forest in the Glacier area. Although young, and not in suitable habitat condition within the next 10 years, both action alternatives would increase the jack pine forest type by 3-5%. This could potentially provide more suitable habitat in the future (see MIH maps in the project file)

Table BE – Heather Vole-1. Effect to Suitable Habitat

Indicators	Existing Condition	Alt 1	Alt 2	Alt 3
	Acre (%)	Acre (%)	Acre (%)	Acre (%)
1. mature and older jack pine forest	3,124 (8.4)	3,313 (8.9)	2,908 (7.8)	3,066 (8.2)
	acres	acres	acres	Acres
2. final harvest on ELT 1, 2 or 14	n/a	0	890	670

Data source: Existing conditions for vegetation indicators are based on frozen August 2007 CDS data project, and all alternatives are based on projected CDS data in the year 2017.
Other Footnotes: Percentages are the percent of total upland forest on federal lands in the project area (37,185 acres). Indicator 1 = MIH 8 mature +. Data for indicator 2 was provided by Casey McQuiston.

Cumulative Effects

Based on Forest-wide projected habitat trends on federal lands (SNF Annual Monitoring Report 2006) the amount of mature jack pine forest (MIH 8) will increase in the Jack Pine Black Spruce and Mesic Birch Aspen Landscape Ecosystems in the next 10 years which at a coarse scale would benefit this species. On non-federal lands management for young forest of aspen and conifer will occur, so habitat would be positively and negatively impacted. However when looked at in combination with federal lands, goals established by the Minnesota Forest Resources Council Landscape Committee guide the emphasis of land management on all ownerships that are located within the SNF. Over arching goals are to increase the amount of Jack Pine Forest (MIH 8) over time.

The cumulative effects analysis for the Forest Plan Revision BE concludes that habitat conditions in the future from federal and non-federal lands are predicted to continue to provide a patchy distribution for heather vole. This project and predicted cumulative actions fall within the analysis and effects that were predicted by the Forest Plan Revision BE. Likely habitat for the heather vole will be maintained in patchy distribution.

Determination

The proposed resource management activities planned in the project area (alternatives 2 and 3) may impact individuals but are not likely to cause a trend to federal listing or loss of viability. This determination is based on the assumption that heather vole is adaptable to a wide variety of habitats, can escape direct mortality from logging by burrowing in its nests or leaving the site, and, if present, source populations would be present in some of the project area. There is also an expected small increase in jack pine forest which may benefit the species. This determination is consistent with the determination in the Forest Plan Programmatic BE. Alternative 1 would likely have no effect to the heather vole. All Alternatives are consistent with Forest Plan direction.

Mitigations

- If heather voles are found in the Glacier area, the district biologist should be notified.

NORTHERN GOSHAWK

Existing Condition

Population and trend: Northern goshawk (hereafter goshawk) is a large forest raptor, occupying boreal and temperate forests throughout the Holarctic. *Accipter gentilis atricapillus*, the subspecies occurring in Minnesota, is widely distributed across the northern half of eastern North America and in many parts of western North America. Goshawk populations in the Lakes States are perhaps smaller than prior to early logging and settlement, especially when passenger pigeons were available for prey (Kennedy 1997). Populations may be increasing with the recovery and maturing of forests in recent times in some parts of the United States (Squires and Reynolds 1997, Kennedy 1997, Rosenfield et al. 1998). Rosenfield et al. (1998) found no evidence of range contraction in Wisconsin. Such data are not available for Minnesota.

Surveys for nesting goshawks have been conducted in several project areas within the Kawishiwi Ranger District over the past 6 years. Three occupied goshawk nesting territories have been found. One of them is within the Glacier project area. Eight survey routes consisting of approximately 60 calling points were conducted in the Glacier area in 2006 and 2007(survey records in project file). The best potential goshawk habitat is within the large mature upland patches in the Fernberg corridor and south of the Kawishiwi River and southwest of Birch Lake (goshawk map, project record). 2005 Forest-wide survey efforts showed an increase of known breeding pairs over those known in 2003 (Annual Monitoring Report 2006). Based on the 2007 Statewide Goshawk monitoring effort there are 26 know territories on the Superior National Forest. Nine were known to be occupied in 2007.

Habitat needs and limiting factors: Reynolds et al. (1992), Graham et al. (1994), Squires and Reynolds (1997), and others state that goshawk is a forest dwelling raptor whose habitat preferences are mature deciduous or mixed deciduous and coniferous forest in fairly contiguous blocks intermixed with younger forests and openings for prey species habitat. Across the range of the species, goshawks have demonstrated an ability to use a wide variety of habitat types that have high degree of canopy closure (Squires and Reynolds 1997). Goshawks are adapted to flying beneath the forest canopy and use primarily mature forest with sufficient open space between the bottom live tree branches and understory for the birds to fly easily. Some understory (e.g., forbs) and down logs are needed for prey species habitat. Adults and fledglings use large down logs as feeding and plucking perches.

In eastern deciduous forests, goshawks prefer to nest in large forested areas containing more mature timber than randomly present in the landscape. In Wisconsin, Rosenfield et al. (1998) found that goshawks nested in a wide array of forest types, including aspen monotypes, pine plantations, sugar maple, maple-oak, and black ash with a mean canopy closure at the nest site of 82%. A Michigan study (Lapinski and Bowerman 2000), found goshawks using forests of tamarack, black spruce, white spruce, balsam fir and mixed conifer types along with other kinds of forests, but avoided younger monotypic aspen, cedar and open areas. Boal et al. (2001) studied habitat use by nesting goshawks in northern Minnesota. Eighty-one percent of 46 nests were built in aspen, 11% in paper birch, 4% in white pine, and 2% each in red oak and red pine. Nesting stands in MN had similar stand structure with 1.1m to 3.5m between the bottom of the overstory and the top of the understory trees (Boal et. al. 2001). On the Superior National Forest, aspen is the most common nest tree (23 nests) followed by birch (5 nests), Jack pine (4 nests) and red pine (2 nests). Goshawks do not generally use the same nest for more than a year, typically having two and up to nine alternate nest sites located within a square mile of the present nest (Estabrook 2000).

Goshawks forage in mature forest habitats. In Minnesota, goshawks preferentially use older age classes for foraging with old (>50 years) upland deciduous and deciduous mixed stands. Boal et al. (2001) found that foraging stands, regardless of stand type, were consistent in having high stand

densities of tall, large canopy trees, with horizontal open spaces of 3 to 12 feet between the bottom of the overstory and top of the understory trees, and up to 3 feet between the bottom of the understory canopy and top of the shrub layer. They suggested that these relatively unobstructed spaces between vegetation layers may serve as important flight paths through forest stands, and the heights in which they occurred was consistent among stand types. Goshawk is an opportunistic hunter preying on a wide variety of vertebrates and insects.

Per Widén (cited in Niemi and Hanowski 1997) suggests that goshawk prefers larger tracts of forest for foraging and, therefore, is affected by fragmentation of forested areas. Goshawk seldom uses recently cut areas for foraging presumably because of the dense understory where prey is hard to detect. Creation of landscape patterns (e.g., large openings from clearcutting or increased edge habitat) that favor predators such as red-tailed hawk, great-horned owl, fisher or raccoon are a threat to goshawk. In one study, stands larger than 50 acres were used more consistently by goshawk than stands smaller than 25 acres (Estabrook 2000). In Wisconsin, Erdman et al. (1998) observed that large clearcuts, selective cuts next to clearcuts, or canopy openings reducing cover to less than 40%, resulted in red-tailed hawks and great horned owl displacing woodland hawks. They attribute most nesting failure to fishers. Boal et al. (2001) summarize that mammalian predation is causing between zero and 30% of nest failures in the western Lakes States.

Reynolds et al. (1992) and Graham et al. (1994) state that the nesting home range of goshawks contains three components: the nest area, the post-fledging family area, and the foraging area. Table *BE-goshawk-1* illustrates some of the biological functions associated with these three habitat components. The forest Plan directs us to maintain a minimum of 50 acres of suitable habitat (100% mature forest with >90% canopy closure) around known nest sites. Forest Plan direction for the post-fledging area is to maintain suitable habitat conditions within a minimum of 60% of 500 ac area encompassing the nest sites. The Forest Plan does not provide direction for management of the foraging area. Foraging areas for nesting goshawk can range from 21,000 to 27,200 acres surrounding the nest site. It is generally accepted that suitable foraging areas contain greater that 40% of the uplands in a mature condition.

Table *BE-goshawk-1*. Biological function of the three components of goshawk home range.

Biological function	Nest area	Post-fledging	Foraging
Courtship and breeding	x		
Egg-laying and incubation	x		
Security for the female and young	x	x	
Foraging for young and female until dispersal occurs	x	x	
Alternate nest sites	x	x	
Nest and territory defense	x	x	
Foraging for adults and juveniles, and especially male during nesting			x
Security for adults and juveniles, and especially the male, while foraging			x

Goshawks are sensitive to disturbance at nest and roost sites and nest abandonment has been documented within 300 feet of logging or recreational camping (Squires and Reynolds 1997). Range wide, destruction or modification of habitat, including fragmentation, changes in vegetation structure and composition, and effects of activities associated with habitat modification are considered the primary threat to breeding goshawks (Squires and Reynolds 1997). Increase in human activity in the form of road traffic, structures and communities may dampen some of the potential recovery from large-scale logging 100 years ago (Squires and Reynolds 1997). The reintroduced fisher is blamed for increased nest failure and adult female mortality in Wisconsin (Erdman et al. 1998). Fishers are

known to occur in the Glacier area, however the impact that they have to goshawk in the Glacier area is unknown.

Forest Plan Direction

In addition to O-WL-1, O-WL-2, O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to Goshawk:

- Provide habitat to provide for population goal minimum of 20-30 breeding pairs
- Protect, maintain or enhance high quality habitat conditions and minimize disturbance to nesting pairs in nesting sites (S-WL-10)
- Maintain suitable habitat condition on a minimum of 60% of the upland forested acres and minimize disturbance to nesting pairs in post-fledging areas (G-WL-22)
- In spatial Zone 3, strive to minimize the decrease in acres and number of patches of mature or older upland forest in patches 300 acres and greater (O-VG-24)

Analysis Indicators

Direct and indirect effects

1) Impacts to Suitable habitat for Goshawk. This is measured by

1a. acres and % of Mature Upland Forest (MIH 1 mature +) remaining with each alternative

1b. acres and number of mature upland patches 100 acres and greater remaining with each alternative

2) Improvements in future Stand Complexity: This is measured by the acres of diversity and under-planting in suitable goshawk habitat with each alternative.

3) Impacts to post-fledgling and foraging areas. This is measured by the acres and % of suitable habitat that would remain with each alternative in these portions of known goshawk territories.

Cumulative Effects

4) Impacts to Suitable habitat for Goshawk. This is measured by the number and acres of large (>300 acres) mature/old upland forest patches in patch zone 3. This indicator utilizes spatial Management Indicator Habitat 13 – Large Patches of Upland Mature Forest.

Direct/Indirect Effects

Effects common to all alternatives

Roads and trails (temporary and system) should have a minimal impact on goshawks, as long as they don't directly impact goshawk nesting habitat.. No new roads would be located within the 50 acre nest area. Gravel pits and road relocation/reconstruction would have a minimal impact on goshawks since they will not be established in goshawk nesting habitat and would only impact a small portion of potential goshawk foraging habitat. Prescribed burning should have a minimal impact on goshawks as long as they don't kill existing or potential nest trees in quality habitat. Prescribed burn objectives should ensure this does not happen. Reforestation and restoration projects should benefit goshawks by providing future foraging and nesting habitat and by increasing within stand diversity, therefore increasing future habitat quality for goshawks.

Effects to the Heart Lake Goshawk Territory

Alternative 1

Direct effects to Goshawk are not expected because no activities would occur near the nest site during the critical nesting period. This alternative would have a beneficial effect on suitable habitat in this territory. The amount of suitable habitat in both the post fledging and foraging areas would increase

from the amount that is available today, providing more area for securing food and dispersal of young (table *BE- Goshawk-2*). This alternative complies with G-WL-22 in maintaining a minimum of 60% of the post-fledging area in a suitable condition.

Alternatives 2 and 3

Alternatives 2 and 3 would have similar impacts to the Heart Lake Territory. Direct effects are not expected because no activities are proposed within the nest site. Both alternatives would result in an increase in suitable post-fledging habitat, which could benefit dispersing young (table *BE – Goshawk-2*). Both alternatives comply with G-WL-22 in maintaining a minimum of 60% of the post-fledging area in a suitable condition. Alternative 2 would result in less suitable foraging habitat; however foraging habitat in both alternatives is maintained in large, connected patches and would likely provide enough hunting areas to sustain this pair. Both alternatives complies with G-WL-22 in maintaining a minimum of 60% of the post-fledging area in a suitable condition

Effects to Goshawk Habitat

Alternative 1

This alternative would result in potentially beneficial impacts to goshawk. The amount of suitable habitat (indicator 1a) and large mature patches (indictor 1b) available across the area would increase (table *BE- Goshawk 2*). This alternative would not create any new young habitat and will, through time, lose the intermixed habitat of young and mature forest that provide a variety of prey species. No management induced improvements to stand complexity would occur (indictor 2). The short term effect to this may be neutral because succession of the under stories of forest stands would occur, however the composition of the understory may be made up of less desirable species than alternatives 2 and 3.

Alternatives 2 and 3

Both action alternatives would result in less suitable habitat than alternative 1 and than exists today, with the least amount of habitat available with alternative 2 (table *BE- Goshawk 2*). Alternative 3 would result in slightly less fragmentation of large mature patches than alternative 2 with a larger acreage and smaller number of patches (indicator 1b). Both action alternatives would maintain at least half of the upland forest in suitable condition for goshawk. Maintenance of larger contiguous blocks would provide higher quality habitat for goshawks in the Project Area. In addition, the young forest created by both action alternatives would provide habitat for important forage species such as ruffed grouse and snowshoe hares that may use the adjacent mature forest and be available to goshawks. Both action alternatives would increase future stand complexity (indicator 2) with alternative 3 doing slightly more. Stand complexity would be improved through increasing the white pine and white spruce component of stand understories through planting and release. Also, mitigation will assure the maintenance of stand complexity in pine and spruce thinning units by requiring the operator to leave 6 to 12 live hardwood trees per acre when available. This will preserve possible future nest trees for goshawks.

Table BE – Goshawk-2. Indicators of direct and indirect effects to Northern goshawk

Indicators	Existing Condition			Alt 1			Alt 2			Alt 3		
	acre		%	acre		%	acres		%	acres		%
1a. Upland Forest in Suitable Habitat[1]	25,964		70	27,654		74	22,951		62	24,051		65
	#	ac	%	#	ac	%	#	ac	%	#	ac	%
1b Patches	51	19,069	51	58	21,862	59	56	18,094	49	54	18,530	50
	acres			acres			acres			acres		
2. Stand Complexity[2]	n/a			0			3,865			4,000		
3. Heart Lake Goshawk Territory	acre		%	acre		%	acre		%	acre		%

Table BE – Goshawk-2. Indicators of direct and indirect effects to Northern goshawk

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3	
Post-fledging area[3]	308	81	380	100	380	100	380	100
Foraging area[4]	5,143	61	5,320	63	4,536	54	5,008	59

Data source: Existing condition for vegetation indicators is based on August 2007 CDS data, and all alternatives are based on projected CDS data in the year 2017.
Other Footnotes: Percentages are the percent of total upland forest on federal lands in the project area (37,185 acres) [1] Suitable goshawk habitat = (MIH 1 Mature+). [2] Stand complexity = planned treatments for NHRR or NHRU in suitable goshawk habitat. [3] Upland portion of the post-fledging area is 380 acres, post fledging area is 592 ac. [4] The upland portion of the foraging area (11,588 ac) used for this analysis is 8,423 ac.

Cumulative Effects

Management intentions of intermingled state, county and private land managers would probably reduce the present level of large blocks of mature upland forest found in the vicinity of project area and in northeastern Minnesota under any of the alternative scenarios. The State and counties plan on harvesting timber in the project area in the next ten years (see Draft EIS appendix C). Cooperative management should help maintain some large patches of forest by consolidating management across boundary lines.

2006 GIS analysis shows a slight increase in mature upland forest on the Superior as a whole. Although current data shows the Superior exceeds Decade 1 objectives, the amount of mature/old forest in MIH 1 is expected to decrease in decades 1 and 2 (SNF Annual Monitoring Report 2006). The Monitoring report also showed a slight increase in large mature patches Forest-wide (*Table BE-Goshawk-3)*. Suitable goshawk habitat will continue to be available in large portions of the Boundary Waters Canoe Area Wilderness. This project will attempt to offset further fragmentation of the landscape by maintaining large, contiguous mature patches of forest and creating large, contiguous patches of young forest. Reduction of goshawk suitable habitat by management of other owners will further increase the importance of maintaining suitable amounts of habitat on federal land.

Fragmentation of larger blocks of habitat would make goshawks more vulnerable to predators and affect species distribution. As mentioned, Boal (2001) documented up to 30% nest predation in northern Minnesota. Wide ranging pairs may not successfully breed if they are forced to expand their home ranges to compensate for further loss of high quality foraging habitat.

Table BE-Goshawk-3: Indicator of Cumulative Effects to Goshawk Habitat

Large Patches of Upland Mature Forest (MIH 13)	**Forest Plan ROD**	**Existing Condition**	**Alternative 1**	**Alternative 2**	**Alternative 3**
FOREST-WIDE	**2004**	**2007**	**2014**		
# (and acres) of ≥300-acre patches	298 (242,770)	288 (310,680)	293 (301,060)	292 (297,940)	290 (298,100)

Data source: Existing condition for vegetation indicators is based on August 2007 CDS data, and all alternatives are based on projected CDS data in the year 2014.

Determination

The proposed resource management activities planned in the project area for Alternatives 2 and 3 may impact individuals but are not likely to cause a trend to federal listing or loss of viability. Within the

next ten years this project would continue to provide sufficient habitat in the Project Area as a whole. All alternatives would maintain over 50% suitable habitat. Both action alternatives would reduce fragmentation by positioning harvest adjacent to recent clearcuts on both Federal and nonfederal lands to increase stand size and increase future stand complexity. This determination is consistent with the determination in the Forest Plan Programmatic BE. All Alternatives are consistent with Forest Plan direction.

Mitigations

- Consult immediately with the District Wildlife Biologist if a large stick nest is found and suspend logging temporarily until a mitigation plan can be devised if the nest is used by goshawk.

- Monitor the Heart Lake Territory to see if it receives continued uses by goshawks.

- Harvest and temporary road construction should not be done between February 1 and August 31 within 2,885 feet of an active nest (S-WL-10).

- If a new goshawk territory is found, suspend harvest until a home range analysis can be conducted on the new site. If it is found that there is enough suitable habitat (using criteria above) remaining after the proposed harvest, continue with the operation. However, if the proposed harvest will lower the suitable upland habitat to levels below the threshold, defer the harvest unit.

- If a new active nest is found in a known goshawk territory, follow the time restrictions listed earlier for the new 500-acre post-fledging territory.

- In thinning units leave 6 to 12 live hardwood trees per acre when available for potential nest sites.

BOREAL OWL

Existing Condition

Population and trend: Hayward (1994) states that boreal owls occupy boreal forests throughout the northern hemisphere. East of the Rocky Mountains, breeding has been confirmed only in Minnesota, and then primarily in northeastern Minnesota. Nesting boreal owls have generally not been detected west of Highway 53 or the Vermillion River, or within 8 miles of the shore of Lake Superior. The prime area for boreal owl appears to the eastern portion of the Laurentian RD, southern portion of Kawishwi RD, and the middle portion of the Tofte RD, but they are not confined to that area (Steve Wilson, Wildlife Biologist, Minnesota DNR and Bill Lane, Research Wildlife Biologist and consultant). Detection probability decreases west of Highway 53 although a few have been observed in Koochiching County (Lisa Belmonte, research wildlife graduate student, University of Minnesota at Duluth 18 Sep. 2001).

The Minnesota Generic Environmental Impact Statement (Jaakko Poyry Consulting Inc. 1994) projected a decrease in the Minnesota boreal owl population if statewide timber harvest increased over one million cords overall or about 25% higher than at present. While attempts have been made to monitor boreal owl populations, present survey techniques are not sufficiently precise to detect population trends for northern Minnesota. Boreal owl populations fluctuate with winter snow depth and prey availability, and winter population irruptions occur periodically (Hayward 1994, Kirk 1994, Wilson 1996, Lane 1997, Wilson 1997). The population on the Superior National Forest is part of a larger Canadian population and may not be viable by itself at present (SNF Annual Monitoring Report 2006). Population trends are difficult to detect given normal large population fluctuations and low precision of survey estimates.

Boreal owls were surveyed in the project area in 2006 and 2007 using both call playback and listening stops. Five survey routes were run and consisted of 70 survey points along roads. These routes were run 2 to 4 times in the spring both years. One boreal owl was detected within the project in 2006.

Habitat needs and limiting factors: Kirk (1994) states that boreal owls prefer forests dominated by black spruce, white spruce, balsam fir, balsam poplar, trembling aspen, and paper birch. They favor mature forest during winter because snow conditions (uncrusted snow) facilitate access to prey; likewise, in summer, mature forest sites have less herbaceous cover than open sites, allowing greater access to prey. Following spring thaw, before herbaceous vegetation becomes dense, owls shift to openings where densities of voles exceed densities in forested stands (The Birds of North America Online 2006).

Nesting habitat is mixed deciduous/conifer usually older than 70 years. Nest trees are typically aspen and birch with an average diameter of 16 to 17.5 inches. Cavities excavated by pileated woodpeckers are often used for nesting. Within 8 acres centered on each nest site nest another important habitat component is six or more dominant or co-dominant conifer that are used as song perches. Nest sites are usually within 200 yards of large areas of productive mature lowland conifer, primarily black spruce, which are preferred for foraging and roosting. Nests that are further than 200 yards from lowland conifer typically have a mature forest corridor to that lowland conifer. Populations are limited by availability of cavities for nesting and food supply (Hayward 1994, Kirk 1994). Limiting factors may be the right combination of nesting and foraging/roosting habitat, and possibly the distribution of these habitats and cavity trees. Fragmentation has been implicated in the isolation of boreal forest lowlands (USDA Forest Service 2004d). Other limiting factors include automobile collisions, and low prey density.

Within the Glacier area upland nesting habitat is prevalent, however large lowland complexes necessary for foraging habitat are limited. Best potential habitat for this species is located in the

Kawishiwi Triangle, with scattered smaller areas located primarily in the southern ½ of the project area.

Forest Plan Direction:

In addition to O-WL-1, O-WL-2, O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to Boreal owl:

- In known or good potential breeding habitat, maintain or restore quality habitat conditions: suitable nesting habitat adjacent to or within ½ mile of foraging and roosting habitat. (O-WL-20)

Analysis Indicators:

1) Impacts to Suitable habitat. This is measured by

1a. acres and percent of mature aspen-birch forest (MIH 4 mature+) adjacent to foraging lowlands greater than 10 acres in size that would remain with each alternative. This represents nesting habitat.

1b. acres and percent of mature lowland black spruce forest (MIH 9+) greater than 10 acres in size that would remain with each alternative. This represents foraging habitat.

No management activities are proposed that will improve or restore habitat for boreal owl so no indictor was chosen to address this. However, it should be noted that in order to maintain existing potential nesting habitat mitigations were applied to many proposed units.

Direct/Indirect Effects

There are no known boreal owl nest sites in the project area, however they have been detected. Boreal owl habitat does currently exist in the project area (see maps in project record). Quality habitat is not widespread in the area but primarily concentrated in the Kawishiwi Triangle area.

Roads and trail (temporary, system, and special use) should have a minimal impact on boreal owls as long as they don't directly impact boreal owl nesting and foraging habitat. Many of the proposed roads use already existing road corridors which are not owl habitat. New construction would be located to avoid disturbance to as much wetland and mature forest as feasible and temporary roads would be decommissioned after use. Gravel pits would have a minimal impact on boreal owls since they are already existing and not located in quality owl habitat. Prescribed burning should have a minimal impact on boreal owls as long as they don't kill existing or potential nest trees in quality habitat. Prescribed burn objectives should ensure this does not happen.

Alternative 1

This alternative could have a beneficial effect on boreal owl. Stands would continue to grow into potential nesting and potential nest trees would continue to be created by pileated woodpeckers. This alternative would maintain the most suitable habitat (*Table BE – Boreal Owl-1*).

Alternatives 2 and 3

Both action alternatives would maintain the same amount of suitable foraging habitat. Alternative 3 would maintain more nesting habitat than alternative 2 and both maintain less than alternative 1 (*Table BE – Boreal Owl-1*). Both alternatives would remove fairly high amounts of suitable nesting habitat in the Kawishiwi Triangle area, and this area hold the greatest likelihood of supporting nesting owls. (see maps in project record). Nesting habitat was selected for harvest to meet other objectives; mainly they were adjacent to previous clearcuts and would consolidate the young forest into larger blocks. This removal of potential nesting areas in high quality habitat could have negative effects to boreal owls in the Glacier area. However, both alternatives would attempt to protect, through mitigation measures, quality boreal owl nesting habitat: mature upland forest nesting habitat (>70

year old aspen and conifer mixed forest) adjacent to lowland conifer forest foraging and roosting habitat. These mitigation measures should help offset this loss of habitat. The harvested nesting habitat should continue to provide some level of nesting opportunities for boreal owls since large trees will be left that could provide cavities. Boreal owls will nest in clearcuts as long as there are old trees left that provide cavities (Steve Wilson, personal communication with Dan Ryan)

Table BE – Boreal Owl-1. Effect to Suitable Habitat

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3	
Prey Habitat	acre	%	acre	%	acres	%	acres	%
1a. nesting habitat	7,632	31	8,331	36	6,174	28	6,536	30
1b. foraging habitat	3,142	62.6	3,130	62.5	3,130	62.5	3,130	62.5

Data source: Existing condition for vegetation indicators are based on frozen August 2007 CDS data, and all alternatives are based on projected CDS data in the year 2017.
Other Footnotes: Percentage of nesting habitat is the percent of total upland deciduous forest on federal lands in the project area (see MIH data in project file). Percent of foraging habitat is the percent of total lowland black spruce forest (5,006 ac).

Cumulative Effects

At the Landscape Ecosystems scale mature aspen-birch forest (MIH 4) is expected to decrease but the amount of Old increases. On federal lands within these LEs there is anticipated to be a reduction in mature upland patches (less than 300 acres) and a reduction in interior forest but an increase in mature lowland patches greater than 300 acres. Harvest by other landowners in the project area (Appendix C) has the potential to further reduce boreal owl nesting, and to a lesser extent, foraging habitat. Most of the other owners will follow the MFRC guidelines which will help retain possible nesting trees in their harvest units. Private land would continue to be bought and sold which could reduce boreal owl habitat.

2005 Forest-wide monitoring (Annual Monitoring Report 2006) showed a slight decrease in mature upland deciduous and a slight increase in upland mature conifer habitat which are both still above FEIS projected condition. It also showed a slight decrease in mature lowland conifer which is slightly below FEIS projected conditions.

This analysis is consistent with the cumulative effects expected in the Programmatic BE for the forest plan where habitat conditions are not anticipated to improve with implementation of the plan. Due to the location of this project (not in prime boreal owl habitat) and the small amount of boreal owl habitat impacted by this, compare to the amounts available forest wide, implementation of Forest Plan Standards and Guidelines together with MFRC best management practices, including maintenance of leave trees and reserve islands in harvest areas should prevent a negative trend in viability.

Determination

The proposed resource management activities planned in the project area for Alternative 2 and 3 may impact individuals but are not likely to cause a trend to federal listing or loss of viability. Alternative 2 would reduce more potential nesting habitat across the entire project area, however both alternative have the same impacts to suitable nesting in the primary area of suitable habitat in the project area (the Kawishiwi Triangle). The majority of this reduction comes from harvesting older aspen greater than 70 years of age. Some harvest of this old aspen is needed to regenerate aspen for future nest habitat. Harvest units should continue to provide some nest habitat through legacy patches and reserve trees/islands left along the wetland/upland interface. This should help offset the loss of nesting habitat. Reduction of fragmentation and the increase of the conifer component in the Project Area should help provide better boreal owl habitat in the long-term. It is important that mitigation measures are followed, especially in the Triangle area. This determination is consistent with the

determination in the Forest Plan Programmatic BE. Alternative 1 will have no effect on boreal owls. Nesting habitat would continue to increase.

All Alternatives are consistent with Forest Plan O-WL-18, G-WL-11, G-WL-12, O-WL-20 and S-WL-5. Boreal owl specific Standards and Guidelines S-WL-6 and G-WL-13 do not apply since they pertain to known nest sites. If any nests are discovered they will then be implemented.

Mitigations

- If a boreal owl nest site is discovered, immediately contact the District Wildlife Biologist.
- If any nesting pairs are discovered, avoid all activity that may disturb known nesting pairs during the nesting season (March 1 – June 1).
- In potential boreal owl nesting habitat, consolidate reserve areas and leave trees along wetland boundary to maintain potential nesting trees. Leave large aspen capable of producing cavities.
- Continue surveys adjacent to a subset of harvest units to locate potential breeding owls.

OLIVE-SIDED FLYCATCHER

Existing Condition

Population and trend: MacLean (1999) summarizes that olive-sided flycatcher (*Contopus cooperi)* has a large breeding range that includes the wooded areas of Canada, Alaska, and the western and northeastern U.S. While secure in some places, a large and significant decline has occurred in many areas. Breeding Bird Survey data for North America shows the species declined 4% per year between 1966 and 1998, 5% per year between 1986 and 1998, and more than 1.5% per year in northern Minnesota between 1966 and 1996 (Sauer et al. 1999). A few individuals are detected each year on songbird monitoring plots in the Superior National Forest but numbers are not large enough to estimate population trends (University of Minnesota Natural Resources Research Institute web site).

NRRI's Breeding Bird Monitoring effort surveys 169 stands on the Superior. It has been detected in 37 stands. However, detections are rare and irregular with only one detection in 20 of the stands during the period of 1991 thru 2005. A detection of a nesting olive-sided flycatcher was reported on the Gunflint Ranger District in 2005 (Annual Monitoring Report 2006).

Habitat needs and limiting factors: Olive-sided flycatchers nest most frequently in larger black spruce-tamarack bogs or in large openings with residuals (USDA Forest Service 2000b). MacLean (1999) states they use burned or cleared areas with standing trees, primarily conifers. Beaver ponds are important habitat. Timber harvest does not provide habitat if it results in an even aged stand with little variation in canopy height, or few dead standing trees. At least 50 acres of habitat may be needed to support a single territorial pair (Niemi and Hanowski 1992, updated 2001). The primary threat to the species, however, appears to be destruction of wintering habitats in the Andes of South America.

Habitat trend: Unknown, possibly decreasing with fire suppression, salvage logging of fire-killed trees, and clearcuts with few residual trees or little variety in canopy structure.

Forest Plan Direction

In addition to O-WL-1, O-WL-2, O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to olive-sided flycatcher:

- Maintain, protect, or improve quality nesting and foraging habitat. This is defined as a variety of boreal forest (generally 10-20%canopy cover) including uplands, lowlands, edges, and beaver meadow with a preponderance of standing live or dead large trees used for perching and foraging, especially spruce or tamarack. High association with riparian and riverine area. (O-WL-25)

Analysis Indicators

1) Impacts to Suitable habitat. This is measured by

acres and percent of young upland conifer forest (MIH 5 young), older riparian forest (MIH 10 mature+) and older lowland black spruce-tamarack forest remaining with each alternative

Direct/Indirect Effects

Roads and trails (temporary, system, special use) should have a minimal impact on olive-sided flycatchers as long as they don't directly impact nesting and foraging habitat. Many of the proposed roads use already existing road corridors which are not flycatcher habitat. New construction will be located to avoid disturbance to as much wetland habitat as feasible. Gravel pits would have a minimal impact since they are already existing and not located in quality habitat. Prescribed burning could have a positive impact on flycatchers due to the possible creation of snags.

Alternative 1

Direct effects would not occur because no planned activities would occur in suitable habitat. Through already planned harvests young conifer forest (MIH 5) is increased slightly from existing condition in the 10 year analysis window (*Table BE – Olive-sided Flycatcher-1*). However, existing habitat would be maintained with fairly good distribution (map in project file).

Alternatives 2 and 3

Existing flycatcher habitat should not be affected by any proposed management activities since low-density conifer lowlands would not be harvested and riverine/riparian areas would be maintained or enhanced through proper riparian management found in the State Best Management Practices (BMP's) and Forest Plan Standards and Guidelines. Also, residual trees would be left during harvest activities.

The project could enhance potential flycatcher habitat in upland forests that are harvested leaving residual trees and more varied forest structure. Residual trees would be left in all harvest units with forest structure most varied in partial harvests and birch shelterwood management. Alternative 2 harvests more area to create temporary openings with residual trees than does Alternatives 3. Given the rarity of the species, all Alternatives create more than adequate temporary habitat for the species in the project area.

Forest Plan O-WL-25 involves maintaining, protecting or improving quality nesting and foraging habitat in mainly riparian or riverine areas. All alternatives would maintain all existing habitat and action alternatives would improve some borderline habitat through harvest, underplanting of riparian areas and retention of leave trees and snags.

Table BE – Olive-sided Flycatcher-1. Effect to Suitable Habitat

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3	
Impacts to Suitable habitat	acre	%	acre	%	acres	%	acres	%
1. amount of young upland conifer forest	230	1	463	1	2,999	8	2,067	6

Data source: Existing condition for vegetation indicators are based on frozen August 2007 CDS data, and all alternatives are based on projected CDS data in the year 2017.
Other Footnotes: Percentages are the percent of total upland and lowland forest on federal lands in the project area (42,203 acres)

Cumulative Effects

Based on Forest-wide projected habitat trends on federal lands (2006 Annual Monitoring Report) in the project Landscape Ecosystems the amount of young upland conifer (MIH 5) increases providing much more potential habitat as long as timber harvests that create this habitat include residual standing conifer trees that provide needed habitat structure. Forest-wide objectives, standards and guidelines will move more upland riparian forest (MIH 10) to a mature condition.

This project, combined with other similar timber sales on the Superior National Forest as well as other ownerships could enhance habitat for this species if abundant conifer residuals are left, especially in large openings. MFRC Management Guidelines should be followed by the State, County and Potlatch and most of the other private landowners in the Project Area during their harvest activities (Appendix C). These guidelines recommend maintaining an adequate amount of residual trees during harvest operations. It is recognized that historically, fire disturbance in upland conifer would have created abundant forage habitat that timber harvest may not be able to replicate at the cumulative effects scale. This result is lower habitat and amount than would occur under natural

conditions. This analysis is consistent with the cumulative effects analysis conducted for the Programmatic BE for the forest plan.

Determination

The proposed resource management activities planned in the project area may have a beneficial impact to olive-sided flycatchers under all alternatives. Lowland and riparian flycatcher habitat should not be affected by management activities and all other harvest activities should retain an adequate amount of residual trees, especially partial harvests and birch shelterwood types, to increase temporary flycatcher habitat over existing. This determination is consistent with the determination in the Forest Plan Programmatic BE. All Alternatives are consistent with the Forest Plan direction

Mitigations

- In the "remainder zone" of conifer units, maintain 10-20% canopy cover for quality olive-sided flycatcher habitat, were possible.

BLACK-THROATED BLUE WARBLER

Existing Condition

The black-throated blue warbler is area sensitive, requiring large, relatively intact areas of continuous canopy forest. Research from the eastern parts if its range (Robbins et. al, 1989) suggests that areas at least 2,500 acres in size and greater than 70% closed canopy are needed to support populations. Fragmented habitats create conditions for American redstarts (*Setophaga ruticilla*) and chestnut-sided warblers (*Dendroica pensylvanica*) that compete with and exclude black-throated blue warblers from an area. Small amounts of fragmentation in otherwise interior forest result in moderate populations of American redstarts and chestnut-sided warblers. In such cases, the likelihood of these species invading adjacent interior patches after a disturbance event is relatively low. As fragmentation of interior forest increases and interior patches become smaller and more isolated, populations of American redstarts and chestnut-sided warblers become much higher and denser in the fragmented landscape. In these situations, the likelihood of these species invading interior patches after even a slight amount of disturbance is much greater. Secure populations of black-throated blue warblers require large areas of interior forest with little or no fragmentation in the form of canopy openings.

NRRI's Breeding Bird Monitoring effort has detected black throated blue warblers in 50 of 169 stands but they have been rather rare (SNF Annual Monitoring Report 2006). This species uses large contiguous northern hardwood forests and is probably associated with small gaps and a well-developed understory (especially Canada yew). Black-throated blue warblers are found only in relatively large blocks of contiguous mature forest (Robbins et al. 1989). It nests in small trees, saplings, or shrubs in dense undergrowth, within about a meter of the ground (Holmes et al. 1986, NatureServe 2007).

Risk factors include timber harvest (including thinning and partial harvest), forest fragmentation, reduction of mature forest patch size, and cultured forests that remove structure. The salvage of patchy blow-down can negatively impact the species, although patch harvest for stand management may improve conditions.

Forest Plan Direction:

In addition to O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to heather vole:

- none

Analysis Indicators

Impacts to Suitable habitat. This is measured by

1) acres and % of mature aspen-birch forest (MIH 4 mature +) remaining with each alternative
2) number and acres of mature upland patches greater the 300 ac remaining with each alternative
3) acres of interior habitat (MIH 12) remaining by alternative. This indicator in combination with indicator 4 is used to assess potential declines in habitat suitability and potential for increase in competition from American Redstarts and chestnut-sided warblers.
4) acres of partial harvest planned in aspen-birch forest

Table BE –Black-Throated Blue Warbler-1. Indicators of direct and indirect effects to Black Throated Blue Warbler

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3	
	acre	%	acre	%	acres	%	acres	%
1. Upland Forest in Suitable Habitat[1]	17,752	47.7	18,237	49.0	14,220	38.2	15,048	40.8
	acres	#	acres	#	acres	#	acres	#
2. 300+ acre patches	14,027	21	15,471	23	12,210	23	12,367	20
	acres		acres		acres		acres	
3. acres of interior habitat	5,150		5,699		4,923		5,113	
4. partial harvest planned in suitable habitat	n/a		0		2,891		2,070	

Data source: Existing condition for vegetation indicators is based on August 2007 CDS data, and all alternatives are based on projected CDS data in the year 2017.
Other Footnotes: Percentages are the percent of total upland forest on federal lands in the project area (37,185 acres) [1]

Roads and trails (temporary, system, special use) should have a minimal impact on black-throated blue warblers as long as they don't directly impact nesting and foraging habitat. Many of the proposed routes use already existing road corridors which are not warbler habitat. Gravel pits would have a minimal impact since they are already existing and not located in quality habitat. Prescribed burning could have a short-term negative impact by removing the understory vegetation. Long-term it could lead to a more diverse multi-layered stand creating better habitat quality.

Alternative 1
No direct effects are expected. Indirectly, changes in habitat suitability would occur. Through succession some mature aspen-birch forest habitat (MIH 4) would succeed to spruce fir forest. The numbers of large mature patches increase also as a result of succession. As stands continue to mature the amount of interior habitat available in the project area would increase from existing condition. No management induced gaps would be created in mature upland aspen-birch forest. Existing roads would continue to fragment some potential habitat. In general, this alternative would result in a small beneficial increase in habitat for the black-throated blue warbler.

Alternative 2 and 3
Direct effects could occur with all action alternatives in the form of disturbance from timber harvest and road construction during the nesting season. The risk of these potential impacts in generally expected to be low and within acceptable risk levels. Forest plan standards and guidelines would be implemented to protect (with a seasonal restriction) known sites if black throated blue warblers are found. Table *BE –Black-Throated Blue Warbler-1* provides the results of analysis indicators. All action alternatives would result in less mature upland forest habitat (8 to 10% reduction) and all would result in an increase in some within stand fragmentation from implementing approximately 2,000 acres of partial harvest. This could have negative indirect effects to the black-throated blue warbler, but in combination with maintaining all large patches and decreasing interior forest around 13%, these effects are expected to be minimal because project area wide habitat would continue to be well distributed. Although outside the analysis time frame, longer-term alternatives 1 and 2 may begin to provide the most beneficial effect as partial harvest treatment begin to result in multi-layering and increase in within stand complexity.

Cumulative Effects

It would be difficult for and unlikely that other ownerships, or combinations of ownerships, would provide very much suitable interior habitat for this species. Providing habitat for the black-throated blue warbler in the Project Area is going to rely heavily on national forest management in cooperation with state and county land managers with intermingled land parcels. Habitat availability outside of the national forest boundaries would probably be scarce. The cumulative effects for this species are likely to be worse than those projected for the National Forests (Appendix C). The Annual Monitoring Report (2006) showed a slight Forest-wide increase in mature upland forest. This may provide more habitat for this species. This analysis is consistent with the cumulative effects analysis conducted in the programmatic BE for the forest plan.

Determination

The proposed resource management activities planned in the project area may impact individuals but are not likely to cause a trend to federal listing or loss of viability for alternatives 1 and 2. All alternatives will maintain well distributed habitat and maintain large mature patches and most interior forest habitat. This determination is consistent with the determination in the Forest Plan Programmatic BE. Alternative 1 will have no effect on the black throated blue warbler. All Alternatives are consistent with Forest Plan direction.

Mitigations

- Implement seasonal restrictions to protect known black throated blue warblers if known to occur within a stand.

BAY-BREASTED WARBLER

Existing Condition

Population and trend: Maxson (1999) summarizes that bay-breasted warbler (*Dendroica castanea*) breed throughout the spruce-fir forest of Canada and the northernmost parts of the U.S. following the range of spruce budworm (*Choristoneura fumiferana*). The project area is at the very edge of the range in Minnesota (Janssen 1987), although vegetation data from the time of European settlement shows most of it as spruce-fir forest. Populations are decreasing rangewide (4.5%/year in North America between 1986 and 1998, Sauer et al. 1999) but trends in northeastern Minnesota are unknown. Loss of habitat, change in vegetation composition, management to control spruce-budworm, fire suppression, and deforestation in wintering habitat all contribute to the population decline.

Habitat needs and limiting factors: Maxson (1999) summarizes that bay-breasted warbler breeds primarily in old spruce-fir forests, sometimes pine, and also in spruce bogs and coniferous riparian areas. They breed in forests where the conifers are dominant or co-dominant trees. We do not have information about their use of black spruce lowlands in Minnesota. They need patches of spruce budworm outbreak over a large area. Birds often move to such an area in large groups. It is possible that maintenance of a viable and well-distributed population may require patches of relatively unfragmented old spruce-fir forest of more than 3,000 acres capable of hosting a large enough spruce budworm outbreak. Robbins (1989) suggested that some warblers may require extensive areas of interior forest habitat but research has not been done to find out to determine its applicability to bay-breasted warbler in northeastern Minnesota.

Habitat trend: Decreasing (Maxson 1999). Green (1995) states that conifer dominated stands have decreased and been replaced by aspen over the past 100 years, indicating that less habitat is available at present compared to 100 years ago. Today the landscape has more habitat fragmentation due to limits on size of timber harvests, and previous Forest Plan emphasis on management for edge species such as deer, and mixed ownership. USDA Forest Service data show that spruce budworm defoliation in the eastern United States dropped substantially in 1986 from 5-8 million acres per year prior to that to less than 1 million acres per year after 1985. In Minnesota, there were about 70,000 of spruce-budworm defoliation in 1999 compared to a million acres in 1958.

Forest Plan Direction:

In addition to O-WL-1, O-WL-2, O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to bay-breasted warbler:

- none

Analysis Indicators

Impacts to Suitable habitat. This is measured by
1) acres and % of mature spruce fir forest (MIH 6) because it represents most habitat requirements of the bay-breasted warbler that would be affected by this project.

Table BE –Bay-breasted Warbler-1. Indicators of direct and indirect effects to Bay-breasted Warbler

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3	
	acre	%	acre	%	acres	%	acres	%
1. Mature and older upland spruce fir forest	3,830	10.3	4,489	12.1	4,216	11.3	4,330	11.6

Data source: Existing condition for vegetation indicators is based on August 2007 CDS data, and all alternatives are based on projected CDS data in the year 2017.
Other Footnotes: Percentages are the percent of total upland forest on federal lands in the project area (37,185 acres) [1]

Direct/Indirect Effects
Effects to Bay-breasted warblers will be analyzed by comparing the amounts of mature spruce-fir forest and any increases in spruce-fir forest between alternatives. The project area has very limited habitat for the bay-breasted warbler.

Roads and trails (temporary, system, special use) should have a minimal impact on bay-breasted warblers as long as they don't directly impact nesting and foraging habitat. Many of the proposed routes use already existing road corridors which are not bay-breasted habitat. Gravel pits would have a minimal impact since they are already existing and not located in quality habitat. Prescribed burning may have a negative impact on bay-breasted warblers due to the killing of balsam fir within the pine stands.

Alternative 1
There would be a slight increase in habitat as a result of succession. This could have slight beneficial impacts on the species

Alternative 2 and 3
There would be a slightly less suitable habitat than in the no action alternative however; levels would be higher than exist today. This project also avoided most fir stands for clearcut harvest for this and other species. Due to the limited amount of habitat, impacts of both action alternatives would be minimal.

Cumulative Effects
This project, combined with other similar timber sales on the Superior National Forest as well as other ownerships (Appendix C), will continue to maintain more aspen than existed prior to European settlement in the project area. This translates to less habitat than would have been available for bay-breasted warbler 100 years ago.

Spruce-fir forest is currently below Forest Plan objectives in the NSU and all LE's in the Project Area. The Minnesota Forest Resources Council Landscape Committee set a goal to increase spruce-fir forest in Minnesota. These spruce-fir goals will also be used as a guideline, to varying extents, by other land management agencies in the Project Area. Therefore, amounts of spruce-fir forest should continue to be maintained or move closer to objectives in the NSU and LE's through conversion to spruce-fir or through natural succession. The Annual Monitoring Report (2006) showed a slight increase Forest-wide in both mature spruce-fir and mature lowland conifer forest which may benefit this species.

Determination
The proposed resource management activities planned in the project area may impact individuals but are not likely to cause a trend to federal listing or loss of viability in alternative 2 and 3. There is an increase of bay-breasted warbler habitat under all alternatives due to the large amount of 40 year old spruce-fir habitat in the project area growing into the mature age class. Retention of all mature patches of forest greater than 300 acres and other spruce-fir forest deferred from harvest for other reasons should provide an adequate amount of habitat to provide for the viability of this species in the Project Area. This determination is consistent with the determination in the Forest Plan Programmatic BE. Alternative 1 will have no effect to the bay breasted warbler.

Mitigations
None identified.

BALD EAGLE

Existing Condition

Population and trend: Recovery goals in the United States have been met. The final rule to de-list the bald eagle was published July 9, 2007. (USDI 2007b) Statewide there appears to be a 28% increase in active nests from the 2000 survey (MN DNR 2006a). On the Superior National Forest the 2005 survey shows a 15.4% increase in active nests from 2000 (MN DNR 2006a). In or adjacent to the project area there are 14 known bald eagle nests.

Habitat needs and limiting factors: Eagles are known to use suitable habitat in the Forest during the spring and summer for breeding, nesting, and raising young. The maintenance of successful reproducing eagles requires a balance of suitable habitat, low contaminants in prey, and low human disturbance. Suitable nesting habitat consists of stands dominated by mature and old growth timber or younger forest with a remnant component of older super (above) canopy trees located within 0.25 miles streams and lakes bearing predominantly shallow water fish species. Nests are sometimes found further from water than 0.25 miles. On the Superior National Forest, 85% of nest trees selected by eagles are large-diameter, old age, white pine (Lindquist 1990). Eagle habitat also includes foraging and roosting areas within 1.5 miles of nesting areas. Limiting factors for eagle appear to be suitable nesting and roosting sites and disturbance from humans during the nesting season.

Forest Plan direction:

In addition to O-WL-1, O-WL-2, O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to bald eagle:

- None

Analysis Indicator:

1) Impacts to suitable habitat. This is measured by

1a. Acres and percent of White and Red Pine Forest (MIH 7), within potential eagle habitat (½ mile of fish bearing waters, greater than 20 ac) that would result with each alternative

1b. acres of diversity planting planned within potential eagle habitat that would result with each alternative

2) Impacts of Human Access/disturbance. This is measured by

2a. Miles of open roads within potential eagle habitat (½ miles of lakes and streams 20 acres or greater) that would result with each alternative. This indicator includes all unclassified, OML 1 and OML 2 roads.

2b. Nest sites that have activities planned within ¼ mile

Direct/Indirect Effects

Alternative 1

This alternative would have no additional effects on Bald Eagle. Amount of pine habitat for nesting and roosting would remain about the same as is found on the landscape today (*Table BE –Bald Eagle-1)*. No additional pine habitat would be added for future nesting and roosting areas. No sites would be disturbed by management activities. Amount of open roads on potential habitat would remain constant providing potential for human disturbance.

Alternatives 2 and 3

Alternatives 2 and 3 could benefit eagle by increase red and white pine in the landscape both through restoration of these forest types and diversity planting within other forest types. Both alternatives could further benefit eagle through a slight reduction of open roads within potential eagle habitat. Both alternatives propose vegetation management and fuels project (such as burning) in close proximity to several known nest sites. These activities could negative affect eagles if activities are conducted during the nesting period. Imposing a seasonal restriction for these activities could mitigate the potential negative effects.

Brush disposal, relocation of road to Smitty's resort, use and expansion and rehabilitation of gravel pits, adding existing unauthorized winter trails to the system, reconstructing the Madden Lake road and improvement of stream crossings would have little to no effect on eagles in the Glacier area.

Table BE –Bald Eagle-1. Indicators of direct and indirect effects to Bald Eagle

Indicators	Existing Condition		Alt 1 No Action		Alt 2 Proposed		Alt 3	
Impacts to habitat	acre	%	acre	%	acres	%	acres	%
1a. amount of white and red pine forest type, within potential eagle habitat.	2,300	7.8	2,245	7.7	2,370	8.1	2,354	8.1
	acre		acre		acres		acres	
1b. amount of diversity planting of pine planned within potential eagle habitat	n/a		0		3,400		2,900	
Disturbance	Miles		Miles		Miles		Miles	
2a. amount of open roads within potential eagle habitat	244		244		239		240	
	sites		sites		sites		sites	
2b. number of nests sites that could be disturbed	n/a		none		579 664 668 683 684		579 664 668 684	

Data source: Existing condition for vegetation indicators are based on frozen August 2007 CDS data, and all alternatives are based on projected CDS data projected in the year 2017. Roads indicator data for Existing Condition and alternatives are based on Aug 2006 road arcs coverage data and Glacier project roads shapefile created by Dan Hernessmaa and edited by David Hernandez.
Other Footnotes: Percentages are the percent of total upland forest on federal lands in potential eagle habitat (½ mile of fish bearing waters, greater than 20 ac) (29,141 acres) For indicator 2a miles of roads with the following class were counted: atvt, ca, cs, njat, njd, su, sunj, sutr, tr, uatv, und, utr

Cumulative Effects

Additional impacts to eagle would occur on lands outside of National Forest jurisdiction. Though it is very difficult to estimate the cumulative effect resulting from management of the National Forests along with neighboring land management and land uses in the reasonably foreseeable future (approximately the next 10 years), we can estimate cumulative effects related to habitat conditions (amount of red and white pine forest) and human disturbances.

Terrestrial habitat – Red and White Pine Forest

Based on Minnesota Generic Environmental Impact Statement Study on Timber Harvesting and Forest Management practices (GEIS) (Jaakko Poyry 1994) red and white pine forest acres are expected to increase. The amount of old forests in both these forest types is also expected to increase. Cumulative effects of forest management on all ownerships should benefit eagle by increasing preferred nesting, roosting, and perching habitat over the next four or more decades on both NFS and non-NFS lands.

Human Access/Disturbance

Increases in the potential for human access near bald eagle territories would occur as people buy, subdivide, and develop private parcels of land. New road construction would be needed to access this property. Some of these roads may be developed near to current or future nesting habitat.

Development of cabins and second homes next to lakeshores could also decrease high quality eagle habitat through actual destruction of potential nesting habitat or indirectly through increases in disturbance associated with motorized recreation such as ATVs and motorboats. Populations of fish, one of the primary types of prey species for eagle, may decrease on lakes with increased fishing pressure. Increasing fish populations through Minnesota DNR stocking would mitigate fish declines in some lakes.

Over the last ten years eagle mortality is becoming increasingly more common from highway collisions (Based on information from Raptor Center 2004). This is likely a result of greater numbers of deer killed along highways and eagles taking advantage of the carrion. Because of their large size and weight, eagles may not be able to fly up high enough off the dead deer, when flushed by oncoming vehicles, in time to avoid collision. With increasing deer populations and increasing numbers of road-killed deer, the cumulative effects of forest management that promotes increasing deer habitat, this indirect negative impact has an increasing potential to result in more harmed or killed eagles along highways both within and off the National Forests.

Based on an increasing population of eagles, overall adverse cumulative impacts to eagle from human disturbance and habitat modification would not be significant enough to reverse its positive population trend.

Determination

The proposed resource management activities planned in the project area *may impact individuals but are not likely to cause a trend to federal listing or loss of viability* in bald eagle. Habitat conditions (red and white pine) would remain the same or increase with the action alternatives. Action alternatives would result in a slight reduction of open roads within potential eagle habitat. Seasonal restriction on some management activities would mitigate potential negative effects from disturbance (see mitigations below).

Mitigations

- Activities planned in the following units should not occur between Feb 15 and Oct 1 to protect nesting eagles (when nests are active).

- Where they occur, all super-canopy red and white pine trees should be retained, where possible in the units that are within ¼ mile of bald eagle foraging areas

- If any a new bald eagle nest is found during project implementation, activities would be temporarily halted in the area. The District Biologist would be consulted and appropriate mitigation measure would be designed and carried out prior to restarting operations.

CONNECTICUT WARBLER

Existing Condition

Population and trend: Rieck (1999) summarizes that the Connecticut warbler (*Oporornis agilis)* breeds from British Columbia to Quebec including the northern Lakes States. The bird is very secretive and difficult to detect. Breeding bird survey data show a 5%/year population decline between 1986 and 1988 in North America (Sauer et al. 1999). NRRI songbird monitoring (Lind et al. 2001) over the past ten years in Minnesota and Chequamegon National Forests shows a significant decline ($p \leq 0.01$). The mean smoothed count per stand dropped from 1.5 to 0.1 on the Chippewa National Forest. NRRI's Breeding Bird Monitoring effort surveys 169 stands on the Superior. It has been detected in 41 stands on the SNF during the period of 1991 thru 2005 (Annual Monitoring Report 2006).

Habitat needs and limiting factors: USDA Forest Service (2000c) notes that Connecticut warbler breeds in short-needle conifer with low ericaceous shrubs (3 feet or less). They may also be in jack pine with a dense blueberry understory. They forage on the ground and in low shrubs. Boreal bogs that are 100 acres of larger are typical habitat in northeastern Minnesota. Territories of a breeding pair are about 1.2 acres. Trees should be at least 15-30 feet tall. Typical habitat consists of wet areas with black spruce, tamarack, mosses, alder, dogwood, Labrador tea, bog rosemary, bog laurel, and leather leaf (Rieck 1999).

Habitat trend: Rieck (1999) and USDA Forest Service (2000c) state that wintering habitat in northern South America is declining and breeding habitat may also be in decline rangewide.

Forest Plan Direction:

In addition to O-WL-1, O-WL-2, O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to heather vole:

- none

Analysis Indicators

Impacts to Suitable habitat. This is measured by

1) acres and % of mature jack pine forest (MIH 8).
2) acres and % of mature lowland black spruce forest (MIH 9). These were chosen for analysis because they represent the most common nesting and cover habitat for Connecticut warblers. This analysis recognizes the limitation that not all mature jack pine provides suitable habitat.
3) acres converted to jack pine will be measured and compared. This analysis is conducted to measure potential future habitat.

Table BE – Connecticut Warbler-1. Direct and indirect effects to Connecticut warbler

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3	
	acre	%	acre	%	acres	%	acres	%
1. MIH 8 mature+ acres and (%) of MIH 1	3,124	8.4	3,313	8.9	2,908	7.8	3,066	8.2
2. MIH 9 mature+ acres and (%) of MIH 9	4,482	89.3	4,630	92.5	4,369	87.3	4,479	89.5
	acres		acres		acres		acres	
3. acres of conversion to jack pine forest	n/a		0		1,351		1,037	

Data source: Existing condition for vegetation indicators are based on frozen August 2007 CDS data, and all alternatives are based on projected CDS data in the year 2017.

Other Footnotes: Percentage of nesting habitat is the percent of total upland deciduous forest on federal lands in the project area (37,185 acres). Percent of foraging habitat is the percent of total lowland black spruce forest (5,006 ac).

Direct/Indirect Effects

There would be minimal impacts to boreal bogs under all alternatives. The primary impact to Connecticut warblers would presumably be from logging nesting habitat during the breeding season (May 15 to August 1). Roads and trails (temporary, system, special use) should have a minimal impact on Connecticut warblers as long as they don't directly impact nesting and foraging habitat. Many of the proposed routes use already existing road corridors which are not bay-breasted habitat and wetlands will be avoided whenever possible. Gravel pits would have a minimal impact since they are already existing and not located in quality habitat. Prescribed burning may have a positive impact on Connecticut warblers if the burning stimulates growth of the understory within the pine stands.

Alternative 1

Indirect effects could occur in the form of changes to suitable habitat (**BE – Connecticut Warbler-1**). During the analysis timeframe (10 years) more jack pine and lowland black spruce-tamarack forest will grow into a mature age class potentially providing more suitable habitat for these species. This increase in habitat should be favorable to the species.

Alternative 2 and 3

Indirect effects could occur with all action alternatives with changes to suitable habitat (*BE – Connecticut Warbler-1*). Both action Alternatives would have similar results. Both mature jack pine forest and mature lowland black spruce-tamarack habitat Indicators would be less than predicted with the no action alternative. However, both would occur at amounts similar to what is on the landscape today. Amounts vary by alternative by not by a large degree. This increase in habitat should be beneficial to the species.

Cumulative Effects

This project, combined with other similar timber sales on the Superior National Forest (Appendix C) as well as other ownerships could impact habitat for this species by altering understory vegetation or by directly impacting nest sites during the breeding season. The cumulative impact of the project would be minimal since the primary habitat for the species (large boreal bogs) should not be impacted by the USFS or other ownerships in the Project Area except for limited timber harvest. Forest-wide monitoring showed a slight increase in mature lowland conifer (Annual Monitoring Report 2006).

Determination

The proposed resource management activities planned in the project area may impact individuals but are not likely to cause a trend to federal listing or loss of viability under alternatives 2 and 3. There is very limited harvest in large boreal bogs and very small amounts of jack pine in the project area. This determination is consistent with the determination in the Forest Plan Programmatic BE. Alternative 1 will have no effect

Mitigations

None identified.

THREE-TOED WOODPECKER

Existing Condition

Population and trend: Drey (1999) summarizes that three-toed woodpecker (*Picoides tridactylus*) breed throughout coniferous forests in Canada and the western U.S., and in northern Minnesota and Wisconsin. Population trends are unknown. NRRI's Breeding Bird Monitoring effort surveys 169 stands on the Superior. It has not detected three-toed woodpeckers on the SNF; however timing and location of survey routes are such that this species is not adequately surveyed (Annual Monitoring Report 2006). Casual observations have been made of this species on the forest.

Habitat needs and limiting factors: Three-toed woodpecker is a species of boreal and montane coniferous forests. It usually inhabits mature or old-growth coniferous stands with abundant insect-infected dead and dying trees (Leonard 2001). Even in predominately living forests, Three-toed woodpeckers forage mainly on dead and dying timber. In the lake states region they seem to nest mainly in spruce and balsam snags and mature trees. This dependence on insect-infected dead and dying timber frequently results in populations showing an association with forest disturbances such as fire, wind throw, floods, insect outbreaks and disease. In particular, Three-toed woodpecker populations often show an increased abundance in early post-fire successional seres (Burdette and Niemi 2002a). According to Green and Niemi (1980), black spruce/tamarack stands are the vegetation community most likely to contain Three-toed woodpeckers in Minnesota.

Studies have also found that they are more likely to occur in larger areas of virgin forest vs. smaller patches (Burdette and Niemi 2002a) suggesting forest fragmentation may harm Three-toed woodpeckers. In summary, Three-toed woodpeckers generally inhabit larger patches of recently burned or decadent old growth coniferous (primarily spruce) stands (Burdette and Niemi 2002a).

Threats facing this species include habitat loss, fire suppression, salvage logging, conifer conversion to aspen, beaver control and poor snag retention policies. Quality habitat on the Superior has been greatly reduced due to the above factors. Promotion of conifer and retaining residual trees (preferably long-lived, windfirm conifers) in large openings may maintain or enhance habitat conditions for three-toed woodpeckers.

Habitat trend: Drey (1999) reports that habitat is decreasing rangewide. Fire suppression, salvage logging, clearcutting without abundant conifer reserve trees, maintenance of aspen, beaver and spruce budworm control, and habitat fragmentation threaten habitat. Forest management that removes conifers that have the potential to have high populations of insects, especially wood-boring beetles, is detrimental to the three-toed woodpecker (Niemi and Hanowski 1992).

Forest Plan Direction:
In addition to O-WL-1, O-WL-2, O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to the three-toed woodpecker:

- Maintain or improve quality nesting and foraging habitat by managing toward the LE Vegetation Objectives for mature and older conifer forest. (O-WL-23)
- The amount and distribution of dead and dying trees should provide adequate representation of patterns and amounts that would result from natural disturbance. If natural disturbances do not provide adequate habitat, it may be necessary to emulate natural disturbance through management ignited fire or other treatments.
- Protect known nest sites within a 200-foot radius surrounding nest sites until young have fledged.
- Where ecologically appropriate, retain 6-10 jack pine per acre in even-aged regeneration harvests in mixed conifer stands.

Analysis Indicators

1) Impacts to Suitable habitat. This is measured by acres and percent of mature and older jack pine forest (MIH 8 mature+) and spruce-fir forest (MIH 6+) remaining with each alternative

2) Enhancements in habitat condition: This is measured by the acres of conversion to conifer. This measures a long-term enhancement.

Table BE – Three –toed woodpecker-1. Direct and indirect effects to three toed woodpecker

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3	
Impact to suitable habitat	acre	%	acre	%	acres	%	acres	%
1. amount of suitable habitat	8,312	22.4	9,119	24.5	8,585	23.0	8,809	23.7
Enhancement indicator	acres		acres		acres		acres	
2. amount of conversion planned	n/a		0		1,653		1,179	

Data source: Existing condition for vegetation indicators are based on frozen August 2007 CDS data, and all alternatives are based on projected CDS data in the year 2017.
Other Footnotes: Percentages are the percent of total upland forest on federal lands in the project area (37,185 acres)

Direct/Indirect Effects

Road system management and gravel pit use and expansion would have minimal effects on this species except where dead trees are removed within suitable habitat. The removal of foraging trees is anticipated to be relatively low with these activities. Prescribed burning may be beneficial to this species if it leads to some mortality of overstory trees.

Alternatives 2 and 3

There is a very limited amount of lowland black spruce harvest (<3% by type) under both action alternatives (*Table BE – Three –toed woodpecker-1*). Harvest was designed to reduce fragmentation by harvesting adjacent to existing clearcuts. There will also be black spruce leave trees left in these harvest areas which will provide temporary habitat for Three-toed woodpeckers. All Alternatives also increase potential future habitat for three-toed woodpeckers by planting a combination of white pine and white spruce with Alternative 2 planting the most.

Many of the currently mature upland patches over 300 acres would be retained under all action alternatives. These large blocks could provide habitat for three-toed woodpeckers. Long-term, fragmentation will also be reduced under all action alternatives as shown by the reduction of edge density of young forest patches.

Mitigation measures included for all alternatives should provide good foraging habitat for three-toed woodpeckers. Six to ten jack pine trees per acre will be left in even-aged jack pine clearcuts and upland black spruce/jack pine clearcuts. Trees will be left evenly spaced or clumped depending on site conditions.

The species is probably not common in the project area at the present time. Timber harvest during the breeding season could result in reduced reproduction that year and loss of individuals, although it would be a very small chance given species rarity and the absence of large areas of standing conifers killed recently by fire or flood.

Alternative 1
There would be a minimal impact to Three-toed woodpecker habitat. Additional habitat could be provided by occasional insect infestation, beaver flooding and small wildfires.

Cumulative Effects
Prior to European settlement, natural fire regimes in mature conifer and large amounts of old growth forest would have created abundant foraging habitat for Three-toed woodpeckers in the Northern Superior Uplands. Clearing of the forests and fire suppression after settlement reduced the amount of suitable habitat available for this species.

Habitat is decreasing rangewide, due to fire suppression, salvage logging, clearcutting without abundant conifer reserve trees, maintenance of aspen forest types, beaver and spruce budworm control, and habitat fragmentation. Forest management that removes conifers that have the potential to have high populations of insects, especially wood-boring beetles, is detrimental to the Three-toed woodpecker. The Annual Monitoring Report (2006) shows a slight increase in mature lowland conifer forest which could benefit this species.

Other ownerships (especially the State) have started converting some aspen stands to conifer stands which should help increase habitat (Appendix C). The July 4th-windstorm created large areas of habitat for this species in other parts of the Superior National Forest. Beaver control measures would probably be similar between all alternatives and would be mainly driven by fur prices, with higher trapping when fur prices are higher. During low fur prices, beaver populations may increase and thereby increase ephemeral Three-toed woodpecker habitat (flood-killed trees).

Determination
The proposed resource management activities planned in the project area may impact individuals but are not likely to cause a trend to federal listing or loss of viability under alternatives 2 and 3. There is limited harvest in lowland black spruce habitat, large mature patches will be protected and mitigation measures will provide habitat in harvest units. This determination is consistent with the determination in the Forest Plan Programmatic BE. Alternative 3 will have no effect. All Alternatives are consistent with the Forest Plan direction.

Mitigations
- Leave a few clumps of long-lived and wind-firm residual conifer trees in clearcuts, especially in large openings, for potential future habitat (when trees are dying).

- Leave 6 to 10 jack pine per acre in jack pine clearcuts and upland black spruce/jack pine clearcuts when appropriate. Leave trees evenly spaced when possible or in clumps on less windfirm sites.

- Immediately contact Wildlife Biologist if a three-toed woodpecker nest is discovered.

GREAT GRAY OWL

Existing Condition

Population and trend: Kozie (1999) summarizes that great gray owl (*Strix nebulosa)* has a holarctic distribution and also breeds in the western United States and in the northern Lakes States. Available evidence does not indicate a decline in the United States. Populations are limited by the availability of pre-existing nest sites and prey. Surveys have been conducted for stick nests and several have been found to-date in the area. Great gray owls were surveyed in the project area in 2006 and 2007 using both call playback and listening stops. Five survey routes were run and consisted of 70 survey points along roads. These routes were run 2 to 4 times in the spring both years. Four great gray owls were detected within the project area. Owls were found to be nesting in one location.

Habitat needs and limiting factors: Kozie (1999) states that natural foraging habitat for great gray owls include anywhere meadow voles (*Microtus pennsylvanicus*) are abundant and available to great gray owls. Meadow vole abundance is influenced by season (more numerous in late summer and fall), a 3-5 year cycle in Minnesota, and habitat capacity. They prefer moist soils and relatively open areas with high primary production of prey (meadow voles). Kozie (1999) summarizes that great gray owl breed in a variety of vegetation types. Nesting commonly occurs in mature aspen adjacent to muskegs. Minimum nest stand size in studies was 10 acres in Manitoba and 27 acres Alberta. Foraging occurs in open habitat, including bogs, selective and clear-cut logged areas with residual perches, natural meadows, and open forests within 1.5 miles of the nest. Perches need not be tall; they can be high stumps, broken-off trees, and the short black spruce found in peatland bogs. Voles 50 feet or more from a perch or forest edge are not available to great gray owls. Kozie (1999) states that great gray owls avoid jack pine, taller black spruce, dense forest cover, large open treeless areas without perches, and habitats with a dense shrub layer for nesting and foraging sites. They also avoid concentrations of predators such as great horned owls. Average home range size for breeding adults was 1.7 mile^2 in Oregon and a Minnesota study found 8 nests in 20 mile^2.

Kozie (1999) recommends the following forestry practices to maintain or enhance great gray owl habitat: 1) Restriction of harvest unit size to < 25 acres with a mosaic of multi-sized units, 2) retention of forest stands within 900 feet of known or potential nest trees or sites, 3) provision of hunting perches in clearcuts, 4) ensuring irregularly shaped harvest units with maximum distance across the cut < 300 feet, and 5) maintenance of forested travel corridors, 150-300 feet wide, should be left between cut areas for moving and sheltered resting places. In the Pacific Northwest, the USDA Forest Service recommended providing a no-harvest buffer of about 300 feet around meadows and natural openings and establishment of a 1320-foot protection zone (125 acres) around nest trees. Kozie (1999) recommended placing priority on maintaining nesting habitat within 0.5 and 1.5 miles of natural openings rather than clearcuts.

Habitat trend: Suitable habitat has likely decreased from historical levels due to permanent land conversion to other use and unsuitable forest types. Current population and trends are unknown, however it was estimated that approximately 200 great gray owl pairs are found in Minnesota year around (Jaakko Poyry, 1992). The winter of 2004/2005 saw a large influx of great gray owls from Canada probably due to low small mammal numbers in Canada. Most of these birds returned north in the spring.

Forest Plan Direction:

In addition to O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to great gray owl:

- In known or good potential breeding habitat, maintain or restore high quality habitat conditions (O-WL-21)

Indicators

1) Impacts to Suitable habitat. This is measured by

1a. acres and % of mature upland forest (MIH 1 mature+) remaining with each alternative. This represents nesting habitat.

1b. acres and percent all lowland conifer forest and non-forest lowlands (all MIH 9 and nonforest lowland LEs), and young upland forest (MIH 1 young) remaining with each alternative. This represent foraging habitat.

2) Enhancements in habitat condition: This is measured by the acres of young upland forest (MIH 1 young) created through treatment that is located within ½ mile of suitable nesting habitat (MIH 1 mature+). Treatments include clear-cut, PC-30, seed tree and shelterwood harvest or burning that creates young forest. This is a measure of potential short-term foraging habitat created.

Direct/Indirect Effects

Roads (temporary roads, and system roads and trails) should have a minimal impact on great gray owls. Owls forage readily along roadsides. Many of the proposed roads use already existing road corridors which are not owl nesting habitat and wetlands will be avoided whenever possible. Gravel pits would have a minimal impact since they are already existing and not located in quality habitat. Prescribed burning should not have an impact on great gray owls unless there was a nest present in the stand.

Logging in nesting habitat could impact the great gray owl in all alternatives, by removing suitable nesting structure. Consequently, harvest can also create more temporary foraging habitat in some conifer forest types. Also, maintaining large mature patches of upland forest would help to ensure suitable interior nesting habitat would be available across the landscape. And implementation of Minnesota Forest Resources Council's Voluntary Site-Level Forest Management Guidelines (MFRC 1999b) would help to ensure that snags, reserve trees, and down wood are provided in all harvested stands.

The project area contains natural habitats that may serve as foraging habitat for great gray owl. The project would create additional temporary foraging habitat for great gray owl with clearcut, partial and shelterwood harvest.

Alternative 1

This alternative would have a minimal impact to great gray owl habitat. No new temporary foraging habitat will be created on USFS land and all existing nesting habitat will be retained. Foraging habitat will be reduced over time as existing young clearcuts age. Foraging habitat will have to be provided solely by sedge meadows, shrub wetlands, and sparsely stocked lowland forests after fifteen years on USFS land.

Alternatives 2 and 3

Both action alternatives would provide more foraging than existing conditions and the no action alternative. Both will also have a decrease in nesting habitat compared to existing and the no action. Both alternatives maintain both good quality foraging and nesting habitat which is well distributed across the project area (see maps in project record). Both action alternatives would follow the great gray owl specific Forest plan objectives and guidelines; O-WL-21, G-WL-14 and G-WL-15. Currently known nest and newly found nests would be protected.

Table BE – Great gray owl-1. Direct and indirect effects to Great Gray Owl

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3	
Impacts to habitat	acre	%	acre	%	acres	%	acres	%
1. Nesting habitat	25,964	69.8	27,654	74.4	22,951	61.7	24,051	64.7
2. Foraging Habitat	10,476	22	9,691	21	15,018	32	13,523	29
Habitat enhancements	acres		acres		acres		acres	
Foraging habitat created	1,293		0		5,831		4,352	

Data source: Existing condition for vegetation indicators are based on frozen August 2007 CDS, and all alternatives are based on projected CDS data in the year 2017.
Other Footnotes: Percentage of nesting habitat is the percent of total upland forest on federal lands in the project area (37,185 acres). Percentage of foraging habitat is the percent of total federal lands in the project area (47,000 ac)

Cumulative Effects

This project, combined with other similar timber sales on the Superior National Forest as well as other ownerships (Appendix C) could impact habitat for this species, both positively and negatively. Potential nesting habitat would be harvested and additional temporary foraging areas would be created. The overall impact should not be significant as long as sufficient nesting habitats are maintained within 1.5 miles of natural foraging habitats and MFRC leave tree guidelines are followed. Forest-wide habitat monitoring (Annual Monitoring Report 2006) showed a slight increase in mature nesting habitat and a slight decrease in young foraging habitat. Forest Plan Management of large mature patches and Goshawk habitat will benefit this species as well.

Determination

Alternatives 2 and 3 may impact but not likely to cause a trend to federal listing or loss of viability of great gray owl. Adequate amount of suitable nesting and foraging habitat appear to be available with all alternatives. Site specific standards and guidelines would help to protect know and newly discovered nest sites from adverse affects of forest management. This determination is consistent with the determination in the Forest Plan Programmatic BE. Alternative 1 would have no effect on the great gray owl. All Alternatives are consistent with the forest plan direction.

Mitigations

- Follow MFRC leave trees guidelines
- Immediately contact District Wildlife Biologist if a stick nest and/or great gray owl nest is discovered.
- Protect any known great gray owl nest and avoid disturbance of nesting pairs during the critical nesting season (March 1 – June 1).(G-WL-15)
- Survey all burn units located in good quality owl habitat prior to burning to locate any potential nests.

AQUATIC WILDLIFE

Three Regional Forester Sensitive Species (RFSS) fish, two RFSS mussels, and one RFSS aquatic insect occur on the Superior National Forest:

SENSITIVE FISH:	Lake Sturgeon (*Acipenser fulvescens)* Shortjaw Cisco (*Coregonus zenithicus)* Northern Brook Lamprey (*Ichthyomyzon fossor)*
SENSITIVE MUSSELS:	Creek Heelsplitter (*Lasmigona compresssa)* Black Sandshell (*Ligumia recta)*
SENSITIVE INSECT:	Quebec Emerald (*Somatochlora brevicincta)*

The known or likely occurrence of a RFSS species or its habitat within the project area was first evaluated to determine the need for analysis. If a species was known or likely to occur within the project area or if the suitable habitat is present in the project area, additional analysis indicators were used to evaluate potential direct, indirect, and cumulative effects. Lake Sturgeon and Shortjaw Cisco are not known to be present or have appropriate habitat so they will not be further analyzed.

NORTHERN BROOK LAMPREY

Existing Condition

The northern brook lamprey is a non-parasitic lamprey that is uncommon with a relatively restricted range. They require moderately warm, low-gradient streams with sections of higher gradient (riffle) reaches suitable for spawning. They are most common in streams of medium size, averaging 19m wide and 0.7m deep; but can occur in smaller (1m to 3m wide) and larger rivers (30m to 100m wide; Becker 1983). Spawning occurs in May to June in gravel areas near riffles about 0.3m deep (Becker 1983). Larval forms (ammocoetes) require soft substrate (approx. 80% sand and silt) for burrowing, often among vegetation at depths of 0.2m to 0.6m (Becker 1983). Ammocoetes diet consists of diatoms and unicellular algae and growth is rapid; larvae require organically enriched, sandy substrate until metamorphosis. After a 3 to 6 year growth period, metamorphosis occurs and adults spawn about 3-4 months afterwards; as adults they do not feed and are believed to die a few days after spawning (Becker 1983). Northern brook lamprey occur in several watersheds on the Superior National Forest in streams of medium size. This species has not been documented within the Glacier Project Area. Habitat for this species in the analysis area is very limited and marginal based on size of streams and potential substrate; potential streams in the project area are smaller and with more course substrate than the typical northern brook lamprey habitat described above. However, due to its presence in a variety of habitat conditions on the Superior National Forest, it is somewhat likely that this species may occur within the project area. Potential habitat within the project area may include Keeley Creek and Nira Creek.

Analysis Indicator*:* ***change in the number of stream crossings***. This indicator assesses the change in the number of road/stream crossings resulting from either decommissioning and/or new road construction that are proposed within the Project Area for each alternative. This indicator does a good job of highlighting differences among alternatives because it represents the potential effects to instream and riparian habitats, potential erosion and point source sediment input at stream crossing sites, as well as potential effects to stream flow, flood flow capacity, and sediment transport. Additionally, this indicator is very useful for determining potential effects to aquatic organism passage and stream connectivity. These potential changes can affect populations and habitat of aquatic RFSS if not properly mitigated.

Direct/Indirect Effects

Alternative 1 – No Action Alternative

No vegetative treatments and no new stream crossings are proposed under alternative 1, therefore there would be no negative impacts to northern brook lamprey or their habitat. Under the no action alternative, improvement of watershed conditions and reduction in sediment sources would not occur from stream crossing improvements. Continued use of some of these stream crossings may continue to contribute sediment into local streams and potentially affect brook lamprey spawning habitat and passage

Alternative 2 and 3 – Action Alternatives

There are no new stream crossings proposed in the two stream systems with potential Northern Brook Lamprey habitat (Keeley and Nira Creek); A stream crossing improvement project is located on the upper portion of Keeley Creek. Short term direct impacts to individuals may occur during stream crossing improvement; however, those impacts will be short term and negligible compared to the benefits to this and other aquatic species in having an improved stream crossing that provides passage and adequate stream flow, flood flow capacity, and natural sediment transport.

Alternatives 2 and 3 each propose to increase the total number of stream crossings associated with new roads. Although this addition would temporarily increase the crossing density, they would be offset by those crossings proposed for decommissioning and be removed themselves after the temporary use. New temporary stream crossings may temporarily impact northern brook lamprey and habitat by increasing localized sediment inputs into streams, unnaturally confining and increasing stream flows, reducing sediment transport, decreasing flood flow capacities, and creating potential fish migration barriers unless properly designed and constructed. These potential impacts would continue until roads are decommissioned after use.

Alternatives 2 and 3 also propose various levels of vegetative management within the Keeley Creek and Nira Creek watershed. Proposed vegetative management associated with alternatives 2 and 3 would not likely affect individuals, populations, and/or habitat of northern brook lamprey provided that required design criteria and mitigation measures are followed during implementation. These design criteria have been developed to maintain or restore riparian ecological function within riparian areas. Under these design criteria, no harvest of trees would occur within certain distances of different types of streams except for the purpose of maintaining or restoring riparian ecological function.

Cumulative Effects

It is likely that historical events have affected individuals and populations of northern brook lamprey within the Glacier Project Area, the Superior National Forest, and on adjacent non-federal lands. It is possible that historical timber harvest, road and trail construction, and poorly designed stream crossings, may have affected lamprey habitat and ammocoete survival by contributing sediment, increasing stream temperatures, and altering stream flow (USDA Forest Service 2004b). Standards and guidelines in the Forest Plan will help to ensure that USFS activities will not contribute to cumulative effects. In addition to Federal standards and guidelines, State, private and local land owners and managers follow established best management practices that should also contribute to eliminating cumulative effects. Provided that best management practices are implemented by all land owners and managers, there should be no cumulative effects to northern brook lamprey and habitat.

Determination

After considering the direct, indirect, and cumulative effects, it has been determined that both action alternatives *may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.*

Mitigation and Recommendations

Follow all relevant design criteria and mitigation measures described in EIS. In addition to required design criteria and mitigation measures, all Forest-wide desired conditions, objectives, standards and guidelines contained in the Superior National Forest Land and Resource Management Plan apply, including those established for: 1) Watershed Health, Riparian Areas, and Soil Resources, 2) Terrestrial and Aquatic Wildlife; and 3) Transportation System (USDA Forest Service 2004b).

CREEK HEELSPLITTER AND BLACK SANDSHELL MUSSEL

Existing Condition

The creek heelsplitter mussel typically occurs in small headwater streams and requires riverine habitat conditions to survive and proliferate (Anderson 2001). It has also been documented at or near river inlets in lakes on the Superior National Forest (MNDNR 2002). Although the creek heelsplitter is capable of self-fertilization, it relies extensively on host fish species for its parasite life stage (glochidia larvae) and dispersal (Anderson 2001). Because of its habitat and host fish requirements, the creek heelsplitter may be affected by vegetative management and road construction activities that could potentially increase sedimentation and stream flow as well as create potential host fish migration barriers at road crossings. Due to this species habitat requirements and existing habitat conditions, it is possible that it occurs in areas within the project area.

The black sandshell mussel is primarily a riverine species that requires deep run or glide habitat in wide rivers with moderate current (USDA FS 2004a). Although the Superior National Forest is near the edge of this species range, it has been documented in several locations in the St. Louis River system (MN NHR 2006 database, MNDNR 2002). The nearest occurrence of this species is in the St. Louis River (MNDNR 2002). The black sandshell mussel also relies on host fish species for its parasitic stage and dispersal. Because of its habitat and host fish requirements, the black sandshell mussel may be affected by vegetative management and road construction activities. Due to this species habitat requirements and existing habitat conditions, it is possible that it occurs in areas within the project area.

Both the black sandshell and creek heelsplitter mussel have marginal habitat within the project area with no known species occurrence; however, one known location for creek heelsplitter exists in the BWCAW in the Kawishiwi River and is adjacent to and within the same watershed as the Glacier Project Area. The Kawishiwi River is the only likely habitat for these two mussel species within the project area and disturbance near those riparian areas with respect to vegetation and transportation management is minimal.

Analysis Indicator: The number of new stream crossings associated with alternatives is a useful indicator for evaluating potential effects to aquatic sensitive species because it is a good index of potential change in sediment input, stream flow, and channel conditions, as well as the potential for fish migration barriers, stream connectivity and/or habitat loss.

Direct/Indirect Effects

Vegetative management activities, new road construction, and stream crossings may affect individuals, populations, and/or habitat of creek heelsplitter and black sandshell mussels within the Glacier project area by potentially increasing inputs of fine sediment into local streams, increasing or rerouting stream flow, increasing stream temperatures, and disrupting existing and/or future habitat unless properly mitigated. Activities at or near road stream crossings may also affect distribution of mussels and movement of their host fish species. Both action alternatives have various levels of vegetative management with associated new road construction.

Alternative 1 – No Action Alternative

No vegetative treatments and no new stream crossings are proposed under alternative 1, therefore there would be no negative impacts to northern brook lamprey or their habitat. Under the no action alternative, improvement of watershed conditions and reduction in sediment sources would not occur from stream crossing improvements. Continued use of some of these stream crossings may continue to contribute sediment into local streams and potentially affect brook lamprey spawning habitat and passage

Alternatives 2 and 3

Proposed vegetative management associated with alternatives 2 and 3 would not likely affect individuals, populations, and/or habitat of creek heelsplitter and black sandshell mussels provided that required design criteria and mitigation measures are followed during project implementation. These design criteria have been developed to maintain or restore riparian ecological function within near-bank and remainder zone areas. Under these design criteria, no harvest of trees would occur within certain distances of different types of streams except for the purpose of maintaining or restoring riparian ecological function. Alternatives 2 and 3 each propose no new stream crossings; however some new roads are proposed within the project area.

Cumulative Effects

Substrate quality, channel stability, and host fish migration opportunities are key habitat components for maintaining individuals, populations, and habitat of creek heelsplitter and black sandshell mussels (USDA Forest Service 2004a). It is likely that historical timber harvest, road and trail construction, and poorly designed stream crossings may have affected RFSS mussels and habitat by altering stream channels and flow, contributing sediment into local streams, increasing stream temperatures, and restricting host fish migration (USDA Forest Service 2004a). Standards and guidelines in the Forest Plan will help to ensure that USFS activities will not contribute to cumulative effects. In addition to Federal standards and guidelines, State, private and local land owners and managers follow established best management practices that should also contribute to eliminating cumulative effects. Provided that best management practices are implemented by all land owners and managers, there should be minimal cumulative effects to creek heelsplitter and black sandshell mussels and habitat.

Determination

Provided that all design criteria and mitigation measures required by this BE as well as those included in the Glacier EIS and Forest Plan are followed during implementation, there is a low risk that the activities associated with the action alternatives would affect creek heelsplitter and black sandshell mussels and habitat. After considering the direct, indirect, and cumulative effects, it has been determined that both action alternatives *may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the population or species.*

Mitigation and Recommendations

Follow all relevant design criteria and mitigation measures described in the Glacier EIS. In addition to required design criteria and mitigation measures, all Forest-wide desired conditions, objectives, standards and guidelines contained in the Superior National Forest Land and Resource Management Plan apply, including those established for: 1) Watershed Health, Riparian Areas, and Soil Resources, 2) Terrestrial and Aquatic Wildlife; and 3) Transportation System (USDA Forest Service 2004b).

QUEBEC EMERALD DRAGONFLY

Existing Condition

The Quebec emerald dragonfly (*Somatochlora brevicincta*) is known to occur on the Superior National Forest (Wayne Steffens, personal communication, 2006). Due to this species habitat requirements and existing habitat conditions, it is possible that it occurs in the Glacier project area.

The Quebec emerald typically occurs in lentic environments. "Habitat is predominantly bogs, fens, and heaths. The microhabitat is water-suspended or water-saturated sphagnum, whether or not associated with open water, and typically showing graminaceous emergents indicating weak minerotrophism. Eggs are laid outside plant tissues on the moss or adjacent water surface, with the larvae likely living within the saturated moss itself rather than on its interface with open water. The species has not been observed at open-water peatland ponds. Landforms in which the habitat can develop will generally be of bedrock or surficial deposits with little mineralizing potential and…may also form adjacent to or within peat bogs or heaths which can form in low relief areas." (NatureServe, 2006).

Analysis Indicator

The analysis indicator for the Quebec emerald is the acres of wetland affected by new road construction. This is a useful indicator of potential habitat degredation in the form of inundation or desiccation of habitat due to water level changes or changes in flow regimes associated with roads. Wet meadow and bogs are potential suitable habitat for the Quebec emerald dragonfly (based on the national wetland inventory and Minnesota wetland type 2 and type 8 wetlands). Acres were calculated based on these two wetland types by buffering new roads 20 meters and calculating the acres of wetland affected.

Direct/Indirect Effects

Alternative 1 – No Action Alternative

There would be no vegetative treatments and no new lowland roads under alternative 1; therefore there would be no negative impacts to Quebec emerald dragonfly or their habitat.

Alternative 2 and 3 – Action Alternatives

New road construction associated with lowland vegetation management may affect individuals, populations, and/or habitat of Quebec emerald within the Glacier Project Area by potential inundation or desiccation of habitat due to water level changes or changes in flow regimes. Potential direct and indirect effects would be considered local and minor over the project area. With all new roads, both new temporary and new system roads, the area of impact is 50 acres or less on wet meadow and bogs within the project area. These two wetland types are potential suitable habitat for the Quebec emerald dragonfly (based on the national wetland inventory and Minnesota wetland type 2 and type 8 wetlands). The potential impact of 50 acres is approximately 0.3% of the total acres of these wetlands types in the project area (13,567 acres). Given high vagility (3 miles/day; NatureServe, 2006) and prevalence of suitable habitat over its range, the overall population in not considered fragile; localized extirpations would likely be re-inhabited shortly after habitat recovery.

Cumulative Effects

Standards and guidelines in the 2004 Forest Plan will help to ensure that USFS activities will not contribute to cumulative effects. In addition to Federal standards and guidelines, State, private and local land owners and managers follow established best management practices that should also contribute to minimizing cumulative effects. Provided that best management practices are implemented by all land owners and managers, there should be no cumulative effects to Quebec emerald dragonfly and their habitat.

Determination

The determination of effects from the proposed alternatives is based upon the direct, indirect, and cumulative effects on populations and habitat of Quebec emerald dragonfly. Provided that all design criteria and mitigation measures are followed during implementation, there is a low risk that the activities associated with the action alternatives would affect this species. Both action alternatives *may impact individuals or habitat, but will not likely contribute to a trend toward federal listing or cause a loss of viability to the populations or species*.

Mitigation and Recommendations

Follow all relevant design criteria and mitigation measures described in the Glacier EIS. In addition to required design criteria and mitigation measures, all Forest-wide desired conditions, objectives, standards and guidelines contained in the Superior National Forest Land and Resource Management Plan apply, including those established for: 1) Watershed Health, Riparian Areas, and Soil Resources, 2) Terrestrial and Aquatic Wildlife; and 3) Transportation System (USDA Forest Service 2004b).

INSECTS

TIGER BEETLE SPECIES

Existing Condition

This species uses sandy or rocky openings, bedrock exposures and gravel pits. It is known to occur in several areas in the project area. Tiger beetles appear to have adapted to the use of gravel pits. They may also use abandoned or little-used logging roads

Analysis Indicators

For this analysis I used the acres of existing gravel pits and the proposed expansion acres to measure the impacts to tiger beetles thru changes is suitable habitat.

Direct/Indirect Effects

Larval habitat of open sandy, gravelly substrate is critical. This stage of habitat is most susceptible to environmental disturbance, as adults can probably disperse to new habitats if disturbance occurs (Steffens 2001). All alternatives would have activities that may negatively impact larval habitat. These include gravel excavation, soil compaction by heavy machinery, vehicles, or RMVs (recreational motor vehicles), and alteration of soil moisture, vegetation, and sun exposure (Steffens 2001). Vegetation succession results in abandonment or dispersal from formerly suitable habitats. The activities in all alternatives that would most commonly cause these changes would include gravel excavation, logging, management-ignited fire, road or trail building and vegetation succession. These same activities, under some circumstances, may also provide new habitats in all alternatives.

Alternative 1

There would be no ground disturbance occurring under Alternative 1. Therefore, there would be no direct or indirect effects to this species.

Alternative 2 and 3

Gravel pit expansion would be the same under all action alternatives. This could lead to an increase in habitat for tiger beetles. There will be mitigation in each gravel pit to ensure that some portion of the pit would not be active, to provide refugia for adult and larval tiger beetles. Timber harvest and the associated road building (temporary and permanent) is higher in Alternative 2 compared to Alternative 3. The project should have minimal direct impact to tiger beetles due to the exclusion of logging in ELT 18 (exposed bedrock). Road construction can create future habitat for the species.

Cumulative Effects

Similar activities will continue on other ownerships (Appendix C). These activities, as on USFS land, could degrade habitat as well as create future habitat. Mining operations can also impact tiger beetles. However, presumably adequate habitat will be maintained. Cumulative effects are expected to be minimal.

Determination

The action alternatives may impact but not likely to cause a trend to federal listing or loss of viability under Alternatives 2 and 3. Alternative 1 will have no effect on the tiger beetle.

Mitigations

- Maintain some portion of the pit in an inactive state, so the area could act as refugia for adult and larval tiger beetles.

MANCINUS ALPINE AND JUTTA ARCTIC

Existing Condition

Jutta Arctic and Mancinus Alpine have not been documented in the project area but it has been located on the Superior National Forest. These species prefer shady, mature black spruce-tamarack forest that is dense enough to be subject to logging or management-ignited fire (MacLean 2001). They may also occur in younger lowland conifer or more open lowland conifer that is not usually subject to logging because of low site productivity. Suitable habitat has likely always been widespread but patchy (USFS, 2004b). Surveys were conducted in the project area with no rare butterflies documented. Threats included timber harvest, management ignited fire, or road construction and use in black spruce-tamarack forest or any other activity that may alter hydrologic conditions of wetland forest (USFS, 2004b).

Forest Plan Direction

In addition to O-WL-1, O-WL-2, O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to sensitive butterflies:

- In all known breeding locations, maintain or restore high quality habitat (O-WL-26)
- Allow only those management activities that protect, maintain or enhance known locations (S-WL-7)

Analysis Indicators

For this analysis I compare the acres of mature lowland conifer forest (MIH 9), by alternative to measure differences in potential impacts, acknowledging limitations of its use. Although MIH 9 is a key habitat type for these species, it is likely that these species occurs in other habitats as well. Until further surveying and study of population status and habitat relationships is conducted, this effect analysis retains uncertainty.

Direct/Indirect Effects

Activities that decrease suitable habitat include timber harvest, management-ignited fire, or road construction and use in black spruce-tamarack forest or any other activity that may alter hydrologic conditions of wetland forests habitat. Changes due to timber harvest or fire are relatively long-term as forests take up to 60 years to become mature again. Road construction or hydrological changes can be either short-term (5-10 years) or long-term (greater than 10 years). I will use miles of new temporary roads affecting wetlands (all wetlands not just Mancinus Alpine and Jutta Arctic habitat) to show the difference between alternatives even though impacts to Mancinus Alpine and Jutta Arctic habitat will be less.

Mature black spruce-tamarack forest that is dense enough to be subject to logging or management-ignited fire is a key habitat for the Mancinus alpine and Jutta Arctic , but the species may also occur in younger lowland conifer or more open lowland conifer that is not usually subject to logging because of low site productivity. It is likely that the Mancinus alpine and Jutta Arctic occurs in habitats other than mature black spruce-tamarack forest and until further surveying and study of population status and habitat relationships is conducted, this effects analysis retains uncertainty.

Table BE –M. Alpine and J. Arctic.

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3	
Impacts to habitat	acre	%	acre	%	acres	%	acres	%
1. suitable habitat	4,482	89.3	4,630	92.5	4,369	87.3	4,479	89.5

Data source: Existing condition for vegetation indicators are based on frozen August 2007 CDS, and all alternatives are based on projected CDS data in the year 2017.
Other Footnotes: Percentage of suitable habitat is the percent of total lowland forest in the project area (5,018 ac)

Alternative 1

There would be no ground disturbance occurring under Alternative 1. Therefore, there would be no direct or indirect effects to any of this species.

Alternative 2 and 3

Both action alternatives show a similar level of mature lowland black spruce habitat compared to existing conditions (*Table BE –M. Alpine and J. Arctic*) as a result of some younger lowland forest growing into this age class. This should lead to a slight beneficial effect for these species. There will also be limited new temporary road construction in wetlands. Alternative 2 has more new temporary roads than Alternative 3. This could lead to some disturbance of these species if it occurs in potential habitat.

Cumulative Effects

Similar activities will occur on other ownerships in the Project Area. Timber harvest and road construction (Appendix C) will continue to have the biggest impact on Mancinus Alpine and Jutta Arctic habitat as we know it. The Travel Management Project may have some long term beneficial effects if lowland roads are closed and allowed to revegitate. It will still be a small percentage of this type affected in the Project Area so cumulative impacts should be minimal. It is likely that the Mancinus alpine and Jutta Arctic occur in habitats other than mature black spruce-tamarack forest and until further surveying and study of population status and habitat relationships is conducted, this cumulative effects analysis remains uncertain. Forest-wide habitat monitoring (Annual Monitoring Report 2006) showed a slight increase to mature lowland conifer which could benefit this species.

Determination

This project may impact individuals of Mancinus alpine and Jutta Arctic, but is not likely to cause a trend to federal listing or loss of viability on the Superior National Forest due to the limited amount of harvest and disturbance in lowland black spruce under alternatives 2 and 3. Alternative 1 will have no effect on these species.

Mitigations

- If Mancinus alpine or Jutta Arctic is found within a proposed harvest unit or road corridor, that district biologist should be consulted with for an appropriate mitigation (O-WL-26 and S-WL-7).

TAIGA ALPINE

Existing Condition
This species has not been located in the project area. But it has been found on other parts of the SNF in Cook and Lake County in 2001 by MacLean (2001) including the McNair Butterfly Management Area. They have been found in black spruce bogs with typical bog plants such as bog laurel, Labrador tea, leather leaf and sedges including patches of cotton grass. They seemed to favor open bog conditions. This habitat is present in the Glacier area and so the species could be present. Since it favors open bog conditions management activities should not affect the population unless there is damage to the understory plant species.

Forest Plan Direction
In addition to O-WL-1, O-WL-2, O-WL-18, G-WL-11, G-WL 12 and S-WL-5 discussed in the introduction to this document the following Forest Plan direction also applies to sensitive butterflies:

- In all known breeding locations, maintain or restore high quality habitat (O-WL-26)
- Allow only those management activities that protect, maintain or enhance known locations (S-WL-7)

Direct/Indirect Effects
Activities that both decrease and increase suitable habitat include timber harvest, management-ignited fire, or road construction and use in black spruce-tamarack forest or any other activity that may alter hydrologic conditions of wetland forests habitat (USDA FS 2000c). There will be no timber harvest in open bogs in the Project Area. Road construction and prescribed fire may impact this habitat type but will be avoided whenever possible. See the Mancinus Alpine and Jutta Arctic discussion for more detailed information. No timber harvest would occur in suitable habitat type under any action alternatives. See Mancinus Alpine and Jutta Arctic discussion for details on road construction. A minimum of this habitat type should be affected by road construction since this type is usually avoided for summer roads and would only be used in the winter for a temporary road. With alternative 1 no impacts are expected.

Cumulative Effects
There should be a minimal impact to open bog conditions by other ownerships in the Project Area since this habitat does not provide adequate timber volume to harvest (Appendix C). The one activity that will affect this habitat type in the future is road construction. The Travel Management Project may have some impacts, both positive and negative, to this species habitat. It will still be a small percentage of this type affected in the Project Area so cumulative impacts should be minimal. Forest-wide habitat monitoring (Annual Monitoring Report 2006) showed a slight increase to mature lowland conifer which could benefit this species.

Determination
This project may impact individuals of Taiga Alpine, but is not likely to cause a trend to federal listing or loss of viability on the Superior National Forest under the action alternatives. Open bog conditions should remain relatively unchanged.

Mitigations

- If Taiga Alpine is found within a proposed harvest unit or road corridor, that district Biologist should be consulted with for an appropriate mitigation (O-WL-26 and S-WL-7).

NABOKOV'S BLUE AND FREIJA'S GRIZZLED SKIPPER

Existing Condition

These species have not been located in the project area. But they have been found on other parts of the SNF in Cook and Lake Counties including the McNair butterfly management area. The Nabokov's Blue butterfly seems to prefer open sandy, grassy jack pine areas with abundant blueberry and dwarf bilberry (*Vaccinium ceespitosum*) primarily on the Vermillion moraine (USFS 2002g, MacLean 2001). This habitat may be present in the project area. Habitat needs for Freija's grizzled skipper are less well understood on the Superior National Forest, but is thought to be provided by upland grasslands, acidic meadows and small grassy opening in boreal forest. Threats to both species include forest succession to ages and forest types that suppress or exclude V*accinium* species and grasses.

Analysis Indicators

For this analysis Vermillion Moraine was assumed to be widespread throughout the Project Area. I used acres of conifer forest (MIH 5), excluding pole-aged stands, to assess habitat conditions. This is intended to be an indicator of acres that could provide the right conditions for these species. This approach has inherent limitations as not all young and mature conifer forest is suitable for these species because of the patchy distribution of bilberry and grassy inclusions. Until further survey and study of population status and habitat relationships is conducted, this effects analysis retains uncertainty.

Direct/Indirect Effects

Creation of young open patches of conifer would sustain habitat for these species in all action alternatives. The effects of establishing young forest are relatively short-term, since conifer grows into pole class at ten years and becomes less suitable for the species (USDA FS 2000c).

Table BE – Nabokov's blue butterfly and Freija's grizzled skipper

Indicators	Existing Condition	Alt 1	Alt 2	Alt 3
	acres	acres	acres	acres
1. potential habitat	8,441	9,875	11,725	11,064

Data source: Data source: Existing condition for vegetation indicators are based on frozen August 2007 CDS, and all alternatives are based on projected CDS data in the year 2017.

Alternative 1

There would be no ground disturbance occurring under Alternative 1. Therefore, there would be no direct or indirect effects to any of these species.

Alternative 2 and 3

Alternative 2 would result in more conifer than Alternatives 1 and 3 (*Table BE – Nabokov's blue butterfly and Freija's grizzled skipper*) as a result of conversion of mature aspen stands to jack pine. However, temporary openings would probably not stay open long enough for these species to colonize, if they are in the area. The project would not impact current known habitat for these species.

Cumulative Effects
Young conifer should continue to be created through timber harvest on other ownerships (DEIS Appendix C). There should be minimal impact to existing young conifer and permanent openings. Forest-wide habitat monitoring (Annual Monitoring Report 2006) showed a no change to young jack pine forest in 2005.

Determination
This project would have no impact on Nabokov's blue or Freija's Grizzled Skipper and is not likely to cause a trend to federal listing or loss of viability on the Superior National Forest under all alternatives.

Mitigations
None identified.

VASCULAR PLANTS, LICHENS, AND BRYOPHYTES

Analysis area and methods

For sensitive plants, the area covered by the analysis of direct and indirect effects includes all lands administered by the Superior National Forest within the Glacier Project area. The area covered by the cumulative effects analysis includes lands of all ownerships within the Glacier Project area. This cumulative effects analysis area was selected because the adjacent non-Forest Service lands in the project area share a number of physical characteristics (e.g. soils, landforms, etc.) which have influenced and constrained land uses in a similar manner. Furthermore, lands of other ownerships are often in close proximity to Forest Service lands. For these reasons, the project area boundary makes a logical analysis unit for cumulative effects.

The time period covered by the cumulative effects analysis is from the 1870's to approximately 2018. The 1870's was chosen because that was when white settlement began to increase in northeastern Minnesota in association with the development of iron mines and timber production (MFRC 1999a). 2018 was chosen because most project activities should be completed within 10 years.

Indicators and habitat groups were used to help evaluate the potential effects of management activities on RFSS plants (Table 17). Indicator 1 describes the number of known RFSS plant occurrences affected by project activities. The remaining Indicators relate to the amount of a ground disturbing activity occurring in different RFSS plant habitats. The Indicators are described below for each of six RFSS plant habitat groups. RFSS plants are grouped by habitat to reduce the amount of repetition in the analysis. The habitat groups are described in more detail in the Biological Evaluation for the Superior National Forest Plan (USDA Forest Service 2004b)

- **Habitat group 1**: RFSS plants of non-forested wetlands, shallow water, and riparian areas
  Indicator: Miles of new lowland road construction on FS lands. This indicator highlights differences between Alternatives well because lowland road construction is one of the only proposed management activities that would have any direct effects to this habitat. Lowlands are considered to be lands classified as ELT 1, 2, 3, 4, 5, or 6. The only new road construction proposed for either alternative are temporary roads.

- **Habitat group 2**: RFSS plants of cliffs and talus slopes
  Indicator: Acres of timber harvest adjacent to rock outcrop areas. This indicator highlights the difference between alternatives well because it measures the amount of ground disturbing impacts proposed for rock outcrop suitable habitat. Rock outcrop areas were identified as mapped Ecological Landtype 18, as areas of visible rock outcrop on air photos, or from having been specifically mentioned in comment letters. Many of the plants in this habitat group use a microhabitat within the rock outcrop, and these microhabitats are hard to quantify. The actual acres of suitable microhabitats affected by the alternatives are likely to be less than that shown for the indicator.

- **Habitat group 3**: RFSS plants of upland disturbed areas (old landings, old roadbeds, etc.)
  Indicators: Acres of upland commercial timber harvest and miles of unclassified road impacted by construction or reconstruction activities. These Indicators highlight differences between Alternatives well because each provides a rough indication of impacts to the types of habitats typically occupied by species in this habitat group. For example, not every acre of commercial timber harvest impacts an acre of disturbed upland areas, but 1000 acres of commercial timber harvest would likely impact more of this habitat than 500 acres of

commercial timber harvest. For the last indicator in this group, the roads covered by the indicator are unclassified roads (which includes unclassified roads that ATV's are using, unclassified roads that are drivable, and unclassified decommissioned roads) that are being converted to classified, special use, or temporary roads.

- **Habitat group 4:** RFSS plants of forested wetlands
  Indicators: Acres of lowland black spruce harvest, and miles of new lowland road construction on FS lands. Acres of lowland black spruce harvest is a good indicator for this habitat since it provides a direct evaluation of how much lowland forest habitat is impacted by alternative. Miles of lowland road construction highlight differences between Alternatives well because lowland road construction also causes direct impacts to this habitat. This latter indicator includes only temporary roads for the Glacier Project; no new lowland system roads are proposed.

- **Habitat group 5**: RFSS plants of northern hardwood forests (sugar maple, basswood, yellow birch, red oak)
  Indicator: Acres of northern hardwood forest types (Forest Type 80's) proposed for treatments. Normally, this indicator is used to evaluate impacts to plants that use northern hardwood forests as suitable habitat. However, since very little of this habitat exists in the project area and because no harvests are proposed for northern hardwood forest types, this indicator is not pertinent for the Glacier Project.

- **Habitat group 6**: RFSS plants of dry to mesic upland forests
  Indicators: Acres of upland commercial timber harvest and miles of new upland road construction on FS lands. These Indicators highlight differences between Alternatives well because each provides an indication of the amount of potential impact to upland forest habitats. Miles of new upland road construction includes both temporary and classified roads.

Table 17. Indicators 1-7 used for RFSS plants effects analysis.

Indicator	Alternative 1	Alternative 2	Alternative 3
1. Number of known sensitive plant occurrences in or next to proposed treatment units	0	7	6
2. Miles of new lowland road construction on FS lands	0	14.4	12.3
3. Miles of new upland road construction on FS lands	0	37.2	30.9
4. Miles of unclassified road impacted by construction and reconstruction	0	24.1	20.1
5. Acres of upland commercial timber harvest	0	7899	5230
6. Acres of lowland black spruce harvest	0	206	130
7. Acres of timber harvest adjacent to rock outcrop areas	0	3118	1453

Sensitive plant survey results

Rare plant surveys were conducted in the Glacier mid-level area in 2006 by a botanist under contract to the Forest Service. Approximately 1311 acres of the project area were surveyed, with surveys focusing on suitable timber stands, as well as some stands selected because they represent high

quality rare plant habitat. An additional 1814 acres were surveyed for RFSS plants in the project area by contract botanists surveying for exploratory drilling proposals in 2005 and 2006. Between 1997 and 2003, there were also four other botanical surveys conducted by contract botanists. Furthermore, portions of the project area were surveyed for rare lichens by University of Minnesota lichenologist Cliff Wetmore in 1999 (Wetmore 2000). University of Minnesota graduate student Becky Knowles surveyed a portion of the project area for lichens in the genus *Peltigera* in summer 2001 (Knowles pers. comm.).

Forest Service contract botanists found several new RFSS plant occurrences in 2005 and 2006 in the Glacier project area. There are no federally threatened or endangered plants in the project area. Details of recent rare plant survey results can be found in CCES (2005) and Schmoller (2006a, 2006b). Details of older rare plant survey results can be found in Bolton and Reed (1997), Walton (1999), Walton (2000), and Pomroy-Petry (2003). New populations of rare plants found during surveys are reported and tracked in the MNDNR Natural Heritage Database (MN DNR 2006).

All sensitive vascular and non-vascular plant species known or suspected to occur in the project area are displayed in Table 2. Six RFSS plant populations occur in stands or on roads proposed for management: club spur orchid (1), cloudberry (1), large-leaved sandwort (2), Canada yew (2), least moonwort (1), and Michigan moonwort (1).

HABITAT GROUP 1: RFSS PLANTS OF SHALLOW WATER AND NON-FORESTED WETLANDS AND RIPARIAN AREAS

Existing Condition

The following sensitive plants use this habitat group and either occur in or have suitable habitat in the analysis area (Table 2): alpine milkvetch, swamp beggar-ticks, floating marsh-marigold, Katahdin sedge, linear-leaved sundew, neat spike rush, moor rush, auricled twayblade, fall dropseed muhly, American shoregrass, dwarf water lily, club-spur orchid, northern bur-reed, awlwort, and lance-leaved violet. One existing winter road that is proposed for use contains a population of club spur orchid. There are 2,619 acres of this type of wetland and riparian habitat scattered throughout the Glacier Project area.

Direct/Indirect Effects

Alternative 1

Indicator 1 and 2 - There would be no ground disturbance occurring under Alternative 1. Therefore, there would be no direct or indirect effects to any of these species.

Alternative 2

Indicator 1 – Number of known sensitive plant occurrences in or next to proposed treatment units. For Alternative 2, road use for accessing units 80-52, 80-54, and 80-84 would have minor short term direct negative impacts to the club spur orchid in the unit. Plants would be driven over, but over the long term effects would be minor because use would be during winter and because the plants are growing in an existing winter road. Any hydrologic impacts associated with the road most likely already exist since the road is an existing road.

Although the following plants are not RFSS, they are considered as Special Concern species by the MN DNR, and effects are discussed briefly here.

For the montane yellow-eyed grass in unit 83-27, brushing activities would avoid the species and there would be no effect to the population.

For the montane yellow-eyed grass and sooty colored beak rush on the winter road accessing units 80-52, 80-54, and 80-84, there would be minor short term negative effects because the plants would be driven over, but over the long term effects would be minor because use would be during winter and because the plants are growing in an existing winter road.

For the few flowered spike rush in unit 14-034, release activities would avoid the species and there would be no effect to the population.

Indicator 2 – Miles of new lowland road construction on FS lands.
There would be no direct negative effect of timber harvesting under alternative 2 since aquatic, non-forested wetland, and non-forested riparian habitats would not be treated. Some sedimentation may be an indirect negative effect of timber harvest, but the open water wetland and perennial/intermittent stream mitigations would help minimize sedimentation effects on suitable habitat for these species. Lowland roads constructed under this alternative would go through some suitable habitat for this suite of species and thus impact suitable habitat, but use would be during frozen conditions (see Appendix E of EA), so no long term negative impacts are expected to suitable habitat for these RFSS plants. Only approximately 1% of the acreage of all wetland types would be directly impacted by creation of lowland roads under this Alternative.

Alternative 3
Indicator 1 – Number of known sensitive plant occurrences in or next to proposed treatment units. For Alternative 3, road use for accessing unit 80-54 would have minor short term direct negative impacts to the club spur orchid in the unit. Plants would be driven over, but over the long term effects would be minor because use would be during winter and because the plants are growing in an existing winter road. Any hydrologic impacts associated with the road most likely already exist since the road is an existing road.

Although the following plants are not RFSS, they are considered as Special Concern species by the MN DNR, and effects are discussed briefly here.

For the montane yellow-eyed grass in unit 83-27, brushing activities would avoid the species and there would be no effect to the population.

For the montane yellow-eyed grass and sooty colored beak rush on the winter road accessing units 80-54, there would be minor short term negative effects because the plants would be driven over, but over the long term effects would be minor because use would be during winter and because the plants are growing in an existing winter road.

For the few flowered spike rush in unit 14-034, release activities would avoid the species and there would be no effect to the population.

Indicator 2 – Miles of new lowland road construction on FS lands. The types of impacts of alternative 3 to plants in this habitat group would be similar to the impacts of alternative 2 described above. Alternative 2 would affect slightly more habitat than Alternative 3, based on the number of miles of new lowland road construction on Forest Service lands (Table 17).

Cumulative Effects

For alternative 1, there would be no cumulative effects to these species since no ground disturbance would occur under Alternative 1.

There would be few cumulative effects of Alternatives 2 or 3 on these species since very little management is proposed in the habitats that they inhabit. In the past, construction and use of lowland roads and wetland draining were the two actions that probably had the biggest impacts on species in this habitat group within the cumulative effects analysis area. At present and in the future, construction and use of roads in lowlands proposed under these Alternatives and elsewhere in the cumulative effects analysis area, including construction of non-jurisdictional roads for access to private developments, temporary roads for mineral exploration projects, future special use permit roads, and roads associated with county or state timber sales would continue to impact suitable habitat, but the proportion of total suitable habitat affected by these activities would be very small.

Summary: Project activities associated with Alternatives 2 and 3 would have only minor negative direct, indirect, and cumulative effects on the suitable habitat for these species. Alternative 2 would impact the greatest amount of suitable habitat, followed by Alternative 3, based on the miles of new lowland road construction on FS lands by alternative (Table 17).

Determination

For Alternative 1, the proposed activities would have no impact on alpine milkvetch, swamp beggar-ticks, floating marsh-marigold, Katahdin sedge, linear-leaved sundew, neat spike rush, moor rush, auricled twayblade, fall dropseed muhly, American shoregrass, dwarf water lily, club-spur orchid, northern bur-reed, awlwort, and lance-leaved violet.

For Alternatives 2 and 3, the proposed activities may impact individuals of alpine milkvetch, swamp beggar-ticks, floating marsh-marigold, Katahdin sedge, linear-leaved sundew, neat spike rush, moor rush, auricled twayblade, fall dropseed muhly, American shoregrass, dwarf water lily, club-spur orchid, northern bur-reed, awlwort, and lance-leaved violet, but are not likely to cause a trend to federal listing or loss of viability.

Additional Mitigations, Design Criteria, and Monitoring

- Monitor the effects of winter road use on the known club spur orchid population
- Avoid the population of montane yellow-eyed grass in unit 83-27 by leaving a 50 foot buffer around the population
- Avoid the population of few-flowered spike rush in unit 14-034 by leaving a 50 foot buffer around the population.

HABITAT GROUP 2: RFSS PLANTS OF CLIFFS AND TALUS SLOPES

Existing Condition

The following sensitive plants use this habitat group and either occur in or have suitable habitat in the analysis area (Table 2): *Cladonia wainoi*, large-leaved sandwort, Appalachian fir clubmoss, *Arctoparmelia centrifuga*, and *Arctoparmelia subcentrifuga.* There is a large amount of apparently suitable habitat for species in this habitat group in the project area. Rock outcrop areas were identified as mapped Ecological Landtype 18, as areas of visible rock outcrop on air photos, or from having been specifically mentioned in comment letters. Many of the plants in this habitat group use a microhabitat within the rock outcrop, and these microhabitats are hard to quantify. The actual acres of suitable microhabitats affected by the alternatives are likely to be less than that shown for the indicator.

Two large-leaved sandwort populations occur in areas proposed for treatment in the Glacier Project. One population is in unit 79-21, which is proposed for thinning to improve habitat for this plant. The other population is along the Spruce Road; this site is proposed for brush cutting and sapling removal to improve habitat for this plant

Direct/Indirect Effects

Alternative 1

There would be no ground disturbance occurring under Alternative 1. Therefore, there would be no direct or indirect effects to any suitable habitat for species in this habitat group.

Alternative 2

Indicator 1 – Number of known sensitive plant occurrences in or next to proposed treatment units. Two large-leaved sandwort populations would be affected by project activities in Alternative 2, and the effects would be beneficial. For the large-leaved sandwort in unit 79-21, thinning would benefit the plant by increasing the amount of light reaching the population. Logging equipment would operate in the population as little as possible to accomplish the thinning and thus minimize any direct impacts to the plants. Logging slash would not be deposited on the plants. Over the long run the increase in light would likely benefit this species. For the large-leaved sandwort along the Spruce Road, the plants would benefit from removal of encroaching brush and saplings; removing the undergrowth would increase the amount of light reaching the plants. Cut brush and saplings would be disposed of away from the population. As described in Appendix D of the EA, a sample of treatment sites would be monitored for weed spread resulting from Glacier Project activities; these two populations would be included in that monitoring to insure that weeds do not start to impact either population.

Indicator 7 – Acres of timber harvest adjacent to rock outcrop areas. Alternative 2 proposes 3,118 acres of timber harvest on and adjacent to rock outcrop areas (Table 17). Some rock outcrop and cliff habitat could experience short term negative impacts as a result of project activities. Ground disturbance from logging activities could cause short term direct impacts to suitable habitat. However, this would be minimized because 74% of the stands covered by this indicator would be harvested during winter, when much less ground disturbance would occur. An indirect effect of this alternative would be an increase in the amount of sunlight reaching the ground. Light levels could increase due to removal of the forest canopy on or next to rocky outcrops, but this would not cause any negative impacts to potential occurrences of these species, particularly *Cladonia wainoi*, which is known to occur on exposed sites with lots of sunlight (USDA Forest Service 2000a).

Another indirect effect of timber harvest in these sites with shallow bedrock would be potential spread of non-native invasive plants. Harvest activities could spread non-native invasive plants and thus degrade suitable habitat for plants in this habitat group. This spread would be minimized by the factors described in more detail in Chapter 3 of the EA: high proportion of winter harvest for stands with rock outcrops, no harvest on mapped Ecological Landtype 18, and operational standards and guides.

None of the other proposed activities in alternative 2 would impact habitat for these plants.

Alternative 3
Indicator 1 – Number of known sensitive plant occurrences in or next to proposed treatment units. Both of the large-leaved sandwort sites described above for Alternative 2 would be treated in Alternative 3. For this indicator, the effects of Alternative 3 would be the same as those described for Alternative 2 above.

Indicator 7 - Acres of timber harvest adjacent to rock outcrop areas. The types of impacts of Alternative 3 to suitable rock outcrop habitat would be similar to the impacts of Alternative 2 described above. However, because Alternative 3 proposes about half as much timber harvest adjacent to rock outcrop sites (Table 17) as Alternative 2, the magnitude of effects of Alternative 3 would be much lower than Alternative 2. Impacts of Alternative 3 would be further reduced by the same factors described above for Alternative 2.

Cumulative Effects
For Alternative 1, there would be no cumulative effects to these species since no ground disturbance would occur under Alternative 1.

There would be few cumulative effects of Alternatives 2 and 3 on these species or their suitable habitat since very little management is proposed that would affect their suitable habitat. Since Europeans began settling the area, there have been relatively few past actions that have impacted this habitat within the cumulative effects analysis area except for road construction and occasional timber harvest. For example, past vegetation management projects may have had some small direct or indirect impacts on cliff or rock outcrop habitat as described above. Current and future actions in the cumulative effects analysis area that could affect this habitat include both road construction and timber harvest. Construction of future special use or non-jurisdictional roads could impact a small amount of rock outcrop habitat, as could current federal timber sales as well as future federal and non-federal timber sales. However, cumulative impacts of Alternatives 2 and 3 would be minimal because these habitats are quite dispersed and only a small proportion of this suitable habitat would be affected by management activities.
Summary: Project activities associated with these Alternatives could have short term direct and indirect negative effects on the suitable habitat for these species. Alternative 2 would have a greater impact on suitable habitat than Alternative 3, based on acres of Indicator 7 (Table 17).

Determination
For Alternative 1, the proposed activities would have no impact on *Cladonia wainoi*, large-leaved sandwort, Appalachian fir clubmoss, *Arctoparmelia centrifuga*, and *Arctoparmelia subcentrifuga*. For Alternatives 2 and 3, the proposed activities may impact individuals of *Cladonia wainoi*, large-leaved sandwort, Appalachian fir clubmoss, *Arctoparmelia centrifuga*, and *Arctoparmelia subcentrifuga*, but are not likely to cause a trend to federal listing or loss of viability.

Additional Mitigations, Design Criteria, and Monitoring

- For the large-leaved sandwort population in unit 79-21, minimize ground disturbance from logging equipment in the population and do not deposit slash on the population
- For the large-leaved sandwort population on the Spruce Road, do not deposit slash on the population.

HABITAT GROUP 3: RFSS PLANTS OF UPLAND DISTURBED AREAS

Existing Condition

The following sensitive plants use this habitat group and either occur in or have suitable habitat in the analysis area (Table 2): pointed moonwort, common moonwort, Michigan moonwort, pale moonwort, ternate grapefern, and least moonwort. It is difficult to quantify how much of this type of suitable habitat exists in the project area. There is one known occurrence of least moonwort next to unit 78-10 along FR181H, which is proposed for use as a winter road in Alternative 2.

Direct/Indirect Effects

Alternative 1

Indicators 1, 4, and 5. There would be no ground disturbance occurring under Alternative 1. Therefore, there would be no direct impacts to any of these species as a result of this project. However, succession and lack of disturbance would probably diminish the amount of suitable habitat in the project area over time under this alternative (USDA Forest Service 2001a, b, c, d, and e), which could lead to long-term downward population trends for any occurrences of these species in the project area. These *Botrychium* species frequently occupy habitats where some disturbance occurred in the past, such as a log landing or old road, and they depend to some degree on disturbance to create suitable habitat.

Alternative 2

Indicator 1 – Number of known sensitive plant occurrences in or next to proposed treatment units. There would be no effects from Alternative 2 to the known least moonwort population by unit 78-10. This moonwort population, which is adjacent to unit 78-10, would be avoided during harvest of the adjacent unit. Part of it would be driven over during use of FR181H, but this use would be during winter during frozen ground conditions when the plants are dormant, and therefore there would be no impacts to the least moonwort population. No logs would be decked on the population.

Indicator 4 – Miles of unclassified road impacted by construction and reconstruction. There are no known occurrences of species in this habitat group on or near unclassified roads proposed for construction or reconstruction, so direct impacts to known occurrences are not expected. However, there would be direct and indirect short-term negative impacts to suitable habitat for these *Botrychium* species from construction and reconstruction activities on unclassified roads. Ground disturbance associated with road construction and reconstruction would cause short-term impacts to suitable habitat – some individuals could be destroyed, since they sometimes occur on old, infrequently used roadbeds. However, over the long term the majority of unclassified roads impacted by construction and reconstruction would still serve as suitable habitat, particularly if the unclassified road is converted to a temporary road or an OML-1 road. Any remaining individuals in treated or untreated portions of the project area could colonize this habitat. Although the biology of these *Botrychium* species is poorly understood (USDA Forest Service 2001a, b, c, d, and e), the creation of new ruderal habitats through project activities would likely perpetuate any populations of these species that may have been missed during project inventories.

Indicator 5 – Acres of upland commercial timber harvest. There would be direct and indirect short-term impacts to suitable habitat for these *Botrychium* species from timber harvest and related activities. Ground disturbance associated with timber harvest would cause short-term impacts to suitable habitat – some individuals could be destroyed. After several years, however, new suitable habitat would be available, such as log landings. Any remaining individuals in treated or untreated portions of the project area could colonize these habitats. Although the biology of these *Botrychium* species is poorly understood (USDA Forest Service 2001a, b, c, d, and e), the creation of new ruderal habitats through project activities would likely perpetuate any populations of these species that may have been missed during project inventories.

Gravel pit use and expansion could have direct and indirect short term impacts to suitable habitat for these *Botrychium* species. Some individuals could be destroyed by this activity. However, all of the areas affected by this activity would still serve as suitable habitat for these species in the long term. Any remaining individuals in treated or untreated portions of the project area could colonize this habitat. Although the biology of these *Botrychium* species is poorly understood (USDA Forest Service 2001a, b, c, d, and e), the creation of new ruderal habitats through project activities would likely perpetuate any populations of these species that may have been missed during project inventories.

Alternative 3

Indicator 1 – Number of known sensitive plant occurrences in or next to proposed treatment units. There are no units or roads proposed in Alternative 3 that have a known occurrence of one of these *Botrychium* species. Therefore, according to this indicator, there would be no impacts to species in this habitat group. The impacts of Alternative 2 to known populations would be mitigated (see discussion for Alternative 2 above), so the direct impacts to known populations of *Botrychium* species would be similar between alternatives.

Indicator 4 - Miles of unclassified road impacted by construction and reconstruction.
The types of impacts of alternative 3 to plants in this habitat group would be similar to the impacts of alternative 2 described above. However, the magnitude of impacts of Alternative 3 would be slightly less than Alternative 2, because only 20.1 miles of road would be affected in Alternative 3 compared to 24.1 miles of road in Alternative 2 (Table 17).

Indicator 5 - Acres of upland commercial timber harvest
The types of impacts of alternative 3 to plants in this habitat group would be similar to the impacts of alternative 2 described above for Indicator 5. Alternative 2 would affect 2,669 acres more habitat than Alternative 3, based on the acres of upland commercial timber harvest (Table 17); therefore, the impacts of Alternative 2 would be greater than Alternative 3 for this indicator.

The proposals for gravel pit use and expansion do not differ between alternatives 2 and 3, so the impacts of gravel pit use and expansion under alternative 3 to plants in this habitat group would be identical to alternative 2.

Cumulative Effects

Very little is known about the distribution of these *Botrychium* species within the cumulative effects analysis area. However, it is unlikely that the lack of ground disturbance associated with Alternative 1 would have any cumulative effects on suitable habitat for these species in the project area.

There would be few cumulative effects of the action Alternatives on these species. Very little is known about the distribution of these *Botrychium* species within the cumulative effects analysis area.

However, similar types of disturbance (for example, timber harvest, road building, and gravel pit development) have occurred within the cumulative effects analysis areas as have occurred within the direct/indirect effects analysis areas. These activities, while sometimes impacting suitable habitat, have also created suitable habitat at the same time. Because ground disturbing activities have created ample suitable habitat in the past and at present, and because similar types of activities will probably occur into the future, it is unlikely that there will be any cumulative effects to species in this habitat group.

Summary: Project activities would have short-term negative direct and indirect effects on suitable habitat for these species in the analysis area. Over the long-term, ground disturbance associated with these Alternatives would maintain or create suitable habitat for these species. Alternative 2 would have slightly greater impacts to suitable habitat for species in this group than Alternative 3, and both would have greater impacts than alternative 1, based on an analysis of Indicators 4 and 5 (Table 17).

Determination

For Alternatives 1, 2, and 3, the proposed activities may impact individuals of pointed moonwort, common moonwort, Michigan moonwort, pale moonwort, ternate grapefern, and least moonwort but are not likely to cause a trend to federal listing or loss of viability.

Additional Mitigations, Design Criteria, and Monitoring

- For the least moonwort population adjacent to unit 78-10 and in and along FR181H, do not deck the logs or deposit slash on the population and ensure that use of FR181H is during frozen ground conditions.

HABITAT GROUP 4: RFSS PLANTS OF FORESTED WETLANDS

Existing Condition

The following sensitive plants use this habitat group and either occur in or have suitable habitat in the analysis area (Table 2): small shinleaf, cloudberry, fairy slipper, ram's head ladyslipper, western Jacob's ladder, *Caloplaca parvula, Certraria aurescens, Frullania selwyniana, Menegazzia terebrata, Ramalina thrausta, Sticta fuliginosa*, and *Usnea longissima*. *Pseudocyphellaria crocata* is analyzed here as well because local occurrences are found in open and forested peatlands. There are approximately 5,897 acres of stands typed as forested wetlands habitat in the project area.

Direct/Indirect Effects

Alternative 1

Indicators 2 and 6. There would be no ground disturbance occurring under alternative 1. Therefore, there would be no direct or indirect effects to any of these species.

Alternative 2

Indicator 2 – Miles of new lowland road construction on FS lands. Alternative 2 proposes the greatest amount of lowland road construction at 14.4 miles, followed by Alternative 3 at 12.3 miles (Table 17). For alternative 2, lowland roads constructed through forested wetlands would potentially cause direct negative impacts (i.e. burial under fill material if it is an all-season classified road) and indirect negative impacts (i.e. increased light levels or change in vegetative composition) to some suitable habitat for these species. For winter roads, impacts such as rutting would be minimized because construction and use would be during frozen conditions. For this alternative, less than 1% of the acreage of all forested wetlands would be directly impacted by creation of lowland roads, so

impacts to this suitable habitat would be minimal. Road construction through lowland cedar and black ash stands would be avoided when possible, but when avoidance is not possible, another RFSS plant survey specific to the lowland road construction would be conducted.

Indicator 6 – Acres of lowland black spruce harvest. For Alternative 2, approximately 206 acres of lowland black spruce harvest are proposed (Table 17), while 130 acres of lowland black spruce harvest are proposed under Alternative 3. These stands are good suitable habitat for small shinleaf, cloudberry, and *Pseudocyphellaria crocata* but poor habitat for the other species in this habitat group. No RFSS plants were found during surveys of lowland black spruce stands, so there would be no direct impacts to known populations. However, there could be indirect negative impacts to suitable habitat for small shinleaf, cloudberry, and *Pseudocyphellaria crocata* due to timber harvest of lowland black spruce stands. The likelihood of impacts is highest for small shinleaf and P. crocata because they are found in closed canopy forests, and the increased light levels resulting from timber harvest could have negative effects on these species. There is less risk for cloudberry which can be found in open tundra habitats. However, impacts to suitable habitat would be minimized because harvest would occur only during frozen conditions when plants are dormant. Only approximately 3% of lowland forest habitat would be affected by lowland black spruce harvest, which further demonstrates the minimal impacts to suitable habitat.

No lowland white cedar, black ash, or mixed conifer stands are proposed for harvest. These lowland forest types are suitable habitat for the other RFSS species in this habitat group (i.e. fairy slipper, ram's head ladyslipper, western Jacob's ladder, *Caloplaca parvula, Certraria aurescens, Frullania selwyniana, Menegazzia terebrata, Ramalina thrausta, Sticta fuliginosa*, and *Usnea longissima*.) There would be no timber harvest-related impacts to these species in alternative 2.

There would be no impacts to species in this habitat group from other proposed project activities associated with Alternative 2.

Although Lapland buttercup is not RFSS, it is considered as a Special Concern species by the MN DNR, and effects are discussed briefly here since it is a forested wetland species. For the Lapland buttercup in unit 95-37, release activities would avoid the species and there would be no effect to the Lapland buttercup population.

Alternative 3

Indicator 2 – Miles of new lowland road construction on FS lands. The types of impacts of alternative 3 to plants in this habitat group would be similar to those described above for alternative 2. However, the magnitude of impacts would be slightly less for Alternative 3, which proposes 12.3 miles of lowland road construction compared to 14.4 for Alternative 2 (Table 17).

Indicator 6 – Acres of lowland black spruce harvest. The types of impacts of alternative 3 to plants in this habitat group would be similar to those described above for alternative 2. However, the magnitude of impacts would be slightly less for Alternative 3, which proposes 130 acres of lowland black spruce harvest compared to 206 acres for Alternative 2 (Table 17).

There would be no impacts to species in this habitat group from other proposed project activities associated with Alternative 3.

Cumulative Effects

For alternative 1, there would be no cumulative effects to these species since no ground disturbance would occur under this alternative.

There would be few cumulative effects of the action Alternatives on these species since very little management is proposed in the habitats that they inhabit, and because such management affects a small proportion of the overall habitat. Since Europeans began settling the area, timber harvest, wetland drainage, and road construction have impacted forested wetlands and reduced the amount and distribution of this habitat within the cumulative effects analysis area (Bradof 1992, Heinselman 1996, Frelich 1998, MN FRC 1999a). More recently, timber sales on federal, State, county, and private lands have changed the age class distribution of lowland black spruce habitats, but have not altered the overall suitability of the habitat for species in this habitat group; see Appendix C in the EA for a summary of current and future timber harvest acres on federal, state, and county lands. At present and in the future, construction and use of roads in lowlands proposed under these Alternatives and elsewhere in the cumulative effects analysis area, including construction of non-jurisdictional roads for access to private developments, temporary roads for mineral exploration projects, future special use permit roads, and roads associated with county or state timber sales would continue to impact suitable habitat, but the proportion of total suitable habitat affected by these activities would be very small. Similarly, current and future timber sales affecting lowlands on state or county lands could change the age class of lowland black spruce forests in the project area, temporarily making some stands less suitable for this suite of sensitive plants. However, the proportion of total suitable habitat affected by these activities would be very small. On the Superior National Forest, potential impacts of these activities would be mitigated by adherence to the Forest Plan standards and guidelines, and on other ownerships the impacts would be mitigated by voluntary adherence to the best management practices (MFRC 1999b).

Summary: Project activities associated with these Alternatives would have only minor direct and indirect negative effects on the suitable habitat for these species. Alternative 2 would have the greatest impacts to suitable habitat, followed by Alternative 3, based on an analysis of Indicators 2 and 6 (Table 17)

Determination

For alternative 1, the proposed activities would have no impact on small shinleaf, cloudberry, fairy slipper, western Jacob's ladder, ram's head ladyslipper, *Caloplaca parvula, Certraria aurescens, Frullania selwyniana, Menegazzia terebrata, Ramalina thrausta, Sticta fuliginosa*, *Usnea longissima,* and *Pseudocyphellaria crocata.*

For Alternatives 2 and 3, the proposed activities may impact individuals of small shinleaf, cloudberry, fairy slipper, western Jacob's ladder, ram's head ladyslipper, *Caloplaca parvula, Certraria aurescens, Frullania selwyniana, Menegazzia terebrata, Ramalina thrausta, Sticta fuliginosa*, *Usnea longissima,* and *Pseudocyphellaria crocata*, but are not likely to cause a trend to federal listing or loss of viability.

Additional Mitigations, Design Criteria, and Monitoring

- Avoid the population of Lapland buttercup in unit 95-37 by leaving a 50 foot buffer around the population
- Where possible, no roads would be placed in lowland cedar or black ash stands; in cases where this is unavoidable, a Sensitive (RFSS) plant survey would be conducted prior to road construction.

HABITAT GROUP 5: RFSS PLANTS OF NORTHERN HARDWOOD FORESTS

Existing Condition

The following sensitive plants use this habitat group and either occur in or have suitable habitat in the analysis area (Table 2): New England sedge. There is very little northern hardwood forest habitat in the Glacier Project area, only about 8 acres of sugar maple forest type. There is no cedar-aspen-paper birch (Forest type 19) habitat in the project area – this is also sometimes suitable habitat for New England sedge.

Direct/Indirect Effects

Alternative 1

There would be no ground disturbance occurring under alternative 1. Therefore, there would be no direct or indirect effects to any of these species.

Alternative 2

There are no known occurrences of any species in this habitat group in the Glacier Project area, and there are no plans for any vegetation management treatments in what little suitable northern hardwoods habitat exists in the project area. Therefore, there would be no impacts to any suitable habitat for plants in this habitat group in Alternative 2.

Alternative 3

There are no known occurrences of any species in this habitat group in the Glacier Project area, and there are no plans for any vegetation management treatments in what little suitable northern hardwoods habitat exists in the project area. Therefore, there would be no impacts to any suitable habitat for plants in this habitat group in Alternative 3.

Cumulative Effects

For alternative 1, there would be no cumulative effects to these species since no ground disturbance would occur under this alternative.

For Alternatives 2 and 3, there would be no cumulative effects to these species since there are no direct or indirect effects caused by these alternatives.

Summary:

Project activities associated with these Alternatives would have no direct, indirect, or cumulative effects on the suitable habitat for species in this habitat group.

Determination

For alternatives 1, 2, and 3, the proposed activities would have no impact on New England sedge.

HABITAT GROUP 6: RFSS PLANTS OF DRY TO MESIC UPLAND FORESTS

Existing Condition

The following sensitive plants use this habitat group and either occur in or have suitable habitat in the analysis area (Table 2): Canada yew, barren strawberry, Canada ricegrass, and *Peltigera venosa*. *Peltigera venosa*, although not included as part of any habitat group in the Forest Plan BE, is analyzed with this habitat group in this BE because of its affinity for bare soil habitats such as rootwads. Canada yew occurs in two proposed treatment units. Based on the criteria in the Forest Plan BE, there are 34,285 acres of upland forest types that could serve as suitable habitat for barren

strawberry in the project area. There are 19,781 acres of forest that could serve as suitable habitat for Canada yew. There are 3,219 acres of uplands in ELT 9, 11, and 13 that could serve as suitable habitat for Canada ricegrass; this species, known from only ten occurrences in Minnesota, occurs in sandy and sandy/gravelly soils (Gerdes 2005) such as is found in these three ELT's. It is difficult to quantify the number of acres of suitable bare soil habitat available for *Peltigera venosa*.

Direct/Indirect Effects

Alternative 1

Indicators 1, 3 and 5. There would be no ground disturbance occurring under alternative 1. Therefore, there would be no direct effects to any of these species, and there would be no indirect impacts to Canada ricegrass, barren strawberry, or *Peltigera venosa*. For Canada yew, the lack of ground disturbance would lead to an indirect benefit for both the known yew occurrences in the analysis area as well as suitable habitat in the analysis area. Deer herbivory on Canada yew severely limits Canada yew growth and sexual reproduction, both in the analysis area (Greenlee pers. obs.) and elsewhere in the upper Midwest (Schmoller 1999). Lack of timber harvest in the analysis area under alternative 1 would probably lead to a long term decrease in the whitetail deer population, which would be an indirect benefit to Canada yew.

Alternative 2

Indicator 1 - Number of known sensitive plant occurrences in or next to proposed treatment units. There are two Canada yew occurrences in areas proposed for treatment in alternative 2: in unit 14-046 and unit 14-11. For the Canada yew in unit 14-046, there would be no impacts of alternative 2 because no timber harvest would occur, only cutting of brush and saplings to release desirable overstory trees. The yew would be identified in the mitigations so that it does not get cut along with other shrubs by accident during project implementation. For the Canada yew in unit 14-11, the proposed treatment is an intermediate harvest that would be conducted in frozen ground conditions. Sufficient canopy would remain to provide shade for the yew population, and minimal ground disturbance would occur because harvest would be during frozen ground conditions. So, there would be minimal direct effects of alternative 2 on the Canada yew in unit 14-11.

Indicator 3 – Miles of new upland road construction on FS lands. Alternative 2 proposes approximately 37.2 miles of new upland road construction. For Canada yew, barren strawberry, Canada ricegrass, and *Peltigera venosa*, upland road construction would have direct and indirect impacts to suitable habitat for these species, but sufficient suitable habitat would remain undisturbed to ensure there is no viability risk to these species. For this indicator, Alternative 2 would impact less than 3% of suitable habitat in the project area for Canada ricegrass, and less than 1% for other species in this group. New upland road construction would have minimal effects to suitable habitat for these species.

Indicator 5 – Acres of upland commercial timber harvest. Approximately 7,899 acres of upland commercial timber harvest is proposed in Alternative 2. Timber harvesting would cause direct and indirect effects to suitable Canada yew upland habitat. Clearcuts would remove the overstory and create open conditions not favored by Canada yew. However, there would be no disturbance in lowland cedar forests in the analysis area, which are also an important habitat for Canada yew. This alternative would probably at a minimum maintain the deer herd in the analysis area, so there would be continued browse pressure on Canada yew in the analysis area. There are 304 known occurrences of Canada yew on the Superior National Forest (USDA Forest Service 2006). Because it is a sensitive species, Canada yew occurrences are generally avoided by Forest Service projects on the Superior (e.g. USDA Forest Service 2004d). Despite potential impacts to suitable habitat, the protection of known occurrences would ensure that there is no risk to the viability of this species due to project activities.

For barren strawberry, ground disturbance caused by timber harvest and site preparation would have short term direct impacts to suitable habitat. However, in the long term timber harvest activities would probably have minimal effects on barren strawberry suitable habitat. Of the 5 known barren strawberry occurrences on the Superior, one was found in a clearcut, and another in a red pine plantation; these occurrences suggest that the species can tolerate some level of disturbance. The red pine plantation containing one occurrence was thinned in 2003, and preliminary monitoring results show no population decline as a result of the thinning (USDA Forest Service 2005a).

For *Peltigera venosa*, timber harvest could have direct and indirect impacts to suitable habitat in the short term. Over the long term however, blowdown at the edges of clearcuts would create suitable habitat for *Peltigera venosa* in the form of the exposed dirt of rootwads. Because there are no known occurrences in the project area, and because recent surveys in the project area or on the Forest did not locate this species (Wetmore 2000; Knowles pers. comm.), it is not likely that timber harvest in Alternative 2 would cause any viability risk for *Peltigera venosa*.

For Canada ricegrass, timber harvest could have direct short-term impacts to suitable habitat for this species. However, over the long term the effects of timber harvest to Canada ricegrass would probably be neutral to somewhat beneficial. In Michigan, the species occurs in logged areas and on road margins (Gerdes 2005). In Minnesota the species occurs in openings and clearings, along abandoned logging roads, thinned mixed pine-hardwood forest, young pine plantation, as well as unlogged red pine forest (Gerdes 2005). Based on the habitats of known occurrences, it seems likely that timber harvest proposed in alternative 2 in the project area would create some suitable habitat for Canada ricegrass in the long term.

There would be no impacts to TES plants in this habitat group from gravel pit use as proposed.

Alternative 3

Indicator 1 - Number of known sensitive plant occurrences in or next to proposed treatment units. The impacts of Alternative 3 on known occurrences of Canada yew would be the same as described above for Alternative 2. The same two yew occurrences would be affected by the same prescriptions as for Alternative 2, and the same mitigations would apply.

Indicator 3 – Miles of new upland road construction on FS lands. Alternative 3 proposes approximately 30.9 miles of new upland road construction. The types of effects of this activity on Canada yew, barren strawberry, Canada ricegrass, and *Peltigera venosa* would be similar to those described for alternative 2. However, the potential impacts of alternative 3 to suitable habitat for these species would be lower than for alternative 2, since fewer miles of new upland road would be constructed under Alternative 3. Alternative 3 would impact approximately 2% of suitable habitat in the project area for Canada ricegrass, and less than 1% for other species in this group. New upland road construction would have minimal effects to suitable habitat for these species.

Indicator 5 – Acres of upland commercial timber harvest. Approximately 5,230 acres of upland commercial timber harvest is proposed in Alternative 3. For Canada yew, barren strawberry, Canada ricegrass, and *Peltigera venosa*, the types of impacts would be similar to those described for alternative 2 above. However, alternative 3 would impact fewer acres of suitable habitat for each of these species than alternative 2 based on analysis of indicator 5.

Cumulative Effects

For alternative 1, there would be no cumulative effects to RFSS plants in this group since no ground disturbance would occur under alternative 1.

There would be few cumulative effects of the action Alternatives on these species. Since Europeans began settling the area, timber harvest (and subsequent forest type changes) and road construction are among the land uses that have most greatly impacted upland forests and altered the amount and distribution of this habitat in the cumulative effects analysis area. Some upland forest types like aspen have increased in acreage since pre-settlement times, while other forest types like red, white and jack pine have decreased (Frelich 1998). More recently, timber sales on federal, State, county, and private lands have changed the age class distribution of upland forest habitats; see Appendix C for a summary of current and future timber harvest on federal, state, and county lands. Construction of roads in the project area, such as MN Highway 1, as well as federal and non-federal timber harvest roads, have also impacted a small proportion of suitable habitat for these species. For Canada ricegrass and barren strawberry, past, present, and reasonably foreseeable timber harvest would not have any long term cumulative impacts to suitable habitat for these species because they appear to be able to tolerate some levels of disturbance. Suitable habitat for *Peltigera venosa* (in the form of tip-ups) would continue to be created by future timber harvests. For Canada yew, future timber harvest on federal and non-federal lands would impact suitable habitat for this species, but negligible cumulative impacts would result and the viability of the species would be maintained by the existing known occurrences throughout the Superior.

Future road construction in the cumulative effects analysis area, including construction of non-jurisdictional roads for access to private developments, temporary roads for mineral exploration projects, future special use permit roads, and roads associated with county or state timber sales, would impact suitable habitats for this suite of rare plants, but would not result in cumulative impacts because these activities would affect only a small proportion of the available suitable habitat. On the Superior National Forest, potential impacts of these activities to this suitable habitat would be mitigated by adherence to the Forest Plan standards and guidelines, and on other ownerships the impacts would be mitigated by voluntary adherence to the best management practices (MFRC 1999).

Summary: Project activities associated with these Alternatives would have short-term negative direct and indirect effects on suitable habitat for these species. Over the long term, however, there should be only minor impacts to suitable habitat for these species. Based on analysis of Indicators 1, 3, and 5, the effects to suitable habitat for species in this group would be greatest for Alternative 2, followed by Alternative 3.

Determination

For alternative 1, the proposed activities would have no impact on Canada yew, barren strawberry, Canada ricegrass, or *Peltigera venosa*.

For Alternatives 2 and 3, the proposed activities may impact individuals of Canada yew, barren strawberry, Canada ricegrass, or *Peltigera venosa* but are not likely to cause a trend to federal listing or loss of viability.

Additional Mitigations, Design Criteria, and Monitoring

- For unit 14-046, avoid cutting the Canada yew in the unit during release activities.

REFERENCES

Anderson, L.A. 2001. The potential impacts of the Winton Hydropower Project on freshwater mussels. Natural Resources Research Institute, Center for Water and the Environment. Duluth, Minnesota. 14pp.

Becker, G.C. *Fishes of Wisconsin.* 1983. The University of Wisconsin Press, Madison, WI. 1052p.

Boal, C.W., D.E. Andersen, and P.L. Kennedy. 2001. Home range and habitat use of northern goshawks (*Accipiter gentilis*) in Minnesota. Final report. Minnesota Cooperative Fish & Wildlife Research Unit, University of Minnesota, St. Paul, MN. 48pp.

Bolton, R.D., and M.K. Reed. 1997. Botanical survey final report – Fernberg Project Area. Unpublished report on file at USDA Forest Service, Aurora, Minnesota. 14 pp.

Bradof, K.L. 1992. "Ditching of Red Lake Peatland during the homestead era." In: *The Patterned Peatlands of Minnesota*. Ed. Wright, H.E., B.A. Coffin, N.E. Aaseng. University of Minnesota Press, Minneapolis, MN. Pp. 263-284.

Burdette, C.L. and G.J. Niemi. 2002a. "Conservation Assessment for Three-toed Woodpecker (*Picoides tridactylus*)." Administrative report in planning record. On file with Forest Supervisor, Chippewa National Forest, 200 Ash Avenue, Cass Lake, MN 56633. 26 p.

Carlson, B., and N. Sather. 2001. Western Jacob's ladder, a true rarity. Unpublished report, Minnesota County Biological Survey, St. Paul, Minnesota. 2 p.

Coffin, B., and L. Pfannmuller, editors. 1988. Minnesota's endangered flora and fauna. University of Minnesota Press and Minnesota Dept. Natural Resources. 473pp.

Critical Connections Ecological Services. 2006. Rare plant survey report. Unpublished report on file at USDA Forest Service, Aurora, Minnesota. Pages unnumbered.

Drey, K. 1999. Species data form, *Picoides tridactylus*. On file at USDA Forest Service, Duluth, MN. 17pp.

Erdman, T.C., D.F. Brinker, J.P. Jacobs, J. Wilde, and T. O. Meyer. 1998. Productivity, population trend, and status of Northern Goshawks, *Accipiter gentilis atricapillus*, in northeastern Wisconsin. Canadian Field-Naturalist 112(1):17-27.

Estabrook. T. 2000. Species data form, *Accipiter gentilis atricapillus*. On file at USDA Forest Service, Duluth, MN. 50pp.

Frelich, L. 1998. Natural variability of forested ecosystems in northern Minnesota. Unpublished report, University of Minnesota, St. Paul, Minnesota. 15 p.

Gerdes, L. 2005. Canada rice-grass: species new to Minnesota! Unpublished report. Minnesota County Biological Survey. St. Paul, Minnesota. 3 pp.

Gerdes, L. 2005a. Slender rush: species new to Minnesota! Unpublished report. Minnesota County Biological Survey. St. Paul, Minnesota. 3 pp.

Graf, D.L. 1997. Distribution of unionid (bivalva) faunas in Minnesota, USA. *The Nautilus*. 110(2):45-54.

Green, J.C. 1995. Birds and forests, a management and conservation guide. Minnesota Department of Natural Resources, St. Paul, MN. 182pp.

Green. J.C. and G.J. Niemi. 1980. Birds of the Superior National Forest. USDA Forest Service, Superior National Forest, Duluth, MN.

Hayward, G.D. 1994. Review of technical knowledge: boreal owl. Pages 92-127 in G.D. Hayward and J. Verner, technical editors. USDA Forest Service General Technical Report RM-253, Ft. Collins, CO.

Heinselman, M. 1996. The Boundary Waters wilderness ecosystem. University of Minnesota Press, Minneapolis, Minnesota. Pp. 18, 97-111.

Holmes, R., T. Sherry, and F. Sturges. 1986. Bird community dynamics in a temperate deciduous forest: long-term trends at Hubbard Brook: Detailed description of breeding habitat in New Hampshire. *Ecol. Monogr.* 56:201-220.

Iverson, G.C., and B. René. 1997. Conceptual approaches for maintaining well-distributed, viable wildlife populations: a resource assessment. Pages 1-23 in K.R. Julin, compiler, Assessments of wildlife viability, old-growth timber volume estimates, forested wetlands, and slope stability. USDA Forest Service General Technical Report PNW-GTR-392.

Jaako Poyry Consulting, Inc. 1992. Forest wildlife, a technical paper for a generic environmental impact statement on timber harvesting and forest management in Minnesota. Minnesota Environmental Quality Board, St. Paul, MN.

Jannett, F.J. 2006. The heather vole (*Phenacomys intermedius*) on Superior National Forest, 2006: additional records, an additional locality, and patterns of trappability. Report submitted to the USFS 11/30/2006. 15pp.

Janssen, R.B. 1987. Birds in Minnesota. University of Minnesota Press, Minneapolis, MN. 352pp.

Janssens, J.A. 2002. Bryophytes of the northern superior uplands and the Superior National Forest: inventory, assessment, and recommendations for conservation. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. Pages unnumbered.

Keane, J.J., and M. L. Morrison. 1994. Northern goshawk ecology: effects of scale and levels of biological organization. Pages 3-11 in W.M. Block, M.L. Morrison, and M.H. Reiser, editors, The northern goshawk: ecology and management. Cooper Ornithological Society Studies in Avian Biology No. 16.

Kennedy, P.L. 1997. The northern goshawk (*Accipiter gentilis* atricapillus): is there evidence of a population decline? Journal Raptor Research 31(2): 95-106.

Kirk, D.A. 1994. Status report on the boreal owl *Aegolius funereus* in Canada. Committee on the Status of Endangered Wildlife in Canada. 20pp.

Kozie, K. 1999. Species data form, *Strix nebulosa*. On file at USDA Forest Service, Duluth, MN. 13pp.

Knowles, B. 2001. email to Jack Greenlee, October 11, 2001.

Lane, W.H. 1997. Distribution and ecology of boreal owls in northeast Minnesota. Masters Thesis, University of Minnesota, St. Paul, MN. 88pp.

Lapinski, N., and W.B. Bowerman. 2000. Habitat use and productivity of the northern goshawk in the upper peninsula of Michigan, report of activities for the 1998-99 field seasons. Northern Michigan University, Marquette, Michigan. Unpublished report. 29pp.

Leonard, D.L., Jr. 2001. "Three-toed woodpeckers (*Picoides tridactylus*)" In *The Birds of North America*, No. 588 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

Lind, J., N. Danz, M.T. Jones, J.M. Hanowski, and G.J. Niemi. 2001. 2000 annual update report: breeding bird monitoring in Great Lakes national forests: 1991-2000. University of Minnesota, Natural Resources Research Institute Technical Report NRRI/TR-2001/04, Duluth, MN.

MacLean, S. 1999. Species data collection form, *Conturnicops noveboracensis*. On file at USDA Forest Service, Duluth, MN. 13pp.

MacLean, D.B. 2001. "Status of Butterflies of Special Concern within the Superior National Forest, Minnesota, 2001." Administrative report in planning record. On file with Forest Supervisor, Chippewa National Forest, 200 Ash Avenue NW, Cass Lake, MN 56633.

Maxson, G. 1999. Species data form, *Dendroica castanea*. On file at USDA Forest Service, Duluth, MN. 14pp.

McAllister J.A., and R.S. Hoffmann. 1988. Mammalian species No. 305, *Phenacomys intermedius*. The American Society of Mammalogists. 8pp.

Minnesota Department of Natural Resources 2002. Final Report: Mussel (Bivalvia: Unionidae) survey of the Superior National Forest. Prepared for the Superior National Forest. Minnesota Department of Natural Resources, Ecological Services Division. St. Paul, Minnesota. 16pp.

Minnesota Department of Natural Resources - Natural Heritage and Non-Game Research Program. 2006. Rare Features Database: rare species occurrences on the Superior National Forest. St. Paul, Minnesota.

Minnesota Department of Natural Resources – 2000Draft Minnesota Wolf Management Plan. St. Paul, Minnesota.

Minnesota Forest Resource Council. 1999a. Minnesota northeast landscape conditions and trends assessment. Minnesota Forest Resource Council document LT-0799. St. Paul, Minnesota. Pp. 37-41, 95-105.

Minnesota Forest Resources Council. 1999b. Sustaining Minnesota forest resources: voluntary site-level forest management guidelines for landowners, loggers and resource managers. Minnesota Forest Resources Council, St. Paul, Minnesota. Pages variable.

Niemi, G.J., and J.M. Hanowski. 1992. Forest wildlife, Forest Birds section. In a technical paper for a generic environmental impact statement on timber harvesting and forest management in Minnesota. Prepared by Jaakko Poyry, Consulting for the Environmental Quality Board.
Available at http://oden.nrri.umn.edu/mnbirds/speciesaccounts.htm

Niemi, G.J., and J.M. Hanowski. 1997. Concluding remarks on raptor responses to forest management: a holarctic perspective. Journal Raptor Research 31(2):191-196.

Phillips, G. L., W. D. Schmid, J. C. Underhill. 1982. Fishes of the Minnesota region. University of Minnesota Press, Minneapolis, MN.

Pomroy-Petry, D. 2003. Botanical field reconnaissance report Superior National Forest – Kawishiwi Summer Homes. Unpublished report on file at USDA Forest Service, Aurora, Minnesota. Pages unnumbered.

Postupalsky, S. 1991. Species account, northern goshawk. Page 168 in R. Brewer, G.A. McPeek, and R.J. Adams, Jr. editors, The atlas of breeding birds of Michigan. Michigan State University Press, East Lansing, MI.

Postupalsky, S. 1997. A study of breeding northern goshawks in Michigan. Pages 13-14 in Status of the northern goshawk in the Midwest, workshop proceedings, Milwaukee Public Museum, Milwaukee, WI, 14 March 1997.

Reynolds, R.T., R.T. Russell, M.H. Reiser, and others. 1992. Management recommendations for the northern goshawk in the southwestern United States. USDA Forest Service General Technical Report RM-217, Ft. Collins, CO. 90pp.

Rieck, K. 1999. Species data form, *Oporonis agilis*. On file at USDA Forest Service, Duluth, MN. 13pp.

Robbins, C.S., D.K. Dawson, and B.A. Dowell. 1989. Habitat area requirements of breeding forest birds of the Middle Atlantic States. Wildlife Monographs 103:1-34.

Rosenfield, R.N., J. Bielefeldt, D.R. Trexel, and T.C. Doolittle. 1998. Breeding distribution and nest-site habitat of northern goshawks in Wisconsin. Journal of Raptor Research 32(3):189-194.

Sauer, J.R., J.E. Hines, I. Thomas, J. Fallon, and G. Gough. 1999. The North American Breeding Bird Survey, Results and Analysis 1966-1998. Version 98.1, USGS Patuxent Wildlife Research Center, Laurel, MD.

Schmoller, D. 1999. Species Data Form, *Taxus canadensis*. Unpublished report on file at USDA Forest Service, Duluth, Minnesota. 12pp.

Schmoller, D. 2006a. Superior National Forest 2006 rare plant survey Glacier project area. Unpublished report on file at USDA Forest Service, Aurora, Minnesota. 83 pp.

Schmoller, D. 2006b. Superior National Forest 2006 rare plant survey Duluth metals sites. Unpublished report on file at USDA Forest Service, Aurora, Minnesota. Pages unnumbered.

Scott, W.B. and E.J. Crossman 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada Bulletin 184. Ottawa, Canada. 966 pp.

Smith, W.R. 1993. Orchids of Minnesota. University of Minnesota Press, Minneapolis, Minnesota. 172 p.

Squires, J.R., and R.T. Reynolds. 1997. Northern goshawk (*Accipiter gentilis*). In A. Poole and F. Gill, editors, The Birds of North America, No. 298. The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Steffens, W.P. 2001. Status surveys for the sensitive species *Cicindela denikei* and other tiger beetles of the Superior National Forest, 19 September 2000. Report on file at USDA Forest Service, Duluth, MN. 25pp.

USDA Forest Service. 2000a. Lichen PVA Panel Notes. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. Pp. 10-11.

USDA Forest Service. 2000b. Population viability assessment workshop notes, Duluth, MN, 11-13 January 2000.

USDA Forest Service. 2001a. Conservation Assessment for western moonwort (*Botrychium hesperium*). Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 35 p.

USDA Forest Service. 2001b. Conservation Assessment for common moonwort (*Botrychium lunaria*). Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 39 p.

USDA Forest Service. 2001c. Conservation Assessment for pale moonwort (*Botrychium pallidum*). Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 38 p.

USDA Forest Service. 2001d. Conservation Assessment for ternate grapefern (*Botrychium rugulosum*). Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 46 p.

USDA Forest Service. 2001e. Conservation Assessment for least grapefern (*Botrychium simplex*). Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 52 p.

USDA Forest Service. 2002a. Conservation assessment for *Arctoparmelia centrifuga*. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 11 p.

USDA Forest Service. 2002c. Conservation assessment for *Caloplaca parvula*. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 10 p.

USDA Forest Service. 2002d. Conservation assessment for *Certraria aurescens*. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 11 p.

USDA Forest Service. 2002e. Conservation assessment for *Cladonia wainoi*. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 10 p.

USDA Forest Service. 2002h. Conservation assessment for *Menegazzia terebrata*. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 15 p.

USDA Forest Service. 2002i. Conservation assessment for *Peltigera venosa*. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 11 p.

USDA Forest Service. 2002j. Conservation assessment for *Pseudocyphellaria crocata*. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 11 p.

USDA Forest Service. 2002k. Conservation assessment for *Ramalina thrausta*. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 11 p.

USDA Forest Service. 2002l. Conservation assessment for *Sticta fuliginosa*. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 11 p.

USDA Forest Service. 2002m. Conservation assessment for *Usnea longissima*. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 13 p.

USDA Forest Service 2004a. Superior National Forest Land and Resource Management Plan. Superior National Forest. Duluth, Minnesota. P. 74.

USDA Forest Service. 2004b. Forest Plan Revision, Chippewa and Superior National Forests, Regional Forester Sensitive Plants Biological Evaluation. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 67p.

USDA Forest Service. 2004d. Virginia forest management project record of decision and FEIS. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. Page 2-19.

USDA Forest Service. 2004g. Conservation assessment for Lance-leaved Violet (*Viola lanceolata var. lanceolata)*. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 22 p.

USDA Forest Service. 2005. Trygstad *Waldsteinia fragarioides* monitoring results: 2003-2004. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 4 p.

USDA Forest Service. 2006. Fiscal Year 2005 Monitoring and Evaluation Report. USDA Forest Service, Superior National Forest internal report.

USDA Forest Service. 2006. Superior National Forest rare plant occurrence records – new records and non-MNDNR tracked records. Administrative report in planning record. On file with Forest Supervisor, Superior National Forest, 8901 Grand Ave. Place, Duluth, Minnesota 55808. 10 p.

Verry, E.S. 2000. "Water flow in soils and streams: Sustaining hydrologic function" *In* Riparian Management in Forests of the Continental Eastern United States. Ed. Verry, Elon S., James W. Hornbeck, and C. Andrew Dolloff. Lewis Publishers, Washington D.C. Pp. 99-124.

Walton, G. 1999. The 1999 sensitive plant survey in the Superior National Forest Kawishiwi District. Unpublished report on file at USDA Forest Service, Aurora, Minnesota. 14 p.

Walton, G. 2000a. The 2000 Big Rice rare plant survey in the Laurentian District of the Superior National Forest. Unpublished report on file at USDA Forest Service, Aurora, Minnesota. 25 p.

Walton, G. 2000c. The 2000 Metroplus rare plant survey in the Superior National Forest Kawishiwi District. Unpublished report on file at USDA Forest Service, Ely, Minnesota. 21 p.

Wetmore, C. 2000. Rare lichen survey of Superior National Forest. Unpublished report on file at USDA Forest Service, Duluth, Minnesota. Pages unnumbered.

Wetmore, C. 2001. Rare lichen habitats in Superior National Forest. Unpublished report on file at USDA Forest Service, Duluth, Minnesota. 20 pp.

Wilson, S. 1996. Irruption of boreal owls, winter 1995-96. The Loon 68:228-231.

Wilson, S. 1997. Irruption of boreal owls, winter 1996-97. The Loon 69:125-128.