APPENDIX F

Biological Evaluation
Of the

GLACIER PROJECT

On
Regional Foresters Sensitive Species

(updated June 2008 to include alternative 4)

Terrestrial Wildlife Evaluation and Assessment:

Prepared by: /s/ Susan C. Catton Date: 7/10/08
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Aquatic Wildlife Evaluation and Assessment:

Prepared by: /s/ Jason Butcher Date: 07/10/08
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Botanical Evaluation and Assessment:

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EXECUTIVE SUMMARY

This Biological Evaluation (BE) analyzes the effects of the Glacier Project on Regional Forester's Sensitive Species (RFSS) known or suspected to occur in the Superior National Forest. The Glacier Project may impact sensitive species. This analysis is conducted to ensure that the needs of these species are given full consideration in the planning and decision making process. The forest recently revised its Forest Plan. For the Plan Revision, a Forest-wide Biological Evaluation (BE) was conducted on the effects of implementation of the Plan. The needs of many sensitive species were considered in the development of Objectives for Management Indicator Habitats (MIH). Where appropriate, MIHs were used as Indicators for species. Where applicable, this BE tiers to the analysis conducted in the Forest Plan BE and FEIS. Refer to the Forest-wide BE, FEIS and the Forest Plan Planning Record for more information.

Species specific recommended mitigations/design features are also found under each species analysis. Mitigation and Design Features are identified to minimize or eliminate impacts of the proposed actions to RFSS. Recommended Mitigations and Design Features are compiled in Appendices B and E of the EIS.

DETERMINATION OF EFFECTS SUMMARY

Terrestrial wildlife species

Alternative 1 may impact individuals of olive-sided flycatcher, three-toed woodpecker and tiger beetle but is not likely to result in a trend toward federal listing or a loss of viability. No impacts to all other terrestrial species are expected.

Alternatives 2, 3 and 4 may impact individuals of heather vole, gray wolf, northern goshawk, boreal owl, olive-sided flycatcher, 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 species

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, all 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, 3, and 4 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, 3, and 4 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, New England sedge, Canada yew, barren strawberry, Canada ricegrass, or *Peltigera venosa* 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.

A Forest Plan management objective related to all species 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)

Project Description

The Glacier Project Area is located in Lake and St. Louis Counties. Activities would be located in portions of Townships 61, 62, and 63 North, and Ranges 9, 10, and 11 West, and are only proposed on National Forest System land. The Project Area boundary encompasses about 90,000 acres of land with mixed ownership. Approximately 47,000 acres (52 percent) of the entire Project Area are on National Forest System land located on the Kawishiwi Ranger District of the Superior National Forest.

The Project Area is approximately 5 to 20 miles east of Ely in the vicinity of the Fernberg Road (County Road 118) and State Highway 1. Some of the larger lakes and rivers in or near the Project Area are Greenstone Lake, Triangle Lake, Farm Lake, Moose Lake, Fall Lake, and the Kawishiwi River. The Project Area is outside the Boundary Waters Canoe Area Wilderness (BWCAW); actions are not proposed within the BWCAW.

The purpose of the Glacier Project is to maintain and promote native vegetation communities that are diverse, productive, healthy, and resilient by moving the vegetation component toward Jack Pine Black Spruce (JPB), Dry Mesic Red and White Pine (DRW) and Lowland Conifer (LLC) Landscape Ecosystem objectives described in the 2004 Superior National Forest Land and Resource Management Plan (Forest Plan p. 2-23, O-VG-1). There is a need to manage the amount, distribution and characteristics of vegetation so that it is more representative of the historical range of natural variability. (Forest Plan, D-VG-3, page 2-22) The associated transportation system (including gravel pits) needed for long-term vegetation management in the Project Area is also addressed.

The EIS considers four alternatives which are summarized in the tables below. Chapter 2 of the supplement to the DEIS (USFS, 2008c) provides detailed descriptions of each of the alternatives. Also see maps, tables and unit data in the supplement or DEIS for site-specific locations and more detailed information. This analysis assumes that in addition to the proposed actions identified below, mitigation and design features have been identified (in appendices B and E of the supplement), and would be implemented with all of the action alternatives.

Table BE-1. Comparison of Vegetation Management (Acres)

Primary Vegetation Management Category	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Create young upland and lowland forest through vegetation management treatments such as clearcut with reserves, seed tree, and shelterwood harvest.	0	5,495	3,963	6,708
Improve the quality of stand conditions through vegetation management treatments such as thinning, variable thinning, and partial harvest. These treatments would increase structural and species diversity and would not change the age of the stand.	0	2,579	1,692	2,582
Improve the quality of stand conditions through a variety of treatments including prescribed burning, biomass removal, mechanical ground disturbance, planting and/or seeding desired species, and removing less desirable species.	0	5,234	5,388	5,368
Total acres of vegetation management	0	13,308	11,043	14,658

* All acres shown are estimates and are based on stand acres. Actual treated acres would be less than the acres shown to account for legacy patches, reserve islands, and other resource mitigations. (Duffy, 2008)

Table BE-2. Comparison of Resource Objectives Met Through Vegetation Management

Landscape Ecosystem Management	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Improve vegetation spatial patterns (reduce forest habitat fragmentation)	30.5	24.6	26.5	24.9
Convert existing aspen and spruce forest to jack pine forest.	0	1,518	1,056	2,121
Convert existing aspen forest to white pine and red pine forest	0	135	172	199
Improve tree species diversity within harvested areas	0	1,889	1,105	2,955
Improve tree species diversity in non-harvest areas	0	5,152	5,303	5,193
Wildlife Habitat Management				
Improve habitat conditions for moose and deer	0	2,790	2,228	3,136
Improve habitat conditions for ruffed and spruce grouse	0	4,681	3,489	5,722
Increase amount and survival of white pine	0	7,858	6,845	7,884
Improve stand complexity for Northern Goshawk	0	3,766	3,366	3,729
Promote future nesting habitat for Bald Eagle	0	3,264	2,731	3,469
Improve habitat conditions for Large-leaved sandwort	0	16	16	16
Fuel Reduction				
Reduce fuel levels to reduce risk of wildfire	0	803	803	803
Brush disposal sites (Ojibway Summer Home and Moose Lake Road)	0	2	2	2
Scenery Enhancement				
Manage areas of high scenic interest for long-lived species	0	556	493	770
Aquatic Habitat Enhancement				
Enhance riparian habitat through planting long-lived tree species and/or releasing existing long-lived tree species adjacent to streams and lakes	0	486	458	486
Sensitive Soils				
Increase long-lived species on nutrient sensitive soils.	0	3,042	2,339	3,374
Forest Products				
Provide sustainable commercial wood products (million board feet)	0	46	33	55

(Duffy, 2008)

Table BE-3. Comparison of Transportation System, Trails, Gravel Pits, and Stream Crossings

Transportation System	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**
Relocate road to Smitty's Resort on Snowbank Lake to allow for gravel pit expansion and add remaining unauthorized road to managed road system to provide access to Federal land.	0	0.2 miles of road construction 0.2 miles of road decommissioned 0.4 miles of existing road added to system		
Reconstruct Madden Lake Road to improve public access to Madden Lake	0	0.9 miles		
Add existing roads to the system to provide long-term access to State and Federal land.	0	0.2***		
Construct new system road to provide long-term access to State and Federal land.	0	0.8		
Use previously constructed temporary road corridor to access vegetation treatment units.	0	28	22	29
Construct new temporary road to access vegetation treatment units.	0	16	11	16
Trails				
Add existing winter-use routes to the trail system	0	7.5		
Gravel Pits				
Gravel pits (Number and total acres of expansion)	0	6 pits, 0.6 acres		
Rehabilitate Gravel pit (Number)	0	1		
Stream Crossings				
Improve Stream Crossings (Number)	0	3		

***Note: this is changed from the draft. We have dropped 0.7 miles of road from the proposal. The road we dropped is a special use road (Halfway road) and will remain special use and private. No change in overall road miles.

Affected Species, Effects of Proposed Action and Determination of Effects

Table BE-4 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 not included below for further evaluation, it is because we have determined that they are not known or expected in the project area, there is not sufficient or appropriate habitat within the analysis area, or little to no effects are predicted as a result of the proposed project. Species listed that do not have potential habitat present and are not known to occur within the project area are indicated and will not receive further discussion in this Biological Evaluation.

The effects to federally listed Threatened or Endangered species were analyzed and documented in a Biological Assessment (BA) as part of the consultation process with the US Fish and Wildlife Service. A summary of these effects can also be found in chapter 3 of the supplement to the DEIS and detailed analysis can be found in the Glacier Project Biological Assessment (USFS 2008b).

Table BE-4: 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.

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Common name ***Scientific name***	**Potential Habitat Present in project area**	**Known Species Presence in project area**	**Habitat Summary**
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
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

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Common name ***Scientific name***	**Potential Habitat Present in project area**	**Known Species Presence in project area**	**Habitat Summary**
Nabokov's (or Northern) blue *Lycaeides idas nabokovi*	Yes	No	*Vaccinium cespitosum* host in open sandy jack pine areas. Closest known locations 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.
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

Table BE-4: 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**
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
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.

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Regional Forester's Sensitive Species			
Common name ***Scientific name***	**Potential Habitat Present in project area**	**Known Species Presence in project area**	**Habitat Summary**
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.
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)

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Regional Forester's Sensitive Species			
Common name ***Scientific name***	**Potential Habitat Present in project area**	**Known Species Presence in project area**	**Habitat Summary**
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
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)

Region 9 Sensitive Species: Terrestrial Wildlife

Analysis Area

Unless otherwise noted in individual species analysis sections, 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. Population viability determinations are made at the scale of the entire SNF.

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).

Gray Wolf – *Canis lupus*

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, last year the U.S. Fish and Wildlife Service 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 (USDI 2007a). Management of the wolf is now governed by the Minnesota Wolf Management Plan of 2001 (MnDNR 2001).

The Minnesota Wolf Management plan establishes a minimum population of 1,600 wolves to ensure the long-term survival of the wolf in Minnesota. The Minnesota wolf population has grown from fewer than 750 animals in the 1950s to the current estimate of 3,020 (Erb and Bensen 2004). The state wolf plan is designed to protect wolves and monitor their population while giving owners of livestock and domestic pets more protection from wolf depredation. It splits the state into two management zones with more protective regulations in the northern third, considered the wolf's core range. Wolves do occur in the Glacier project area and are part of the larger Great Lakes Population. The Glacier project is located in core range as designated by the Minnesota Wolf Management Plan. Management objectives for gray wolves identified by the Forest Plan 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.

It was not necessary to conduct project area specific surveys for wolf because the project benefits from information gathered through wolf pack monitoring effects done by the US Geological Survey and the Minnesota Department of Natural Resource (Mech 2007). Wolf occurrences were recorded during surveys for other species such as lynx, boreal owl, great gray owl, and goshawk (see Glacier project record).

More information on wolf monitoring and population trends can be found in the draft 2007 Monitoring and Evaluation report (USFS 2008).

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 live in territories and home ranges are 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).

Availability of prey, human settlement and roads are described as having the greatest detriment to wolf distribution within their range (USFS 2004d). On the Superior National Forest, habitat for wolf prey species is currently abundant and well distributed (USFS 2008). Unless food is very abundant, up to one-half of wolf pups may 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 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

Alternative 1

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. However, with the no action alternative most upland forests would grow and become less suitable to deer and moose for foraging. The amount of quality foraging habitat would diminish and have poor distribution (see MIH maps in project record) across the analysis area. Also through forest succession with this alternative, the amount of upland conifer forest for hiding and thermal cover for moose and deer would increase slightly and would continue to be well distributed. In the short-term (10 years) this change in habitat conditions would likely have minimal effect on wolf because deer and wolf populations remain high and deer can persist in sub-optimal habitat conditions. Low standard roads would not change with this alternative so they would have no additional effects on wolf.

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

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3		Alt 4	
Prey Habitat	acre	%	acre	%	acres	%	acres	%	acres	%
1a. young upland forest <10 years old	1,293	4	508	1	5,835	16	4,340	12	6,951	19
1b. upland conifer (spruce and pine) > 9 years old on all uplands	12,314	33	13,681	37	12,374	33	13,040	35	12,163	33
	Miles		Miles		Miles		Miles		Miles	
2. Miles of temp (su-t) and OML 1 roads	(0, 15) 15		(0, 15) 15		(45, 17) 62		(33, 17) 52		(46, 17) 62	

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 +.

Alternatives 2-4

One objective of this project is to improve habitat conditions for deer and moose. The action alternatives may lead to positive benefits for wolves by creating quality foraging habitat for prey species. Action alternatives would result in an 11%-18% increase in the amount of foraging habitat (*Table BE-Wolf-1, indicator1a*), with alternative 4 resulting in the most and alternative 3 resulting in the least. 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,* MIH maps in project record). 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 2004d).

The larger impact to wolves would come from human access/disturbance. All action alternatives would result in an increased potential for negative wolf/human interactions with 2 mile increase in low standard roads and 33-46 mile increase in temporary roads (*Table BE-Wolf-1, indicator 2*). The impact of this increase in low standard roads would 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. Alternatives 2 and 4 have slightly more miles of temporary road than Alternative 3 but because of the reasons stated above none of the action alternatives are expected to adversely 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.

Cumulative Effects
The Glacier project supplement appendix C provides a list of past, present and reasonably foreseeable future actions that could contribute to cumulative effects. The incremental effects of those projects are addressed here.

Past vegetation management projects on both federal lands (such as the Rusty Diamond and Tomahawk) and non-federal ownership (such as State, County and private) have created and maintained suitable forest habitat conditions for wolf in this area. Current and planned 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 in the near term. Trends in edge habitat appear to be increasing (Wolter and White 2002).

Cumulative impacts could occur as a result of human access and disturbance although with this project these cumulative impacts are expected to be minimal for the reasons stated below. It is known that as people buy, subdivide and develop private lands there is in increase in the potential for human access into wolf territory that could result in disturbance to wolves or wolf mortality. In this analysis area the only known planned development is the Black Wolf lots. This 60 acre parcel is located just outside of the city of Ely in an area that is relatively highly developed already, and provides marginal wolf habitat at best. It is known that Potlatch Corporation recently sold all of their lands in Lake County; however future development plans for these lands are not known at this time. The South Kawishiwi Land Exchange is not likely to contribute to cumulative impacts to wolves because these lands are already developed and further development on them in unlikely. In exchange for the 424 acres of land the summer home group is located on the Forest Service would receive approximately 1,254 acres of lands that are currently and would remain undeveloped and may provide better quality habitat for wolf and its prey. Ample amounts of suitable habitat will continue to be provided by the BWCAW.

Harvesting on State, County, and private land and mineral exploration on all ownerships would require additional road development. Not all of these roads may be effectively closed following harvest. Proposed Travel Management Project on the SNF, once signed and implemented, would reduce the number or open roads on federal lands which could help off set increases in open roads on non-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. Planned hunter walking trails could contribute a slight increase in negative effects because they would likely result in a slightly higher hunter use and risk to wolves. 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 as design speeds on roads increase (such as on Hwy 1). 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 proposed harvest 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. All Alternatives are consistent with Forest Plan direction for this species.

Design Criteria / Site-specific 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 – *Phenacomys intermedius*

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). Since 1987 the heather vole (*Phenacomys intermedius*) is documented in Minnesota Natural Heritage rare species database from six sites, all on the Superior NF in Lake and Cook Counties (MN DNR Natural Heritage and Non-Game Research Program 2007),. Additionally one specimen was taken in 1940 near Burntside Lake (St. Louis County), (Jannett and Oehlenschlager 1997). The Superior NF supports annual small mammal population monitoring and a total of 12 heather voles have been trapped at seven sites (Jannett 2005). A long-term (1995-2006) study of small mammal populations has documented 64 heather voles, all on the Superior National Forest. This is up from the three sites known at the time of the Forest Plan ROD (USDA Forest Service 2004b - Forest Plan BE, Table 3, p. 12). In addition, 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 of these routes falls within the Glacier project area. Statewide and Forest population trends are unknown: because of the rarity of the species it is not possible to detect trends (USDA Forest Service 2004b). There are no known occurrences of heather voles in the analysis area (MN DNR 2006b, Jannett 2004). The nearest known heather vole location is 12 miles south of the project area off of the Tomahawk road (MN NHP 2006b). No project-specific surveys were conducted. The need for project area-specific surveys was assessed and based on species' habitat requirements, distribution, and expected management impacts, I determined that surveys at the site level were not required to adequately assess impacts to the heather vole.

Habitat needs and limiting factors*:* Coffin and Pfannmuller (1988, p. 308) 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. Most sites where Jannett (2004) found heather voles contained jack pine and black spruce forest types. Other also found high densities of heather voles in Ontario in jack pine monocultures with a dense, relatively continuous understory of ericaceous shrubs. *Vaccinium* species (the blueberries family) are often present where heather voles are found. Upland forests and openings with ericaceous ground cover and not far from water, appear to be preferred habitat. Suitable habitat conditions historically were likely patchy in distribution across the forest (USDA Forest Service 2004b). 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.

Threats and limiting factors include direct mortality and timber harvest activities which encourage grass growth and provide habitat for meadow voles which can out-compete heather voles (USFS 2006a). Fires suppression has likely had a large negative impact to habitat conditions from historical conditions. Timber harvest can 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 (USFS 2006a). Harvest activities, or natural succession and fire suppression that close the canopy and discourage growth of *Vaccinium* sp. can be detrimental to the heather vole. This species is also vulnerable to predation (USDA Forest Service 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 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.

Activities to improve or restore habitat. This is measured by the acres of conversion to Jack pine planned with each alternative.

Direct/Indirect Effects

Alternative 1

This alternative (no action) would result in no direct effects to heather vole from harvest activities. Existing roads allow for the potential of direct mortality of heather voles. *Table BE – Heather Vole-1* provides the results of the indicators analysis. Heather Voles would benefit from an increase in mature jack pine and mature upland conifer habitat as pole-aged stands of these forest types mature. Overall, habitat for the heather vole would be slightly greater throughout the project area than currently exists, although its distribution would still be patchy. Lack of disturbance could reduce the quality of habitat, however. No activities would occur that encourage the growth the grass. Therefore increased competition from meadow voles is not expected.

Table BE – Heather Vole-1. Effect to Suitable Habitat					
Indicators	Existing Condition	Alt 1	Alt 2	Alt 3	Alt 4
	Acre (%)	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)	2,821 (7.6)
	acres	acres	acres	acres	acres
2. final harvest on ELT 1, 2 or 14	n/a	0	890	670	912
Activities that improve or restore habitat	n/a	0	1,518	1,056	2,121
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.					

Alternatives 2-4

The action alternatives could directly affect individuals by harvest activities or associated road building that destroys an active nest of young voles. However, these direct effects are expected to be minimal as most heather voles should be able to move away from disturbance or seek shelter. There is a relatively small difference between alternatives with regards to suitable habitat (indicator 1), with alternative 3 providing the most and alternative 4 the least. However, alternative 4 would result in the greatest number of acres converted to Jack pine forest which would benefit heather vole. Alternative 4 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 would 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, all 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). The effects of these changes in habitat for heather vole are expected to be minimal because in general the changes are relatively small and some beneficial changes would occur.

Cumulative Effects

The Glacier project supplement appendix C provides a list of past, present and reasonably foreseeable future actions that could contribute to cumulative effects. The incremental effects of those projects are addressed here. 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 the Dry Red White Pine Landscape Ecosystems in the next 10 years which at a coarse scale would benefit this species. Young lowland conifer and edge habitat would provide less of these habitat types. On non-federal lands management for young forest of aspen and conifer would continue which may negatively impact heather voles by decreasing mature jack pine and upland conifer habitat and increasing habitat for and

competition from Meadow voles. These actions would also benefit the species by increasing edge habitat. Long term, heather voles may be benefited as goals established by the Minnesota Forest Resources Council Landscape Committee to increase the amount of Jack Pine Forest (MIH 8) over time guide the land management on all ownerships. This project and predicted cumulative actions from federal and non-federal lands 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 in the project area and across the forest.

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. 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.

Design Criteria / Site-specific mitigations

- Consult with the District Wildlife Biologist if heather vole is found to occur within a planned harvest unit to determine appropriate mitigation needs.

Northern Goshawk – *Accipiter gentilis*

Existing Condition

Population and trend: Northern goshawk (hereafter goshawk) is a large forest raptor, occupying boreal and temperate forests throughout the Holarctic (Brown and Amadon 1968, cited in Keane and Morrison 1994). *Accipter gentillis 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 (Squires and Reynolds, 1997). Goshawk populations in the Lakes States are perhaps less 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 (Postupalsky 1991, 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, 2007 and 2008 (survey records in project file). Within the SNF boundary 26 nests have been identified since 2000, double the 12 nests that we were aware of during the process of revising the Plan revision in 2003-2004. (USFS 2008). Based on the 2007 Statewide Goshawk monitoring effort nine of the 26 known territories were occupied in 2007 (MN DNR 2007). Though these data do not allow detection at this time of a reliable trend data for the Superior NF, the increase shows progress toward the Forest Plan desired condition of 20-30 occupied nests (O-WL-31).

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. Goshawks may use forest edge if large-bodied prey is more common there.

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%. 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 1.1meter

to 3.5 meters 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) (personal communication with Grozier 2006). 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 use 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 than 40% of the uplands in a mature condition. 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).

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
Based on above description of goshawk habitats and rationale provided in the Final EIS for the Forest Plan, Section 3.3.6.1.b (pages 3.3.6-3 through -4) and Forest Plan BE for goshawk indicators 1, 2, and 3 (USDA Forest Service 2004b p. 34-35) the following indicators were selected to analyze potential impacts:

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.
Note: The analysis area for this indicator goes beyond the project area analysis area used for direct and indirect effects. The analysis area is extended out to patch zone 3 because the Glacier area falls entirely within this zone and this zone has a special set of management objectives that influence goshawk habitat. Forest Plan objectives for this zone are to:" *strive too minimize the decrease in acres and number of older upland patches"* and "*to strive to minimize the decrease in interior forest habitat"*.

Direct/Indirect Effects

Effects common to all alternatives

Roads and trails (temporary and system) could impact nesting goshawks however these effects area expected to be minimal because none are planned within known nesting areas, and if a new nest is found mitigations are in place that would protect it from disturbance. Gravel pits and road Smitty's road and the Madden Creek 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 because stand structure post burns should still provide suitable habitat conditions. 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.

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

Indicators	Existing Condition			Alt 1			Alt 2			Alt 3			Alt 4		
	acre		%	acre		%	acres		%	acres		%	acres		%
1a. Upland Forest in Suitable Habitat[1]	25,964		70	27,654		74	22,951		62	24,051		65	21,834		59
	#	ac	%	#	ac	%	#	ac	%	#	ac	%	#	ac	%
1b Patches	51	19,069	51	58	21,862	59	56	18,094	49	54	18,530	50	51	17,295	47
	acres			acres			acres			acres					
2. Stand Complexity[2]	n/a			0			3,755			3,366			3,729		
3. Heart Lake Goshawk Territory	acre		%	acre		%	acre		%	acre		%	acres		%
Post-fledging area[3]	308		81	380		100	380		100	380		100	380		100
Foraging area[4]	5,143		61	5,320		63	4,536		54	5,008		59	4,535		54

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, NHRU or PC60, VT, or TH with underplanting 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.

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 both increase (table *BE- Goshawk 2*). This alternative would not create any new young habitat and would, through time, lose the intermixed habitat of young and mature forest that provides for a variety of prey species. No management induced improvements to stand complexity would occur (indicator 2). The short term effect to that may be neutral because succession of the under stories of forest stands would occur.

Alternatives 2-4

All action alternatives would result in less suitable habitat than alternative 1 and than exists today, with the least amount of habitat available with alternative 4. The amount of large mature patches would also decrease (table *BE- Goshawk 2*). Alternative 3 would result in slightly less fragmentation and alternative 4 slightly more fragmentation of large mature patches than alternative 2 (indicator 1b). The effect of these changes to the amount of suitable habitat is expected to be minimal because all action alternatives would maintain a majority of the upland forest in suitable condition for goshawk (large patches of mature forest). In addition, maintenance of larger contiguous blocks would provide higher quality habitat for goshawks in the Project Area. Young forest created 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. All action alternatives would increase future stand complexity (indicator 2) with

alternative 2 doing slightly more than the others. Stand complexity would be improved through increasing the white pine and white spruce component of stand understories through planting and release. Also, mitigation would 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 would preserve possible future nest trees 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. More than 40% of the foraging area would be in suitable condition ensuring that adequate habitat is maintained.

Alternatives 2, 3 and 4

All action alternatives would have similar impacts to the Heart Lake Territory. Direct effects are not expected because no activities are proposed within the nest site. All alternatives would result in an increase in suitable post-fledging habitat, which could benefit dispersing young (table *BE – Goshawk-2*). All alternatives comply with G-WL-22 and maintain 100% of the post-fledging area in a suitable condition. Alternatives 2 and 4 would result in less suitable foraging habitat; however foraging habitat in all alternatives is maintained in large, connected patches and would likely provide enough hunting areas to sustain this pair. In addition, more than 40% of the foraging area on NFS lands alone would be in suitable condition ensuring that more than adequate habitat is maintained.

Cumulative Effects

The Glacier project supplement appendix C provides a list of past, present and reasonably foreseeable future actions that could contribute to cumulative effects. The incremental effects of those projects are addressed here.

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. It would be difficult for and unlikely that other ownerships, or combinations of ownerships, would provide very much suitable interior habitat for this species. Reduction of suitable habitat by management of other owners would further increase the importance of maintaining suitable amounts of habitat on National Forest System Lands. This project attempts to offset further fragmentation of the landscape by maintaining large, contiguous mature patches of forest and creating large, contiguous patches of young forest, thus ensuring that suitable habitat would continue to be available on federal lands. Vegetation management of intermingled federal, state, county and private land managers in the Glacier area would reduce the present level of large blocks of mature upland habitat under all alternatives. Past, present and future harvests in the

Glacier area over the next 10 years area listed in Appendix C. However, cooperative management should help maintain some large patches of forest by consolidating management across boundary lines.

Planned fuels projects would have minimal impacts to goshawk because anticipated changes to suitable habitat would be minor. New developments (Black Wolf lots) would have minimal cumulative impacts due to there location on the landscape they are located in marginal habitat. Impacts from hunter walking trails, and mining exploration would be primarily in the form of disturbance to nesting goshawks. These cumulative impacts are expected to be minimal because none of the activities are located near known sites. The highway 1 construction would contribute minimal cumulative impacts because although reconstruction activities could disturb nesting goshawks, the result would contribute very little change to existing habitat conditions. Non-native invasive species management would contribute no cumulative impacts.

The 2007 draft Monitoring and Evaluation report shows that forest-wide mature and older upland forest, a key indicator of suitable habitat for goshawk, was 56%, well above the 41% threshold and the 48% projected for the end of Decade 1 of Plan implementation. Monitoring data on forest wide patches in zone 3 shows 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. All of these conditions should ensure viability of goshawk on the forest.

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**	**Alternative 4**
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)	292 (297,634)

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, 3 and 4 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 the majority of the uplands in suitable habitat condition. 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. Forest wide suitable goshawk habitat would be maintained and well distributed. This determination is consistent with the determination in the Forest Plan

Programmatic BE. Alternative 1 would have no effect. All Alternatives are consistent with Forest Plan direction.

Design Criteria / Site-specific mitigations

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

- If any nesting territories are located maintain nest habitat in a 50-acre area around active or recently inactive nests (S-WL-10). Also, within post-fledging areas (500 acres) maintain suitable habitat conditions on a minimum of 60% of the upland habitat (G-WL-22). No timber would be harvested within a 50-acre nest area around a known site. No new roads would be located within the 50 acre nest area. Do not establish gravel pits in goshawk nesting habitat.

- 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. If an active nest, follow the time restrictions listed earlier for the 500-acre post-fledging territory.

- Harvest and temporary road construction should not be done between March 1 and August 31 within 2,885 feet of an active nest.

- Generally, consider silvicultural prescriptions that maintain or enhance goshawk habitat. A possibility for aspen-birch-balsam fir forests might be to harvest dominant and co-dominant trees maintaining >50% canopy cover, harvest intermediate and suppressed trees except leaving perhaps 10 conifer per acre, and create openings ¼ to 2 acres in size that cover a maximum of 10% of the stand. Plant widely spaced (15 ft. x 15 ft.) white pine and white spruce under canopy, and a mix of widely spaced red pine and jack pine among aspen and paper birch sprouts in openings.

- If a goshawk territory is found, suspend harvest until a home range analysis can be conducted on the new site. If there will be 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.

- Thinning in conifer stands should maintain open flying conditions for goshawk and aspen-birch component. In thinned stands maintain > 50% canopy cover and most deciduous trees, especially aspen. Leave 6 to 12 live hardwood trees per acre when available for possible future nest trees. See appendix B of the supplement to the DEIS for a list of the specific units to which this applies.

Boreal Owl - *Aegolius funereus*

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 Kawishiwi 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, Lane 1997). The population on the Superior National Forest is part of a larger Canadian population and may not be viable by itself at present (USFS 2006). Population trends are difficult to detect given normal large population fluctuations and low precision of survey estimates. Population estimates of boreal owls in Minnesota range between 100-600 individuals (Lane, 2001). Average home range size for four radio-tagged boreal owls on the Superior National Forest was 1,202 ha (Lane 2000). Home range size is probably variable depending on prey density and other factors.

Boreal owls were surveyed in the project area in 2006, 2007 and 2008 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. No proposed harvest would occur near the detection. The Minnesota DNR's Natural Heritage Database has no documented occurrences in the Glacier area.

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 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). Other 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 (USFS 2004b). 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 half of the project area. The importance that the BWCAW plays in maintaining boreal owl populations on the forest 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 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 and indirect effects
Common to all alternatives
Direct effects to nest sites are not expected because there is currently no known active nesting territory in the project area. One owl was detected in the Project Area during surveys in 2006 but additional surveys of the location failed to detect the owl again and no nest could be located (survey data in project record).

Roads (temporary, system, special use) should have a minimal impact on boreal owls since roads are generally located away from the upland/wetland interface. 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 because suitable habitat conditions should remain after the burn.

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*).

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

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3		Alt 4	
	Acres	%	Acres	%	acres	%	acres	%	acres	%
1a. nesting habitat	7,632	31	8,331	36	6,174	28	6,536	30	4,171	17
1b. foraging habitat	3,142	63	3,130	63	3,130	63	3,130	63	3,130	63

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 (24,641 ac). Percent of foraging habitat is the percent of total lowland black spruce forest (5,006 ac).

Alternatives 2, 3 and 4
All action alternatives would maintain the same amount of suitable foraging habitat. Alternative 3 would maintain more nesting habitat than alternatives 2 or 4 and both maintain less than alternative 1 (*Table BE – Boreal Owl-1*). All alternatives would remove fairly high amounts of suitable nesting habitat in the Kawishiwi Triangle area, and this area holds 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, all 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 would 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).

Cumulative Effects
The Glacier project supplement appendix C provides a list of past, present and reasonably foreseeable future actions that could contribute to cumulative effects. The incremental effects of those projects are addressed here. On federal lands within the Dry Mesic Red and White Pine and the Jack Pine Black Spruce LE 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. Other activities listed in appendix C are not expected to have any significant cumulative effects.

At the Forest scale the 2006 Annual Monitoring Report shows a slight decrease in mature upland deciduous and a slight increase in upland mature conifer habitat, however both are still above the Forest Plan FEIS project 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 Alternatives 2, 3 and 4 may impact individuals but are not likely to cause a trend to federal listing or loss of viability. Alternative 4 would reduce the most potential nesting habitat across the entire project area; however all alternatives 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 nesting 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 would 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.

Design Criteria / Site-specific 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. See appendix B of the supplement to the DEIS for a list of the specific units to which this applies.

- Continue surveys adjacent to a subset of harvest units to locate potential breeding owls.

Olive-sided flycatcher – *Contopus cooperi*

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. Historically, fire regimes in upland conifers created and maintained foraging habitat that was widely distributed but had gaps (USDA Forest Service 2004b). 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 (Jim Lind, communication to Susan Catton August 2005). Forty-eight individuals have been documented during the NRRI bird monitoring from 1991 to 2005 (Lind et al. 2006b) a few of these occurring in the project area. In 2008, bird survey plots in lowland conifer forest types have been added to the long-term bird monitoring done by NRRI in an effort to better detect and monitor species such as olive-sided flycatcher. Although no project specific surveys for olive-sided flycatcher were conducted, I assume that they are likely to occur in the area. Potential impacts to olive-sided flycatcher can be adequately assessed based on species' habitat requirements, distribution, and expected management impacts to habitat.

Habitat needs and limiting factors*:* Olive-sided flycatcher nests most frequently in larger black spruce-tamarack bogs or in large openings with residuals (USDA Forest Service 2004b). MacLean (1999) states they use burned or cleared areas with standing trees, primarily conifers. Beaver ponds are also important habitat. Forage habitat structure of live and dead snags is the most important component in the breeding range. Reduction on fire frequency may have a greater impact on foraging habitat and may not be outweighed by habitat created through harvesting gaps (USDA Forest Service 2004b). 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 exclusion of large scale fires in conifer stands and changes in wintering habitats in the Andes of South America (NatureServe 2006).

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

1. 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

Effects common to all alternatives

Roads and trails (temporary, system, and special use) should have a minimal impact on olive-sided flycatchers because they do not generally change the suitability of nesting and foraging habitat. Many of the proposed roads use already existing road corridors which are not flycatcher habitat. New construction would be located to avoid disturbance to as much wetland habitat as feasible. With all alternatives, low-density conifer lowlands 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, providing suitable habitat for the olive-sided flycatcher. All action alternatives would retain snags and leave islands via standards and guidelines but this is likely of lesser importance than fire regime. 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 the amount of suitable habitat would increase slightly from existing condition in the 10 year analysis window (*Table BE – Olive-sided Flycatcher-1*). Habitat would be maintained with fairly good distribution (map in project file). This alternative would have minimal impacts on olive-sided flycatcher.

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

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3		Alt 4	
Impacts to Suitable habitat	acre	%	acre	%	acres	%	acres	%	acres	%
1. amount of suitable habitat	7,536	18	7,998	19	10,091	24	9,357	22	10,806	26

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)

Alternatives 2, 3 and 4

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. All project alternatives 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. All action alternatives increase the amount of potential habitat, however, alternative 4 creates the most potential beneficial effects on habitat through timber harvest (*Table BE – Olive-sided Flycatcher-1*). All alternatives create more than adequate temporary habitat for the species in the project area. Direct effects from each action alternative are not expected because little activity would occur in suitable nesting habitat during the breeding season. 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.

Cumulative Effects

The Glacier project supplement appendix C provides a list of past, present and reasonably foreseeable future actions that could contribute to cumulative effects. The incremental effects of those projects are addressed here. This project, combined with other similar timber sales in the project area on all ownerships could enhance habitat for this species by planting conifer and leaving abundant conifer residuals, especially in large openings. MFRC Management Guidelines should be followed by the Minnesota Department of Natural Resources, St. Louis and Lake Counties, 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. Other projects listed in appendix C would contribute little to cumulative effect on olive-sided flycatcher.

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 (Management Indicator Habitat 5) increases providing more potential habitat and reserve tree guidelines would ensure that residual standing conifer trees were left to provide needed habitat structure. This would benefit the olive-sided flycatcher, because the amount of suitable habitat would increase in the Jack Pine Black Spruce (JBS) Landscape Ecosystems (LE) and decrease in the Dry Mesic Red and White Pine (DRW) LE. Forest-wide objectives, standards and guidelines would move upland riparian forest (Indicator Habitat 10) to a mature condition. 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 Biological Evaluation for the forest plan. Natural processes such as large scale blow down event and fires in the BWCAW help to maintain habitat for the olive-sided flycatcher.

Determination

The proposed resource management activities planned in the project area may impact individuals of olive-sided flycatcher but is not likely to result in a trend towards listing or a loss of viability.

All Alternatives could result in direct effects to birds during the nesting season, however these effects are expect to be localized and not impact all. All alternatives may have some beneficial impacts to the species as well by increasing the amount of suitable habitat. Leave tree guidelines would benefit this species. Declines most likely caused by habitat loss in wintering grounds. Lowland and riparian flycatcher habitat should not be affected by management activities and all harvest activities should retain an adequate amount of residual trees. This determination is consistent with the determination in the Forest Plan Programmatic BE. All Alternatives are consistent with the Forest Plan O-WL-18, G-WL-11, G-WL-12 S-WL-5, and O-WL-25

Design Criteria / Site-specific mitigations

- Each harvest unit would have approximately 6 to 12 live trees left uncut per acre. These trees would be greater than 8 inches DBH and would be left individually, in clumps, or as reserve islands ranging from 0.25 to 2 acres in size. Emphasis would be placed on maintaining reserve clumps in areas of a unit which could serve as travel corridors for wildlife between adjacent forest cover patches and would meet visual quality objectives.

- Within clearcut stands larger than 20 acres, 5 percent or more of the total stand acreage would not be harvested, but would instead be retained as a "legacy patch" of live trees. Legacy patch vegetation would aid in the recolonization of the adjacent managed area, and assist in the protection of organic matter and associated organisms in the soil. Where possible, each legacy patch would be at least two acres in size.

- Where possible maintain 10-20% canopy cover along riparian areas with a preponderance of large standing live or dead trees used for nesting and perching, especially spruce or tamarack (O-WL-25). See appendix B of the supplement to the DEIS for a list of the specific units to which this applies.

Black-throated blue warbler – *Dendroica caerulescens*

Existing Condition

Population and trend: This species is considered widespread and relatively abundant with no evidence of large scale declines over its entire range (Nature Serve 2006). On the Superior National Forest this species has a very limited range where it is found nesting primarily in northeastern Minnesota in Cook and southeastern Lake Counties (outside the Project Area), however singing males are found across the forest. One hundred twenty six individuals have been documented during the NRRI bird monitoring from 1991 to 2002 (Lind et al. 2006). Based on eleven stands in which black-throated blue warblers were detected, the species shows a significant increase in population (11.6%) on the Superior NF between 1991 and 2005 (Lind et al 2006a). Black-throated blue warblers have been documented in the project area during project level breeding bird surveys done in 2008 and during NRRI bird surveys.

Habitat use and limiting factors: This species uses large contiguous hardwood forests, requires large relatively intact areas of continuous canopy and is probably associated with small gaps and a well-developed under story. Research from the eastern parts of its range suggests that areas at least 2,500 acres in size and greater than 70% closed canopy are needed to support populations (Robbins et. al, 1989). Vegetation management that reduces mature forest patches, removes structure and creates forest fragmentation in mature aspen-birch forest can reduce habitat suitability for the black-throated blue warbler. It nests in small trees, saplings, or shrubs in dense undergrowth, within about a meter of the ground (Holmes et al. 1986, NatureServe 2006). Fragmented habitats create conditions for American redstarts (*Setophaga ruticilla*) and chestnut-sided warblers (*Dendroica pensylvanica*) that compete with and can 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 these situations, the likelihood of competing species invading interior patches after even a slight amount of disturbance is much greater. 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 (USDA Forest Service 2004a).

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 black throated blue warbler:

- 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.

Direct/Indirect Effects

Effects common to all alternatives

Roads and trails (temporary, system, and special use) may have some impact on black-throated blue warblers because they create canopy gaps which may allow for the increase in American redstarts and chestnut-sided warblers into interior forest. Additional impacts from roads and trails would be minimal however because many of the proposed routes use already existing road corridors or are not located in suitable 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. Alternative 1 would result in the most mature forest patches and acres, as well as the most interior habitat available in the Project Area (*Table BE –Black-Throated Blue Warbler-1*). No management induced gaps would be created in mature aspen-birch forest. No harvest in mature aspen-birch would take place. 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.

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		Alt 4	
	acre	%	acre	%	acres	%	acres	%	acres	%
1. Upland Forest in Suitable Habitat[1]	17,752	48	18,237	49	14,220	38	15,048	41	13,314	36
	acres	#	acres	#	acres	#	acres	#	acres	%
2. 300+ acre patches	14,027	21	15,471	23	12,210	23	12,367	20	10,897	16
	acres		acres		acres		acres		acres	
3. acres of interior habitat	5,150		5,699		4,923		5,113		4,765	

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]

Alternative 2, 3 and 4
Direct effects could occur with all action alternatives in the form of disturbance from timber harvest and road construction and use during the nesting season. Since the species has a very limited range on the Superior National Forest; primarily in northeastern Minnesota in Cook and southeastern Lake Counties (outside the Project Area) and few black-throated blue warblers have been documented in the project area, the risk of these potential impacts is generally expected to be low and within acceptable risk levels. In addition, seasonal restricts would be applied in stands with known black-throated blue warbler locations to further mitigate any adverse effects. Compared to existing conditions, all action alternatives would result in less mature upland deciduous forest habitat, fewer patches and acres as well as less interior habitat (*BE –Black-Throated Blue Warbler-1*, see also FEIS Table 3.8-6). All action alternatives would increase within stand fragmentation. Alternative 4 would result in the greatest negative effects to black-throated blue warbler habitat. Alternative 2 and 3 differ little in overall effects. All these habitat changes could have negative indirect effects to the black-throated blue warbler. Although outside the analysis time frame, alternatives 2 and 3 may begin to provide the most beneficial long-term effect as partial harvest treatments begin to result in multi-layering and increase in within stand complexity.

Cumulative Effects
The Glacier project supplement appendix C provides a list of past, present and reasonably foreseeable future actions that could contribute to cumulative effects. The incremental effects of those projects are addressed here. In the project area, management intentions of intermingled state, county and private lands managers would probably reduce the present level of large blocks of mature upland forest. Other ownership lands are generally in smaller units, less contiguous and more scattered than NFS lands. Therefore, management of these areas tends to fragment the forest, and decrease large mature patch and interior forest habitat conditions. It would be difficult for and unlikely that other ownerships, or combinations of ownerships, would provide very much suitable interior habitat. This would result in negative cumulative impacts because the decrease of habitat quality improves conditions for American redstarts and chestnut-sided warblers that compete with and exclude black-throated blue warblers from an area. All action alternatives would attempt to offset further fragmentation of the landscape by maintaining large, contiguous mature patches of forest and creating large, contiguous patches of young forest.

According to the 2006 Annual Monitoring report, Forest-wide on national forest lands, in both the JPB and DRW LEs the amount of mature and older Upland Deciduous Forest (MIH 2) is predicted to decrease which could negatively affect the species. However, acres of aspen maintained (the Forest Type within MIH 2 that this project would affect) would still be more than would have occurred under the range of natural variability and adequate amounts of habitat for the species would be retained (Annual Monitoring report 2006). On NFS lands, the Project falls in Forest Plan Spatial Management Zone 3 which is not generally considered prime black-throated blue warbler habitat on the forest. Compared to existing conditions, mature/old interior forest (MIH 12) is projected to decrease slightly in Zone 3. This results in a slight net loss of

interior habitat which could negatively affect the species (FEIS Table 3.8-7). Table 3.8-8 of the FEIS shows a projected decrease in MIH 13 (300 + acres patches) for Zone 3 compared to existing conditions. However, Zone 3 MIH 13 acres remain above Forest Plan condition 2004, which objectives were based on. Compared to existing conditions the result is a net loss of mature patch habitat which could negatively affect the species. This decrease in suitable habitat conditions is consistent with the cumulative effects analysis and predictions conducted in the programmatic BE for the Forest Plan. Despite the decrease in Suitable habitat, adequate amounts should be maintain in prime range (patch zones 1 and 2) in order to maintain viability. The BWCAW likely provides little suitable habitat for black throated blue warblers due to the larger amounts of conifer forest that dominates.

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 2, 3 and 4. All alternatives would maintain well distributed habitat and maintain large mature patches and most interior forest habitat and risk of disturbance is low because seasonal restrictions would be applied near known sites to protect breeding pairs. This determination is consistent with the determination in the Forest Plan Programmatic BE. Alternative 1 would have no effect on the black throated blue warbler. All alternatives are consistent with O-WL-18, G-WL-11, G-WL-12 and S-WL-5.

Design Criteria/ Site-specific mitigations

- (G-WL-11 and G-WL-12) If any nesting pairs are discovered, harvest unit between August 15 and May 15 (outside of nesting season for Black throated blue warbler). See appendix B of the supplement to the DEIS for a list of the specific units to which this applies.

Bay-breasted warbler – *Dendroica castanea*

Existing Condition

Population and trend: An estimated 90% of this species population is found in Canada with the Superior National Forest falling at the southern edge of the species range. The bay-breasted warbler breeds throughout the spruce-fir forest of Canada and the northern most parts of the U.S. following the range of spruce budworm (*Choristoneura fumiferana*) (Maxson 1999). On the Superior much of the breeding habitat occurs along the Minnesota/Canadian border and in the Boundary Waters Canoe Area Wilderness (USFS, 2004b). Little is known about the overall population trend of the bay-breasted warbler because of the remote areas where they are primarily found (Jakko Poyry, 1992). However, the population does fluctuate in apparent response to outbreaks of spruce budworm its obligate prey species. Populations may have declined in the past 100 years with a reduction in conifer dominated stands being replaced by aspen. Nineteen individuals have been documented on the Superior National Forest during the NRRI bird monitoring from 1991 to 2005 (Lind et al. 2006b), a number not abundant enough to calculate statistical trends in annual abundance. Although no birds have been detected in the project area, I assume that they are likely to occur because suitable habitat is present. Potential impacts to bay-breasted warbler can be adequately assessed based on species' habitat requirements, distribution, and expected management impacts to habitat.

Habitat needs and limiting factors*:* Maxson (1999) summarizes that bay-breasted warbler breeds primarily in old upland and lowland spruce-fir forests, sometimes pine, and coniferous riparian areas. They breed in forests where the conifers are dominant or co-dominant trees. They need patches of spruce budworm outbreak over a large enough area that the birds can find. Birds often move to such an area in large groups. 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, emphasis from the last Forest Plan 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 acres of spruce-budworm defoliation in 1999 compared to a million acres in 1958. Limiting factors include 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 (USFS 2002b, USFS 2004b).

In the Glacier area, suitable habitat for the bay-breasted warbler is currently patchy and not abundant.

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.

Direct/Indirect Effects

Effects common to all alternatives

Timber harvest during the breeding season could have direct effects on nesting warblers, but these effects are expected to be minimal as small amounts of suitable habitat is proposed for treatment. Road system management activities and gravel pit use and expansion are anticipated to have little to no effect because of the limited amount of habitat available. Prescribed burning may have a negative impact on bay-breasted warblers due to the killing of balsam fir within the pine stands.

Alternative 1

Direct effects from alternative 1 are not expected. Indirect effects could occur in the form of changes to suitable habitat (*Table BE –Bay-breasted Warbler-1*). During the analysis timeframe (10 years) more spruce-fir forest will grow into a mature age class potentially providing more suitable habitat for these species. The benefits of this for the species would likely be slight because habitat would still be not abundant and have patchy distribution across the project area although more abundant in the southern 1/3 of the area.

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		Alt 4	
	acre	%	acre	%	acres	%	acres	%	acres	%
1. Mature and older upland spruce fir forest	3,830	10	4,489	12	4,216	11	4,330	12	4,092	11

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]

Alternatives 2, 3 and 4

Direct effects to these species are not expected, because mitigations would be implemented to protect known sites from disturbance and habitat change. Indirect effects could occur with all action alternatives with changes to suitable habitat (*Table BE –Bay-breasted Warbler-1*). All action alternatives would result in more mature spruce-fir forest than occurs today which could have a slight benefit to bay-breasted warbler. Suitable habitat would have the best distribution in the southern 1/3 of the project area which could possibly produce spruce budworm outbreaks over large enough areas to benefit the species.

Cumulative Effects
This project, combined with other similar timber sales on the Superior National Forest as well as other ownerships (see Section 3.7 Vegetation and 3.8.3 Management Indicator Habitats, cumulative effects sections in the FEIS), would 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. However, consistent with Forest Plan objectives for both DRW and JPB Landscape Ecosystems, MIH 6 (upland spruce-fir) is projected to increase overall and in particular mature and older MIH 6 would increase. This may, to a small degree, benefit the species on a larger scale. 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 Northern Superior Uplands and LEs through conversion to spruce-fir or through natural succession. The best potential habitat for the bay-breasted warbler would still occur in the BWCAW.

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 Alternatives 2, 3 and 4. 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 older 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.

Design Criteria / Site-specific mitigations
None identified

Bald Eagle – Haliaeetus leucocephalus

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). Population trends on SNF, based on active nest survey in 2005, have increased since 2000: 90 active breeding territories, exceeding Forest Plan goal of 85 (USFS 2008). In or adjacent to the project area there are 14 known bald eagle nests.

Habitat needs and limiting factors: Bald eagles are known to use suitable habitat on 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 and Rogers1992). 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

With the delisting of the bald eagle, management objectives identified by the Forest Plan 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. 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 Indicators

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 and under planting of white pine 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

With the no action alternative potential nesting habitat would be allowed to grow older. 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, however white pine is currently found scattered throughout the analysis area in the understory though no TSI work would be done to improve it's chances for survival. No sites would be disturbed by management activities. Amount of open roads on potential habitat would remain constant providing potential for human disturbance. In general this alterative would have no additional effects than then existing condition. Currently eagles are successfully breeding and raising young 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		Alt 4	
Impacts to habitat	acre	%	acre	%	acres	%	acres	%	acres	%
1a. amount of white and red pine forest type, within potential eagle habitat.	2,300	8	2,245	8	2,370	8	2,354	8	2,370	8
	acre		acre		acres		acres		acres	
1b. amount of diversity planting of pine planned within potential eagle habitat	n/a		0		3,264		2,731		3,469	
Disturbance	Miles		Miles		Miles		Miles		miles	
2a. amount of open roads within potential eagle habitat	244		244		239		240		239	
	sites		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		579 664 668 683 684	

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

Alternatives 2, 3 and 4

Alternatives 2, 3 and 4 have similar effects to eagle so are discussed together. All action alternatives 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. All action alternatives could further benefit eagle through a slight reduction of open roads within potential eagle habitat. All action 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 would mitigate the potential negative effects. In addition, large mature red and white pine trees would be maintained in stands that are final harvested within 1/4 mile of eagle foraging area as an added measure to maintain suitable eagle habitat.

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.

Cumulative Effects

Additional impacts to eagle would occur on lands outside of National Forest jurisdiction. The activities considered in the cumulative effects analysis are listed in appendix C of the DEIS.

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, including those listed in appendix C, 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. Fuels projects should not impact eagles because seasonal restrictions or other mitigating measures would be put in place to protect nesting eagles. The necessary mitigating measure would be identified during the specific fuels planning for each site. Development in the Black Wolf lots and hunter walking trails would have not impact on eagles because the area is located in marginal habitat for eagles. The cumulative impact from minerals exploration is expected to be minimal because mitigations have been applied to that project to minimize disturbance and exploration would not change habitat conditions. Non-native invasive species management would have no cumulative impact to eagles. The Travel Management project may have beneficial impacts by resulting in a lower road density in eagle habitat. The South Kawishiwi Summer Home land exchange would have no cumulative impacts on eagles because changes in vegetation of land use would not change as a result of the project. Ample amounts of suitable habitat will continue to be provided by the BWCAW.

Based on an increasing population of eagles, overall adverse cumulative impacts to eagle from human disturbance and habitat modification would be insignificant and would not reverse eagles 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 and reserve tree design criteria on some management activities would mitigate potential negative effects from disturbance (see mitigations below).

Design Criteria / Site-specific mitigations

- Activities planned in the following units should not occur between Feb 15 and Oct 1 to protect nesting eagles (when nests are active). See appendix B of the supplement to the DEIS for a list of the specific units to which this applies.

- 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. See appendix B of the supplement to the DEIS for a list of the specific units to which this applies.

- 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 – *Oporornis agilis*

Existing Condition

Population and trend*:* Rieck (1999) summarizes that Connecticut warbler (*Oporonis agilis)* breeds from British Columbia to Quebec including the northern Lakes States. The bird is very secretive and difficult to detect. The trend for Connecticut Warbler in Minnesota from the North American Breeding Bird atlas is 1.0 during the period of 1966-1999 (a non-significant increasing trend) (Sauer et al. 2001). NRRI songbird monitoring (Lind et al. 2006 a and b) over the past ten years in the Great Lakes National Forests shows a 14% annual decline on the Chippewa National Forest but does not provide trend data for the Superior National Forest. One hundred twenty individuals have been documented on the Superior National Forest during NRRI bird monitoring from 1991 to 2005 (Lind et al. 2006a and b). Connecticut warblers have been observed in the project area. Potential impacts to Connecticut warbler can be habitat requirements, distribution, and expected management impacts to habitat.

Habitat needs and limiting factors: USDA Forest Service (2000b) notes that Connecticut warbler breeds in short-needle conifer with low ericaceous shrubs (3 feet or less). They may also be in pine with a dense blueberry understory. They forage on the ground and in low shrubs. 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). They also use jack pine forests. The Conservation Assessment for Connecticut Warbler (USDA Forest Service 2002f) lists the "Superior National Forest Habitat of Connecticut Warbler occurrences: Primarily boreal bogs and jack pine (which is a rare habitat there)" (USDA 2000b). Lind et al 2006a and b specifically found Connecticut warblers most abundant in black spruce forest types, followed by saw-sized jack pine and then to a lesser degree in descending order of abundance: saw-sized jack pine, saw-size red pine, saw-size fir/aspen/paper birch, saw-size quaking aspen, saw-size white pine, regenerating jack pine, pole-size mixed conifer swamp, regenerating quaking aspen, pole-size fir/aspen/paper birch, and pole-size quaking aspen. This data is based on point count surveys conducted over a period of ten years in 168 stands on the Superior National Forest. Threats and limiting factors are not fully understood but include loss of breeding habitat, loss of wintering habitat, nest predation and parasitism, collision with towers, and possible habitat fragmentation (USFS 2002f, 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 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.

Direct/Indirect Effects

Effects common to all alternatives

Effects of the project are expected to be minor since the primary habitat for the species (large boreal bogs and jack pine) would not be impacted by the USFS. Connecticut warbler habitat; mature jack pine forests (MIH 8) would increase in all alternatives and lowland black spruce (MIH 9) would change very little. Direct effects from logging and associated road system management or gravel pit use and expansion will likely have minimal effects as the Project proposes no activities in known nesting habitat during the breeding season (May 15 to August 1).

Alternative 1

Indirect effects could occur in the form of changes to suitable habitat (*Table 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. In this alternative no additional acreage would be converted to jack pine.

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

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3		Alt 4	
	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	2,821	7.6
2. MIH 9 mature+ acres and (%) of MIH 9	4,482	89	4,630	91	4,369	87	4,479	90	4,339	87
	acres		acres		acres		acres		acres	
3. acres of conversion to jack pine forest	n/a		0		1,518		1,056		2,121	

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).

Alternative 2, 3 and 4
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 but not by a large degree. In addition, all action alternatives would increase jack pine in the project area through conversion of other forest types, with alternative 4 resulting in the greatest increase. 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). Forest-wide in both DRW and JPB Landscape Ecosystems, mature and older jack pine will increase providing more habitat for this species. Harvest on non-federal lands may provide slightly more acreage of Jack Pine thru conversion but probably not a large contribution. Project alternatives would have on impact on potential habitat available in the BWCAW.

Determination
The proposed resource management activities planned in the project area may impact individuals of Connecticut warbler but are not likely to cause a trend to federal listing or loss of viability. There is very limited harvest in boreal bogs and mature jack pine habitat is maintained with all alternatives. All alternatives are consistent with the Forest Plan O-WL-18, G-WL-11, G-WL-12 and S-WL-5. Alternative 1 will have no effect

Design Criteria / Site-specific mitigations
Non identified

Three-toed woodpecker – *Picoides triadactylus*

Existing Condition

Population and Trends: 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 but quite likely downward (NatureServe 2006). Neither the Great Lakes National Forests Breeding Bird Monitoring effort (169 stands on the Superior monitored; http://www.nrri.umn.edu/mnbirds/speciestrends.htm) nor the Fish and Wildlife Service Breeding Bird Survey (8 routes of 50 monitoring points each; http://www.mbr-pwrc.usgs.gov/bbs/trend/tf05.html) have detected three-toed woodpecker on the Superior National Forest (SNF). On the SNF, it is thought that inventory and monitoring population trend of this species is not practical: due to its extreme rarity it would be costly to survey and results would be scientifically unreliable. Even if the bird is detected, there would not be enough information to calculate statistical trends in annual abundance. In part, it is likely that the timing surveys are such that this species would not generally be detected. For these reasons, potential abundance and trend is evaluated with habitat indicators (Shedd 2006). Casual observations have been made of this species on the forest. It is considered very rare on the forest (Green and Neimi, 2002).

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). In Region 9 they seem to nest mainly in spruce and balsam snags and mature trees. 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 (USFS 2002n). According to Green and Niemi (2002), 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 (USFS 2002n) 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 (USFS 2002n). Threats facing this species include habitat loss, fire suppression, salvage logging, conifer conversion, 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.

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.

Direct/Indirect Effects
Effects common to all alternatives
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.

Alternative 1
Direct effects are not expected because no activities are planned in suitable habitat. Indirect effects could occur due to changes in habitat quantity/quality (*Table BE – Three –toed woodpecker-1*). Overall habitat for three-toed woodpecker would be impacted positively, by increasing from existing condition.

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

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3		Alt 4	
Impact to suitable habitat	acre	%	acre	%	acres	%	acres	%	acres	%
1. amount of suitable habitat	8,532	22	10,577	25	9,780	23	10,108	24	6,913	19
Enhancement indicator	acres		acres		acres		acres			
2. amount of conversion planned	n/a		0		1,653		1,228		2,320	

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)

Alternative 2, 3 and 4

Direct effects could occur with all action alternatives in the form of disturbance from timber harvest and road construction and use during the nesting season. Since Forest Plan standards and guidelines would be implemented to protect (with a seasonal restriction) known sites where the species occur, the risk of these potential impacts is generally expected to be low and within acceptable risk levels. *Table BE – Three –toed woodpecker-1* provides the results of the indicators analysis. The amount of suitable habitat in all action alternatives would be less than would be available with the no action alternative however, Alternatives 2 and 3 would result in more habitat than is currently available in the project area. Upland harvests in mature jack pine and spruce-fir were designed to reduce fragmentation by harvesting adjacent to existing clearcuts or strip cuts. There will also be black spruce leave trees left in these harvest areas which will provide temporary habitat for three-toed woodpeckers. All action alternatives also appear to increase potential future habitat for three-toed woodpeckers by planting a combination of white pine and white spruce. Overall, the action alternatives differ little in effects to habitat for the three-toed woodpecker.

Mitigation measures included for all alternatives should provide good foraging habitat for three-toed woodpeckers. Six to ten jack pine or spruce will be retained per acre (in addition to reserve trees) in even-aged jack pine and upland black spruce/jack pine clearcuts (G-WL-18). Trees will be left evenly spaced or clumped depending on site conditions.

Cumulative Effects

Habitat is decreasing range-wide from historic conditions. Fire suppression, salvage logging, clearcutting without abundant conifer reserve trees, maintenance of aspen, beaver and spruce budworm control, and habitat fragmentation threaten habitat for this species, however the windstorm of July 4th 1999 created large areas of habitat for this species in some parts of the Superior National Forest. 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. On NFS lands on the Superior, mature and older spruce-fir, jack pine and lowland black spruce tamarack forest would increase in both the JPB and DRW Landscape Ecosystems

(2006 Annual Monitoring Report). This would benefit the species by providing more potential habitat. Other ownerships (especially the State) have started converting some aspen stands to conifer stands (appendix C). This would gradually increase habitat for the three-toed woodpecker from existing conditions. Natural processes such as large scale blow down event and fires in the BWCAW help to maintain habitat for the three-toed woodpecker.

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 the action alternatives. There is limited harvest in lowland black spruce habitat, large mature patches will be protected and mitigation measures will provide habitat in harvest units. Alternative 1 will have no effect. All Alternatives are consistent with the Forest Plan O-WL-18, G-WL-11, G-WL-12 and S-WL-5, O-WL-23, O-WL-24 and G-WL-17.

Design Criteria / Site-specific mitigations

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

- (G-WL-18) Retain 6-10 jack pine or spruce per acre (in addition to reserve trees) in even-aged regeneration harvests in Jack Pine and Upland Black Spruce forest types. See appendix B of the supplement to the DEIS for a list of the specific units to which this applies.

Great gray owl – *Strix nebulosa*

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. Population trends for the species are impossible to detect because of a lack of suitable monitoring program for the species. Winter invasions, suggests highs in the population cycle; however, the causes and source populations for these invasions is unclear (Jakko Poyry 1992). Great gray owls were surveyed in the project area in 2006, 2007 and 2008 using both call playback and listening stops. Five survey routes were run and consisted of 70 survey points along roads. These routes were run 1 to 4 times in the spring all years. Five great gray owls were detected within the project area. Owls were found to be nesting in one location (survey records in project file).

Habitat needs and limiting factors: Kozie (1999) states that natural foraging habitat for great gray owl includes 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. The owls 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. Abundant perches are needed. Perches need not be tall; they can be high stumps, broken-off trees, and the short black spruce found in peatland bogs. 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. They also avoid concentrations of predators such as great horned owl. 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. Limiting factors include availability of suitable nesting sites, foraging habitat, and prey abundance (Duncan and Hayward 1994, in Hayward 1994). Additional limiting factors include collisions with automobiles, development and disturbance during nesting (Natureserve 2006).

In the Glacier area, both potential nesting and foraging habitats are abundant and well distributed.

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)

Analysis 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 clearcut, 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

Effects common to all alternatives

Roads (temporary roads, and system roads and trails) should have a minimal impact on great gray owls. Owls forage readily along roadsides. Roads in all alternatives could cause direct mortality however, this effect is thought to be minimal as many roads in suitable habitat are low standard and receive low speeds and traffic volume. 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 2006) 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

In this alternative, through succession, nesting habitat will increase and foraging habitat would decrease. No new temporary foraging habitat will be created on NFS land. In the long term (after 10 years), young upland will largely disappear from the landscape and foraging habitat would have to be provided solely by non-forest, lowland hardwoods and lowland conifer forests. Overall there would be an increase in potential nesting and a decrease in potential foraging habitat. The effect of this is expected to be relatively minor because ample amount and distribution of both would remain.

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

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3		Alt 4	
Impacts to habitat	acre	%	acre	%	acres	%	acres	%	acres	%
1. Nesting habitat	25,964	70	27,654	74	22,951	62	24,051	65	21,834	59
2. Foraging Habitat	10,476	22	9,691	21	15,018	32	13,523	29	16,919	36
Habitat enhancements	acres		acres		acres		acres		acres	
Foraging habitat created	1,293		0		5,831		4,352		6,951	

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)

Alternatives 2, 3 and 4
All action alternatives would provide more foraging than existing conditions and the no action alternative. All action alternatives also show a decrease in nesting habitat compared to existing and the no action. All action alternatives maintain both good quality foraging and nesting habitat which is well distributed across the project area (see maps in project record). And all 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 any newly found nests would be protected.

Cumulative Effects
Forest wide, in the next ten years, nesting habitat (mature and older MIH 1) is projected to increase in the Jack Pine Black Spruce LE while it would decrease in the Dry Red and White Pine LE (net decrease of 131 acres). This slight decrease is not likely to cause any significant negative effects or associated cumulative effects to the species, especially when considering that nesting habitat is not thought to be the limiting factor in the SNF.

Future Forest Service vegetation management (*i.e.* Glacier and Border projects), within the next ten years are expected to harvest nesting habitat and thus create foraging habitat within the DRW Landscape Ecosystem. This would presumably offset or lessen the negative impacts to gray owls from the projected decrease in foraging habitat. No treatments or changes are expected to occur in non-forest or lowland hardwoods which also serve as foraging habitat. 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 will be harvested and additional temporary foraging areas will be created. Leave trees (MFRC site-level guidelines) would provide foraging perches in harvested areas. Creation of temporary foraging habitat through harvest should assure that the remaining potential nest habitat (>59 years of age) will be within 1.5 miles of some type of foraging habitat. Suitable habitat is also maintained in the BWCAW.

Determination
All alternatives may impact habitat of the great gray owl but are not likely to cause a trend to federal listing or loss of viability. Adequate amount of suitable nesting and foraging habitat appear to be available with all alternatives. Site specific standards and guidelines would help to protect known nest sites from adverse affects of forest management. All alternatives are consistent with the Forest Plan O-WL-18, G-WL-11, G-WL-12, S-WL-5, O-WL-21, G-WL-14 and G-WL 15.

Design Criteria / Site-specific mitigations

- Follow reserve tree and legacy patch guidelines.
- If a great gray owl nest is discovered, immediately contact district wildlife biologist. Allow, to the extent practical, only activities that protect, maintain or enhance site conditions within 660 feet of known nest site. (G-WL-14)
- Avoid disturbance of nesting pairs during the critical nesting season (March 1 – June 1). (G-WL-15)
- Protect stick nests with reserve trees or legacy patches where possible specifically when in close proximity to wetlands or lowland black spruce (O-WL-21).
- Survey all burn units prior to burning to locate any potential nests.

Sensitive Species: Terrestrial insects

Laurentian Tiger Beetle – *Cicindela denikei*

Existing Condition

Population and trend: While this species has a limited range it does not appear to be rare within it (Nature Serve 2006). There are 71 documented sites in Minnesota, including at least 33 sites on the Superior National Forest and 4 sites in the project area (MN DNR Heritage database 2006b). This is up from the 13 known sites in the SNF at the time of the Forest Plan ROD (USDA Forest Service 2004b - Forest Plan BE, Table 3, p. 15.). Project level surveys conducted in 2007 found *Cicindela denikei* at two of the 4 sites surveyed (survey records in project file).

Habitat needs and limiting factors: Micro-site rather than overstory forest type is important. This species uses sandy or rocky openings, bedrock exposures, gravel pits, and abandoned or little-used gravel roads. Habitat does exist in the project area: although the soil in some sites may be too coarse to provide quality habitat. Potential impacts to tiger beetle can be adequately assessed based on species' habitat requirements, distribution, and expected management impacts to habitat. Threats to tiger beetles include fire suppression, natural succession; logging, and road building. Gravel extraction can have both beneficial and negative impacts by destroying habitat and individuals and creating new suitable sites.

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 tiger beetle:

- none

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

Effects common to all alternatives

Open sandy, gravelly substrate is critical for the larval stage of the tiger beetle. The larval stage 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 larva and larval habitat. These activities 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 changes from suitable habitat to an unsuitable condition leading to adult abandonment or dispersal from these sites. The activities in all alternatives that would most commonly cause these changes include gravel excavation, logging, management-ignited fire, road or trail building

and vegetation succession. Many of these same activities, under some circumstances, may also provide new habitats in all Alternatives.

Alternatives 1, 2, 3 and 4
Direct and indirect effects could occur and would be similar under all action alternatives. Existing gravel pits would continue to be used. Gravel pit expansion would occur with all action alternatives. Results of these actions could have detrimental direct effects by crushing larva and indirect effects by destroying existing suitable habitat and beneficial effects from creating future suitable habitat. Considering there ample amounts of potential suitable soils in the Project Area, effects of any expansion are expected to be minor. These effects are expected to be minimal because mitigations would be implemented 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) associated with the action alternatives which could have additional impacts. The project should have minimal direct impact to tiger beetles due to the minimal logging in ELT 18 (exposed bedrock). Road construction can create future habitat for the species.

Cumulative Effects
Gravel pit management is likely to be similar on all ownership: pits would be expanded and eventually revegetated. The cumulative effect of these alternatives together with gravel pit expansion on non-federal 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 however, adequate habitat likely would be maintained and cumulative effects are expected to be minimal. Habitat for tiger beetles is known to occur in the BWCAW and would be maintained.

Determination
All alternatives may impact individuals of tiger beetles, but is not likely to cause a trend to federal listing or loss of viability because habitat will be both destroyed and created. All Alternatives are consistent with the Forest Plan O-WL-18, G-WL-11, G-WL-12 and S-WL-5.

Design Criteria / Site-specific mitigations
- Maintain some portion of gravel pits in an inactive state at all times, so the area could act as a refugia for adult and larval tiger beetles and provide for re-colonization.

Mancinus Alpine – *Erbia disa mancinus* and
Jutta Arctic – *Oeneis jutta ascerta*

Existing Condition

Population and trend: While there is little known about population status and habitat relationships for these species, *Jutta arctic* is of conservation concern primarily in the extreme southern periphery of the range in the northern USA and is considered apparently secure in Ontario (Holmes *et al.*, 1991, on Natureserve 2006). Neither Mancinus Alpine or Jutta Arctic have been documented in the project area however, suitable habitat exists. There were 3 documented sites for Jutta Arctic on the SNF (2004) at the signing of the Forest Plan ROD (USDA Forest Service 2004b - Forest Plan BE, Table 3, p. 16). Mancinus alpine has been documented at 4 sites in Minnesota, including 2 sites on the Superior National Forest (MN DNR Heritage database 2006b). No rare butterflies were detected during project level surveys in 2006 (project survey records in project file).

Habitat needs and limiting factors: 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). 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) and acres of harvest in lowland black spruce-tamarack forest type 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 occur 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

Effects Common to All Alternatives

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). Direct effects from gravel pit use and expansion to these species are not expected, because mitigations would be implemented to protect known sites from disturbance and habitat change will have no effect on these species because its suitable habitat would not be impacted by existing or proposed gravel pits. Direct effects would not occur from winter roads as butterflies are in their dormant period.

Alternative 1

Direct effects from alternative 1 are not expected. Amount of temporary winter roads would not change so no additional effects would occur from roads. No mature lowland black spruce-tamarack would be harvested under this alternative.

Table BE –M. Alpine and J. Arctic.

Indicators	Existing Condition		Alt 1		Alt 2		Alt 3		Alt 4	
Impacts to habitat	acre	%	acre	%	acres	%	acres	%	acres	%
1. suitable habitat	4,482	89	4,630	93	4,369	87	4,479	90	4,339	87

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 2, 3 and 4

Direct effects to these species are not expected, because mitigations would be implemented to protect known sites from disturbance and habitat change. Indirect effects could occur with all action alternatives. All action alternatives propose to harvest small amounts of mature lowland black spruce-tamarack forest, despite this, mature lowland conifer habitat would increase from the existing conditions. An increase in temporary winter roads could affect these species by potentially changing suitable habitat and hydrologic function. These effects should be short term (5-10 year) and habitat will become suitable again when hydrologic function is restored.

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 revegetate. 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. Forest-wide habitat monitoring (Annual Monitoring Report 2006) showed a slight increase to mature lowland conifer which could benefit this species. Suitable habitat in the BWCAW would remain unaffected.

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 in lowland black spruce. All Alternatives are consistent with the Forest Plan O-WL-18, G-WL-11, G-WL-12, S-WL-5, O-WL-26 and S-WL-7.

Design Criteria / Site-specific 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).

Nabokov's Blue – *Lycaeides idas nabokovi* and
Freija's Grizzled Skipper – *Pyrgus centaureae freija*

Existing Condition

Population and trend: These species have not been located in the project area, but have been found on other parts of the SNF in Cook and Lake Counties. Nabokov's Blue was documented on the McNair site on the east side of the Laurentian District in 2000 and 2001. Freija's is documented to occur only at the McNair site, but hasn't been relocated for more than 20 years and there are no new locations. Locations for Nabokov's blue are up from eight known occurrences in 2004 at the signing of the Forest Plan ROD (USDA Forest Service 2004b - Forest Plan BE, Table 3, p. 16) to at least 12 sites. No rare butterflies were detected during project level surveys in 2004 and 2005. Although no butterflies were detected, I assume that they are likely to occur in the area. Potential impacts to the butterflies can be adequately assessed based on species' habitat requirements, distribution, and expected management impacts to habitat.

Habitat needs and limiting factors: The Nabokov's Blue butterfly seem to prefer open sandy, grassy jack pine areas with abundant blueberry and dwarf bilberry (*Vaccinium ceespitosum*) primarily on 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 that suppress or exclude *vaccinium* species and grasses.

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 Vermillion Moraine was assumed to be widespread throughout the Project Area. I used acres of conifer forest (MIH 5), excluding pole-aged stands, growing on Ecological Land Types 8, 9, 11, or 16-18 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

Effects Common to All Alternatives

Creation of young open patches of conifer forest may sustain habitat for these species in all alternatives. The effects of establishing young forest are relatively short-term, since most upland conifers grows into pole class at ten years and becomes less suitable for the species (USDA FS 2000b). Mature conifer would provide conditions suitable for these species however as conifer stands mature natural canopy gaps may form. Roads can be sources of direct mortality; however, these effects are expected to be relatively small as most roads within the project receive lower levels of use and speeds. Gravel pit use and expansion should have very little effect on these species because minimal amount of suitable habitat would be impacted.

Alternatives 1, 2, 3 and 4

Existing roads would continue to be a possible source of direct mortality. No other direct effects to these species are expected because mitigations would be implemented to protect known sites from disturbance and habitat change. Each action alternative would have similar indirect effects to these species (*Table BE – Nabokov's blue butterfly and Freija's grizzled skipper*). All action alternatives would result in an increase in potential habitat. Harvested units could provide a short-term (10-20 year) increase in potential suitable sites for these species. However, these temporary openings may not stay open long enough for these species to colonize, so any beneficial effects are expected to be minimal.

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

Indicators	Existing Condition	Alt 1	Alt 2	Alt 3	Alt 4
Impacts to habitat	acre	acre	acres	acres	acres
1. potential habitat	8,441	9,875	11,725	11,064	11,725

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: Data for indicator 1 was provided by Casey McQuiston

Cumulative Effects

Young conifer should continue to be created through timber harvest on other ownerships (Appendix C). There should be minimal impact to existing young conifer and permanent openings. Forest wide in the DRW and JBP Landscape Ecosystems, young and mature and older conifer forest habitat would increase (Annual Monitoring Report 2006) providing more potential habitat for these species. Timber harvest in suitable habitat would be expected to continue on all ownerships, which would maintain young openings in conifer types necessary for these species. Harvested units could provide a short-term (10-20 year) increase in potential suitable sites for these species. However, these temporary openings may not stay open long enough for these species to colonize, so any cumulative beneficial effects are expected to be minimal. This analysis is consistent with the cumulative effects predicted in the programmatic BE for the Forest Plan. The BWCAW does not likely provide much suitable habitat for these species.

Determination
This project may impact individuals of Nabokov's blue or Freija's grizzled skipper but is not likely to cause a trend to federal listing or loss of viability on the Superior National Forest. Amount of suitable habitat may increase over time with the increase in habitat suitability for *Vaccinium* spp. All Alternatives are consistent with the Forest Plan O-WL-18, G-WL-11, G-WL-12, S-WL-5, and O-WL-27.

Design Criteria / Site-specific mitigations

- If Nabokov's blue or Freija's grizzled skipper are found within a proposed harvest unit or road corridor, the district biologist should be consulted with for an appropriate mitigation. (O-WL-27).

Sensitive Species: 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.

Analysis area

The scale for analysis of potential direct and indirect effects includes all Forest Service lands within the project area. The area covered by cumulative effects is all ownerships in each 6th level (12 digit) hydrologic unit code (HUC) that is within and/or intersects the project area. These are appropriate analysis areas because the effects of potential sediment input into local streams as well as a measure of potential change to watershed, stream, and wetland hydrologic functions can best be measured at these scales.

Northern brook lamprey – *Ichthyomyzon fosso*

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 19 meters wide and 0.7 meters deep; but can occur in smaller (1meter to 3meters wide) and larger rivers (30 meters to 100 meters wide; Becker 1983). Spawning occurs in May to June in gravel areas near riffles about 0.3 meters deep (Becker 1983). Larval forms (ammocoetes) require soft substrate (approx. 80% sand and silt) for burrowing, often among vegetation at depths of 0.2 meters to 0.6 meters (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 highlights the 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, 3, and 4 – 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.

All action alternatives 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.

All action alternatives propose various levels of vegetative management within the Keeley Creek and Nira Creek watershed. Proposed vegetative management associated with these alternatives 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 all 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 2004a).

Creek heelsplitter mussel – *Lasmigona compressa* and Black sandshell mussel – *Ligumia rect*

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 2004b). 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 DNR 2006b, 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. All 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, 3, and 4 – Action Alternatives
Proposed vegetative management associated with all action alternatives 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.

All action alternatives 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 both mussel species 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.

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 2004b). 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 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 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 all 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 2004a).

Quebec Emerald Dragonfly - *Somatochlora brevicincta*

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 Indicators

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, 3, and 4 – 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. All 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 2004a).

Sensitive Species: 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 1870s to approximately 2018. The 1870s 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 2006). 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 BE – RFSS plants-1*). 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 2004c)

- **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 ATVs 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 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 BE – RFSS plants-1. Indicators1-7 used for RFSS plants effects analysis.				
Indicator	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1. Number of known sensitive plant occurrences in or next to proposed treatment units	0	7	6	7
2. Miles of new lowland road construction on FS lands	0	14.4	12.3	15.1
3. Miles of new upland road construction on FS lands	0	37.2	30.9	38.5
4. Miles of unclassified road impacted by construction and reconstruction	0	24.1	20.1	26.0
5. Acres of upland commercial timber harvest	0	7899	5230	9045
6. Acres of lowland black spruce harvest	0	206	130	235
7. Acres of timber harvest adjacent to rock outcrop areas	0	3118	1453	3423

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 1,311 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 1,814 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 2006b).

All sensitive vascular and non-vascular plant species known or suspected to occur in the project area are displayed in *Table BE-4*. 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 BE-4*): 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 road. 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), 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 road. 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 BE – RFSS plants-1*).

Alternative 4
Indicator 1 – Number of known sensitive plant occurrences in or next to proposed treatment units. For Alternative 4, 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 road. 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. The types of impacts of alternative 4 to plants in this habitat group would be similar to the impacts of alternative 2 described above. Alternative 4 would affect slightly more habitat than Alternative 2, based on the number of miles of new lowland road construction on Forest Service lands (*Table BE – RFSS plants-1*).

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, 3, or 4 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 such as the Black Wolf lots (FEIS Appendix C), 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. Mineral exploration in the project area would also affect some suitable habitat since some of the proposed drill sites are in lowlands, but the proportion of suitable habitat affected by drilling would be very small.

Summary: Project activities associated with Alternatives 2, 3, or 4 would have only minor negative direct, indirect, and cumulative effects on the suitable habitat for these species. Alternative 4 would impact the greatest amount of suitable habitat, followed by Alternative 2 and then Alternative 3, based on the miles of new lowland road construction on FS lands by alternative (*Table BE – RFSS plants-1*).

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, 3, and 4, 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.

Mitigations and Design Criteria

- 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 BE-4*): *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 79-58, 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 79-58, 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 FEIS, 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 BE – RFSS plants-1*). 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 2002e).

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 3.5 of the FEIS: 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 BE – RFSS plants-1*) 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.

Alternative 4
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 4. For this indicator, the effects of Alternative 4 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 4 to suitable rock outcrop habitat would be similar to the impacts of Alternative 2 described above. Because Alternative 4 proposes a slightly greater amount of timber harvest adjacent to rock outcrop sites (*Table BE – RFSS plants-1*) compared to Alternative 2, the magnitude of effects of Alternative 4 would be slightly greater than Alternative 2. Impacts of Alternative 4 would be minimized 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, 3, and 4 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 roads, logging roads for state, county, or private timber harvests, or non-jurisdictional roads for private developments such as the Black Wolf lots (Appendix C) could impact a small amount of rock outcrop habitat. Timber harvest associated with the Rusty Diamond EA or Tomahawk EA, as well as ongoing or future state, private, or county harvests could also impact a small amount of rock outcrop habitat. However, cumulative impacts of Alternatives 2, 3, and 4 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 4 would have a slightly greater impact on suitable habitat than Alternative 2, and both of these alternatives would have a greater impact on suitable habitat than Alternative 3, based on acres of Indicator 7 (*Table BE – RFSS plants-1*).

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, 3, and 4, 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.

Mitigations and Design Criteria
- For the large-leaved sandwort population in unit 79-58, 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 BE - 4*): 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 Alternatives 2 and 4.

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 BE – RFSS plants-1*).

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 BE – RFSS plants-1*); therefore, the impacts of Alternative 2 would be greater than Alternative 3 for this indicator.

Alternative 4

Indicator 1 – Number of known sensitive plant occurrences in or next to proposed treatment units. There would be no effects from Alternative 4 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. The types of impacts of alternative 4 to plants in this habitat group would be similar to the impacts of alternative 2 described above. However, the magnitude of impacts of Alternative 4 would be slightly greater than Alternative 2, because 26 miles of road would be affected in Alternative 4 compared to 24.1 miles of road in Alternative 2 (*Table BE – RFSS plants-1*).

Indicator 5 - Acres of upland commercial timber harvest
The types of impacts of alternative 4 to plants in this habitat group would be similar to the impacts of alternative 2 described above for Indicator 5. Alternative 4 would affect 1,146 acres more habitat than Alternative 2, based on the acres of upland commercial timber harvest (*Table BE – RFSS plants-1*); therefore, the impacts of Alternative 4 would be greater than Alternative 2 for this indicator.

The proposals for gravel pit use and expansion do not differ between alternatives 2, 3, and 4, so the impacts of gravel pit use and expansion under these alternatives would be identical.

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 4 would have slightly greater impacts to suitable habitat for species in this group

than Alternative 2. Both alternatives would have greater impacts than alternative 3, and all three action alternatives would have greater impacts than Alternative 1, based on an analysis of Indicators 4 and 5 (*Table BE – RFSS plants-1*).

Determination

For Alternatives 1, 2, 3, and 4, 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.

Mitigations and Design Criteria

- 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 BE-4*): 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 and Alternative 4 at 15.1 miles (*Table BE – RFSS plants-1*). 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 BE – RFSS plants-1*), while 130 acres and 235 acres of lowland black spruce harvest are proposed under Alternatives 3 and 4. 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 BE – RFSS plants-1*).

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 BE – RFSS plants-1*).

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

Alternative 4
Indicator 2 – Miles of new lowland road construction on FS lands. The types of impacts of alternative 4 to plants in this habitat group would be similar to those described above for alternative 2. However, the magnitude of impacts would be slightly greater for Alternative 4, which proposes 15.1 miles of lowland road construction compared to 14.4 for Alternative 2 (*Table BE – RFSS plants-1*).

Indicator 6 – Acres of lowland black spruce harvest. The types of impacts of alternative 4 to plants in this habitat group would be similar to those described above for alternative 2. However, the magnitude of impacts would be slightly greater for Alternative 4, which

proposes 235 acres of lowland black spruce harvest compared to 206 acres for Alternative 2 (*Table BE – RFSS plants-1*).

There would be no impacts to species in this habitat group from other proposed project activities associated with Alternative 4.

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, MFRC 2005). More recently, timber sales on federal lands (for example those associated with the Rusty Diamond EA or the Tomahawk EA), 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 FEIS 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 such as the Black Wolf lots (Appendix C), temporary roads for mineral exploration projects, future special use permit roads, and roads associated with county, state, or private 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. Ongoing mineral exploration projects could also affect a small amount of this habitat. 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 2005).

Summary: Project activities associated with these alternatives would have only minor direct and indirect negative effects on the suitable habitat for these species. Alternative 4 would have the greatest impacts to suitable habitat, followed by Alternative 2 and then Alternative 3, based on an analysis of Indicators 2 and 6 (*Table BE – RFSS plants-1*)

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, 3, and 4, 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.

Mitigations and Design Criteria

- 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 BE-4*): 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.

Alternatives 2, 3 and 4
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 Alternatives 2, 3 or 4.

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, 3, and 4, 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, 3, and 4, the proposed activities would have no impact on New England sedge.

Mitigations and Design Criteria
None identified

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 BE-4*): 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 2005a) 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 2006b). Because it is a sensitive species, Canada yew occurrences are generally avoided by Forest Service projects on the Superior (e.g. USDA Forest Service 2004e). 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 2005a). 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 2005a). 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.

Alternative 4
Indicator 1 - Number of known sensitive plant occurrences in or next to proposed treatment units. The impacts of Alternative 4 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 4 proposes approximately 38.5 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 4 to suitable habitat for these species would be greater than for alternative 2, since more miles of new upland road would be constructed under Alternative 4. Alternative 4 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 9,045 acres of upland commercial timber harvest is proposed in Alternative 4. 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 4 would impact more acres of suitable habitat for each of these species than alternatives 2 or 3 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 (for example those associated with the Rusty Diamond EA or the Tomahawk EA), State, county, and private lands have changed the age class distribution of upland forest habitats; see Appendix C for a summary of past timber harvest on federal, private, state, and county lands. Construction of roads in the project area, such as MN Highway 1, as well as federal, state, private, and county 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.

Fuels reduction projects have resulted in the treatment of 2560 acres in the project area in the last 10 years. There are 1395 acres of fuels reduction treatments scheduled for the next 5 years in the project area (Appendix C). These treatments have changed the age class and species composition of upland habitats, 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 such as the Black Wolf lots (Appendix C), temporary roads for mineral exploration projects, future special use permit roads, and roads associated with county, private, 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. Ongoing

mineral exploration projects could also affect a small amount of this 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 2005).

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 4, followed by Alternative 2, and then 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, 3, and 4, 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.

Mitigations and Design Criteria

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

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