Forest Plan Revision

Chippewa and Superior National Forests

Regional Forester Sensitive Plants Biological Evaluation

Prepared by:_____ Date: May 6, 2004
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TABLE OF CONTENTS

EXECUTIVE SUMMARY

The historical, current, and likely future abundance and distribution of suitable ecological conditions for each sensitive plant for each alternative are displayed in table 1 and table 2 as an outcome ranging from A to E (outcome statements are described on pages 15-16). The majority of sensitive plants are habitat specialists whose abundance and distribution have probably not changed dramatically since historical times and that would not likely change in response to alternatives. In contrast, for many sensitive plant species of forested habitats, the distribution and abundance of suitable habitats has declined since historical times and would not improve during the time scale of this analysis; some of these species' outcomes would decline in response to alternatives, and other species' outcomes would increase in response to alternatives. The outcomes in table 1 represent direct and indirect effects, and the outcomes in table 2 represent cumulative effects.

The alternatives for Forest Plan Revision on the Chippewa and Superior National Forest would have the following effects on sensitive plants:

All the alternatives **may impact individuals but are not likely to cause a trend to federal listing or loss of viability**.

TABLE 1: HISTORIC, CURRENT, AND FUTURE (IN 2, 5, AND 10 DECADES FROM PRESENT) OUTCOMES FOR TES PLANTS

Species	HISTORIC	CURRENT	ALT. A			ALT. B			ALT. C			ALT. D			ALT. E			Alt. F			ALT. G		
			2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10
Guild 1. Shallow water/littoral zone – fluctuating shore																							
Alpine milkvetch	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Katahdin sedge	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Creeping rush	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
American shore-grass	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Awlwort (SNF)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Awlwort (CNF)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Guild 2. Riparian – aquatic, open marsh, and alder/shrub dominated																							
Floating marsh-marigold	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Dwarf water-lily	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Auricled twayblade	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Guild 3. Nonforest wetland, disturbed wetland, and fluctuating shore – predominantly open																							
Swamp beggar-ticks	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Pond reedgrass	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Neat spike-rush	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Olivaceous spike-rush	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Few-flowered spike-rush	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Moor rush	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Vasey's rush	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Fall dropseed muhly	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Small green woodland orchid (SNF)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Small green woodland orchid (CNF)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Northern bur-reed (SNF)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Northern bur-reed (CNF)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Lance-leaved violet	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Guild 4. Cliff, talus slopes, and exposed rock habitat																							
Arctoparmelia centrifuga	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Arctoparmelia subcentrifuga	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Long-leaved arnica	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Maidenhair spleenwort	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Ross' sedge	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Cladonia wainoi	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Large-leaved sandwort	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Sticky locoweed	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Nodding saxifrage	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Encrusted saxifrage	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
False-asphodel	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Smooth woodsia	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E

TABLE 1: HISTORIC, CURRENT, AND FUTURE (IN 2, 5, AND 10 DECADES FROM PRESENT) OUTCOMES FOR TES PLANTS

Species	HISTORIC	CURRENT	ALT. A			ALT. B			ALT. C			ALT. D			ALT. E			Alt. F			ALT. G		
			2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10
Guild 5. Upland disturbed, barrens, or early successional forest habitat																							
Pointed moonwort	D	D	D	D	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D
Common moonwort	D	D	D	D	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D
Michigan moonwort	D	D	D	D	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D
Pale moonwort (SNF)	D	D	D	D	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D
Pale moonwort (CNF)	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Ternate grapefern (SNF)	D	D	D	D	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D
Ternate grapefern (CNF)	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Least grapefern (SNF)	D	D	D	D	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D
Least grapefern (CNF)	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Black hawthorn	D	E	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**
Guild 6a. Forested wetland – black spruce, tamarack, and mixed conifer																							
Caloplaca parvula	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
White adder's mouth	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Western Jacob's ladder	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Small shinleaf	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Cloudberry	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Sticta fuliginosa	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Guild 6b. Forested wetland – white cedar dominated																							
Fairy slipper (SNF)	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D
Fairy slipper (CNF)	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Cetraria aurescens	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Ram's-head lady's slipper (SNF)	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D
Ram's-head lady's slipper (CNF)	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Limestone oak fern	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Menegazzia terebrata	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Ramalina thrausta	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Usnea longissima	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Guild 7. Mesic hardwood-dominated forest																							
Moschatel	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Triangle grape-fern (SNF)	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Triangle grape-fern (CNF)	B	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Goblin fern (SNF)	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Goblin fern (CNF)	B	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Blunt-lobed grapefern	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
New England sedge	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Goldie's wood fern	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
White trout lily	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
One-flowered broomrape	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Chilean sweet cicely	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Braun's holly fern	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Rough-fruited fairy bells	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Canada yew (SNF)	B	D	D	**E**	**E**	D	**C**	**C**	D	**E**	**E**	D	**C**	**C**	D	D	**E**	D	D	D	D	D	D
Canada yew (CNF)	B	D	D	**E**	**E**	D	**C**	**C**	D	**E**	**E**	D	**C**	**C**	D	D	D	D	D	D	D	D	D
Barren strawberry	B	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Unguilded																							
Peltigera venosa	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Pseudocyphellaria crocata	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E

Source: Biological assessment/evaluation for TES plants and animals
Definitions: See biological evaluation for outcome definitions
Notes: Outcomes in underlined bold text are those that differ from the current outcome

TABLE 2: CUMULATIVE HISTORIC, CURRENT, AND FUTURE (IN 2, 5, AND 10 DECADES FROM PRESENT) OUTCOMES FOR TES PLANTS

Species	HISTORIC	CURRENT	ALT. A			ALT. B			ALT. C			ALT. D			ALT. E			Alt. F			ALT. G		
			2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10
Guild 1. Shallow water/littoral zone – fluctuating shore																							
Alpine milkvetch	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Katahdin sedge	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Creeping rush	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
American shore-grass	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Awlwort (SNF)	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Awlwort (CNF)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Guild 2. Riparian – aquatic, open marsh, and alder/shrub dominated																							
Floating marsh-marigold	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Dwarf water-lily	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Auricled twayblade	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Guild 3. Nonforest wetland, disturbed wetland, and fluctuating shore – predominantly open																							
Swamp beggar-ticks	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Pond reedgrass	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Neat spike-rush	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Olivaceous spike-rush	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Few-flowered spike-rush	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Moor rush	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Vasey's rush	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Fall dropseed muhly	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Small green woodland orchid (SNF)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Small green woodland orchid (CNF)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Northern bur-reed (SNF)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Northern bur-reed (CNF)	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Lance-leaved violet	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Guild 4. Cliff, talus slopes, and exposed rock habitat																							
Arctoparmelia centrifuga	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Arctoparmelia subcentrifuga	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Long-leaved arnica	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Maidenhair spleenwort	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Ross' sedge	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Cladonia wainoi	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Large-leaved sandwort	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Sticky locoweed	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Nodding saxifrage	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Encrusted saxifrage	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
False-asphodel	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Smooth woodsia	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Guild 5. Upland disturbed, barrens, or early successional forest habitat																							
Pointed moonwort	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Common moonwort	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Michigan moonwort	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Pale moonwort (SNF)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Pale moonwort (CNF)	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Ternate grapefern (SNF)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Ternate grapefern (CNF)	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Least grapefern (SNF)	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Least grapefern (CNF)	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Black hawthorn	D	E	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**	**D**
Guild 6a. Forested wetland – black spruce, tamarack, and mixed conifer																							
Caloplaca parvula	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
White adder's mouth	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Western Jacob's ladder	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Small shinleaf	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Cloudberry	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Sticta fuliginosa	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Guild 6b. Forested wetland – white cedar dominated																							
Fairy slipper (SNF)	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D
Fairy slipper (CNF)	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Cetraria aurescens	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Ram's-head lady's slipper (SNF)	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D
Ram's-head lady's slipper (CNF)	C	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Limestone oak fern	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Menegazzia terebrata	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Ramalina thrausta	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Usnea longissima	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Guild 7. Mesic hardwood-dominated forest																							
Moschatel	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Triangle grape-fern (SNF)	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Triangle grape-fern (CNF)	B	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Goblin fern (SNF)	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Goblin fern (CNF)	B	D	**E**	**E**	**E**	D	D	D	**E**	**E**	**E**	D	D	D	D	D	D	D	D	D	D	D	D
Blunt-lobed grapefern	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
New England sedge	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Goldie's wood fern	D	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
White trout lily	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E

Source: Biological assessment/evaluation for TES plants and animals
Definitions: See biological evaluation for outcome definitions
Notes: Outcomes in underlined bold text are those that differ from the current outcome

TABLE 2: CUMULATIVE HISTORIC, CURRENT, AND FUTURE (IN 2, 5, AND 10 DECADES FROM PRESENT) OUTCOMES FOR TES PLANTS

Species	HISTORIC	CURRENT	ALT. A			ALT. B			ALT. C			ALT. D			ALT. E			Alt. F			ALT. G		
			2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10	2	5	10
One-flowered broomrape	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Chilean sweet cicely	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Braun's holly fern	C	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Rough-fruited fairy bells	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
Canada yew (SNF)	B	D	D	**E**	**E**	D	**C**	**C**	D	**E**	**E**	D	**C**	**C**	D	D	**E**	D	D	D	D	D	D
Canada yew (CNF)	B	D	D	**E**	**E**	D	**C**	**C**	D	**E**	**E**	D	**C**	**C**	D	D	D	D	D	D	D	D	D
Barren strawberry	B	C	C	C	C	C	C	C	C	C	***C***	C	C	C	C	C	C	C	C	C	C	C	C
Unguilded																							
Peltigera venosa	E	E	E	E	E	E	E	E	E	E	***E***	E	E	E	E	E	E	E	E	E	E	E	E
Pseudocyphellaria crocata	E	E	E	E	E	E	E	E	E	E	***E***	E	E	E	E	E	E	E	E	E	E	E	E

Source: Biological assessment/evaluation for TES plants and animals
Definitions: See biological evaluation for outcome definitions
Notes: Outcomes in underlined bold text are those that differ from the current outcome

BIOLOGICAL EVALUATION

INTRODUCTION

This Biological Evaluation (BE) documents the likely impacts on 66 sensitive plant species from forest management activities described in the FEIS for Forest Plan Revision on the Chippewa and Superior National Forests. No federally proposed, threatened, or endangered plant species are known from the Forests. This BE was prepared in compliance with the requirements of Forest Service Manual Directives 2671.1 through 2672.43, the Endangered Species Act of 1973 as amended, and the National Forest Management Act of 1976. The intent of this BE is to document whether the proposed forest management activities are expected to result in the loss of sensitive plant species viability or create trends toward federal listing.

The area covered by the analysis of direct and indirect effects includes all lands administered by the Chippewa and Superior National Forests. The area covered by the cumulative effects analysis for the Chippewa is land of all ownerships within the Drift and Lake Plains Section, and land of all ownerships within the Northern Superior Uplands for the Superior. For northern bur-reed, pale moonwort, and least grapefern, the cumulative effects analysis area would be both sections because these species are fairly well-distributed throughout both sections and populations have potential to interact between sections.

DESCRIPTION OF THE ALTERNATIVES

A detailed description of the alternatives can be found in Chapter 2 of the FEIS. Based on the response to comments, alternative E in the DEIS has been changed to modified alternative E in the FEIS. However, hereafter in this analysis, modified alternative E is simply referred to as "alternative E".

CONSULTATION WITH US FISH AND WILDLIFE SERVICE

Interagency cooperation between the Forest Service and US Fish and Wildlife Service (USFWS) regarding proposed, endangered, or threatened species is described in Section 7 of the Endangered Species Act. No federally proposed, threatened, or endangered plant species are known from the Chippewa or Superior National Forests. Therefore, no consultation with USFWS is required.

EXISTING CONDITION – SPECIES EVALUATED AND ENVIRONMENTAL BASELINE

Table 3 displays all of the sensitive plant species known to occur on the Chippewa and Superior National Forests (USDA Forest Service 2002a). All of these species occur within the proclamation boundaries of the Forests and are therefore considered in this BE. Several sources of data were used to prepare habitat and life history descriptions found in table 3. For vascular plants, the following sources were used: Minnesota Natural Heritage Program data (MN DNR 2001), species literature reviews conducted between October 1999 and March 2000, information collected from taxonomic experts through the species viability evaluation (SVE) process, Chippewa National Forest Sensitive Plant Habitats (USDA Forest Service 2001a), the University of Minnesota Bell Herbarium, and sensitive plant survey reports. For lichens, the following sources were used: USDA Forest Service (2000d), Wetmore (2001), *Arctoparmelia centrifuga* conservation assessment (USDA Forest Service 2002j), *Caloplaca parvula* conservation assessment (USDA Forest Service 2002k), *Certraria aurescens* conservation assessment (USDA Forest Service 2002l), *Cladonia wainoi* conservation assessment (USDA Forest Service 2002m),

Table 3: Vascular and non vascular sensitive plants on the Chippewa and Superior National Forests

Common name *Scientific name*	**Global[1] Rank**	**State[2] Rank**	**Global Distribution[3]**	**National Forest Distribution**	**Number of Occurrences (Sup./Chip.)[4]**	**Indicators[5]**	**Life History & Habitat Summary**
Guild 1. Shallow water/littoral zone - fluctuating shore							
Alpine milkvetch *Astragalus alpinus*	G5	E	CB	Superior	2	None	Perennial herb; Sandy, gravelly fluctuating shorelines with sparse vegetation. Inland strand beach - sparse vegetation
Katahdin sedge *Carex katahdinensis*	G5	T	D	Superior	14	Water access	Perennial graminoid; Along shores of large and small lakes; ephemeral pool; sandy soils with rock fragments; may need disturbance (e.g., seasonal flooding)
Creeping rush *Juncus subtilis*	G3	Non	P	Superior	1	Water access	Perennial graminoid; Sandy lakeshore
American shore-grass *Littorella uniflora*	G5	SC	W	Superior	29	Water access	Perennial herb; Shallow margins of nutrient-poor lakes, seepage lakes, sandy substrate, may have fine gravel/organic soil. Fluctuating up to about 1 meter.
Awlwort *Subularia aquatica*	G5	T	CB	Superior and Chippewa	13/2	Water access	Annual herb; 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.
Guild 2. Riparian - aquatic, open marsh, and alder/shrub dominated							
Floating marsh-marigold *Caltha natans*	G4G5	E	CB	Superior	9	Water access, riparian standards & guidelines, acres of riparian timber harvest	Perennial herb; shallow water of pools, ditches, sheltered lake margins, slow moving creeks, sloughs and oxbows, pools in shrub swamps
Dwarf water-lily *Nymphaea leibergii*	G5	T	SD	Superior	9	Water access, riparian standards & guidelines, acres of riparian timber harvest	Perennial herb; Slow moving streams, rivers, beaver impoundments 1-2 m deep. Occurs at outer margin of emergent vegetation.
Auricled twayblade *Listera auriculata*	G3	E	P	Superior	4	Riparian standards & guidelines, acres of riparian timber harvest	Perennial herb; On alluvial or lake-deposited sands or gravels, with occasional seasonal flooding, associated with riparian alder or spruce/fir forest
Guild 3. Nonforest wetland, disturbed wetland, and fluctuating shore – predominantly open							
Swamp beggar-ticks *Bidens discoidea*	G5	Non	P	Superior	1	None	Annual herb; Wet habitats: partly submerged logs and hummocks in floating mats and in swamps; silty shores
Pond reedgrass *Calamagrostis lacustris*	G5T5	SC	W	Superior	1 (Walton 2001)	None	Perennial graminoid; Rocky gravelly sandy lake margins & beaches, rock crevices
Neat spike-rush *Eleocharis nitida*	G3G4	T	SD	Superior	14	None	Perennial graminoid; Mineral soil of wetlands, often w/ open canopy and disturbance, such as logging roads/ditches through wetlands
Olivaceous spike-rush *Eleocharis olivacea*	G5	T	P	Chippewa	1	None	Perennial graminoid; Floating muck mat, muck substrates around peatland ponds
Few-flowered spike-rush *Eleocharis*	G5	SC	CB	Chippewa	1	Water access	Perennial graminoid; Shallow, sandy lakeshores; calcareous seepage fens

Common name *Scientific name*	**Global[1] Rank**	**State[2] Rank**	**Global Distribution[3]**	**National Forest Distribution**	**Number of Occurrences (Sup./Chip.)[4]**	**Indicators[5]**	**Life History & Habitat Summary**
quinqueflora							
Moor rush *Juncus stygius*	G5	SC	CB	Superior	2	None	Perennial graminoid; Shallow pools in non-forested patterned peatlands, often in a sedge-dominated community
Vasey's rush *Juncus vaseyi*	G5	---	W	Superior	9	None	Perennial graminoid; Seasonally wet soil of wetlands, often w/ open canopy and disturbance, such as roadside ditch, trail, gravel pit, often with sedges and grasses (Walton 1999a, Walton 2000a)
Fall dropseed muhly *Muhlenbergia uniflora*	G5	SC	P	Superior	3	Water access	Perennial graminoid; Wet sandy beaches, floating peat mats
Club-spur orchid *Platanthera clavellata*	G5	SC	P	Superior and Chippewa	12/1	None	Perennial herb; Floating bog mats, sphagnum, stunted conifer swamp, mixed spruce tamarack, borrow pits, winter logging roads
Northern bur-reed *Sparganium glomeratum*	G4?	SC	CB	Superior and Chippewa	20/17	None	Perennial herb; Floating muck mats or muck substrates adjacent to ponds, ditches, moats
Lance-leaved violet *Viola lanceolata*	G5	T	P	Superior	2	Water access	Perennial herb; Sandy to peaty lakeshores; borders of marshes and bogs, damp sand ditches
Guild 4. Cliff, talus slopes, and exposed rock habitat							
A lichen sp. *Arctoparmelia centrifuga*	G3G5	---	P	Superior	1	None	Lichen; Sunny rocks and open talus slopes
A lichen sp. *Arctoparmelia subcentrifuga*	---	---	P	Superior	1	None	Lichen; Sunny rocks and open talus slopes
Long-leaved arnica *Arnica lonchophylla*	G4	T	D	Superior	1	None	Perennial herb; Cool & moist cliffs and ledges on North Shore. Arctic disjunct
Maidenhair spleenwort *Asplenium trichomanes*	G5	T	W	Superior	7	None	Perennial fern; In crevices of moist, mostly east-facing cliffs, ledges, and talus, Rove formation
Ross' sedge *Carex rossii*	G5	Non	D	Superior	3	None	Perennial graminoid; Rocky summits, dry exposed cliff faces, rocky slopes, in east Border Lakes subsection
a lichen species *Cladonia wainoi (=pseudorangiformis)*	---	SC	D	Superior	1	None	Lichen; On rock outcrops and thin soil – exposed sites with lots of light
Large-leaved sandwort *Moehringia macrophylla*	G4	T	W	Superior	10	None	Perennial herb; Cliffs/rock outcrops, talus, conifer sites on shallow soils, pine plantation with rocky outcrops; usually semi-open shrub or tree canopy
Sticky locoweed *Oxytropis viscida*	G5T4?	E	D	Superior	1	None	Perennial herb; Slate cliffs and talus slopes in east Border Lakes subsection. Arctic/alpine disjunct
Nodding saxifrage *Saxifraga cernua*	G4	E	D	Superior	1	None	Perennial herb; Cliffs, ledges, diabase cliff (calcium based feldspars). Arctic/alpine disjunct. One

Common name *Scientific name*	**Global[1] Rank**	**State[2] Rank**	**Global Distribution[3]**	**National Forest Distribution**	**Number of Occurrences (Sup./Chip.)[4]**	**Indicators[5]**	**Life History & Habitat Summary**
							location in MN on open cliff.
Encrusted saxifrage *Saxifraga paniculata*	G5	T	D	Superior	13	None	Perennial herb; Cliffs, sheltered crevices, and ledges of north-facing cliffs. Arctic/alpine disjunct.
False-asphodel *Tofieldia pusilla*	G5	E	D	Superior	3	None	Perennial herb; Sedge mats at edges of shoreline rock pools along Lake Superior. Arctic disjunct.
Smooth woodsia *Woodsia glabella*	G5	T	D	Superior	1	None	Perennial fern; Moist, north-facing cliffs along Lake Superior. Arctic disjunct.
Guild 5. Upland disturbed, barrens, or early successional forest habitat							
Pointed moonwort *Botrychium acuminatum*	G1	Non	RE	Superior	3	None	Perennial fern; Open habitats such as old log landing, old dirt roads, borrow pits
Common moonwort *Botrychium lunaria*	G5	T	CB	Superior	2	None	Perennial fern; Open habitats such as old log landings, sawmill sites, old building sites; open habitats throughout its range (Wagner & Wagner 1993)
Michigan moonwort *Botrychium michiganense (hesperium)*	G3	Non	SD	Superior	6	None	Perennial fern; 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)
Pale moonwort *Botrychium pallidum*	G2G3	E	SD	Superior and Chippewa	5/27	None	Perennial fern; Open, disturbed habitats, log landings, roadsides, dunes, sandy gravel pits.
Ternate grape-fern *Botrychium rugulosum (=ternatum)*	G3	T	SD	Superior and Chippewa	8/12	None	Perennial fern; Dry areas with short grasses, bracken, sweet fern, jack, red, aspen/fir, open areas within these types. Margins of ephemeral pools in pines, spruce, birch/aspen. pH near neutral.
Least grape-fern *Botrychium simplex*	G5	SC	CB	Superior and Chippewa	14/13	None	Perennial fern; Generally open habitats, such as old log landings, roadside ditch, trails, open fields, base of cliff, railroad right of way
Black hawthorn *Crataegus douglasii*	G5	T	D	Superior	11	None	Shrub; North Shore rocky, gravelly streambeds/banks and open areas; and rocky borders of woods
Guild 6a. Forested wetland – black spruce, tamarack, and mixed conifer							
a lichen sp. *Caloplaca parvula*	---	E	RE	Superior	2	Black ash: MAT, OLD, OLDER	Lichen; Smooth bark of young black ash in moist, humid old growth black ash stand
White adder's mouth *Malaxis brachypoda*	G4Q	SC	SD	Chippewa	24	White cedar: MAT, OLD, OLDER Mixed swamp conifer: MAT, OLD, OLDER Mixed lowland hardwoods: MAT, OLD, OLDER	Perennial herb; Conifer swamps, generally dominated by cedar; also black ash swamps; usually at base of *Sphagnum* hummocks
Western Jacob's ladder *Polemonium occidentale ssp. lacustre*	G5?T1Q	E	D	Superior	1	White cedar: YOUNG, IMMA Mixed swamp conifer: YOUNG, IMMA	Perennial herb: Primarily white cedar swamps, also mixed conifer swamps; thrives in openings (Carlson and Sather (2001)
Lesser wintergreen or Small shinleaf *Pyrola minor*	G5	SC	CB	Superior	10	Black spruce: MAT, OLD, OLDER Mixed swamp conifer: MAT, OLD, OLDER	Perennial herb; Black spruce swamps, and ecotone between uplands and lowland alder/conifer swamp, prefers closed canopy.

Common name *Scientific name*	**Global[1] Rank**	**State[2] Rank**	**Global Distribution[3]**	**National Forest Distribution**	**Number of Occurrences (Sup./Chip.)[4]**	**Indicators[5]**	**Life History & Habitat Summary**
Cloudberry *Rubus chamaemorus*	G5	T	CB	Superior	3	Black spruce: MAT, OLD, OLDER Mixed swamp conifer: MAT, OLD, OLDER	Shrub; Black spruce/sphagnum forest, acidic.
a lichen sp. *Sticta fuliginosa*	G3G5	SC	SD	Superior	2	White cedar: MAT, OLD, OLDER Black ash: MAT, OLD, OLDER	Lichen; On hardwoods in humid, old growth cedar or ash bogs.
Guild 6b. Forested wetland – white cedar dominated							
Fairy slipper *Calypso bulbosa*	G5	---	CB	Superior and Chippewa	1 (Bell Herbarium 2002)/20	White cedar: MAT, OLD, OLDER Mixed swamp conifer: MAT, OLD, OLDER	Perennial herb; Hummocks in northern white cedar swamps, moist to wet lowland conifer swamps, and to lesser extent in upland coniferous forests (Smith 1993)
a lichen sp. *Cetraria aurescens*	---	SC	P	Superior	7	Black spruce: MAT, OLD, OLDER White cedar: MAT, OLD, OLDER Mixed swamp conifer: MAT, OLD, OLDER	Lichen; Conifer bark in lowland conifer swamps (old cedar/black spruce)
Ram's-head lady's slipper *Cypripedium arietinum*	G3	T	SD	Superior and Chippewa	4/19	White cedar: ALL Jack pine: ALL Red pine: ALL White pine: ALL	Perennial herb; 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
Limestone oak fern *Gymnocarpium robertianum*	G5	---	W	Chippewa	3	White cedar: MAT, OLD, OLDER Mixed swamp conifer: MAT, OLD, OLDER	Perennial fern; Cedar swamps
Port-hole lichen *Menegazzia terebrata*	---	---	CB	Superior	6 (USDA Forest Service 2002d)	White cedar: MAT, OLD, OLDER	Lichen; Cedar swamps, especially old growth; base of cedar trees
A lichen sp. *Ramalina thrausta*	G3G5	---	CB	Superior	2	White cedar: MAT, OLD, OLDER Mixed swamp conifer: MAT, OLD, OLDER	Lichen; Cedar swamps, especially old growth
a lichen sp. *Usnea longissima*	G3	---	SD	Superior	4	White cedar: MAT, OLD, OLDER Mixed swamp conifer: MAT, OLD, OLDER	Lichen; On old conifers in moist situations, often in or near a conifer or hardwood swamp
Guild 7. Mesic Hardwood-dominated forest							
Moschatel *Adoxa moschatellina*	G5	SC	CB	Superior	22	Upland northern hardwoods: MAT, OLD, OLDER	Perennial herb; Shaded damp cliffs and slopes in upland mature northern hardwood forest on North Shore
Triangle grape-fern *Botrychium lanceolatum*	G5	T	CB	Superior and Chippewa	6/19	Upland northern hardwoods: MAT, OLD, OLDER	Perennial fern; Northern hardwood forest, oldfields, old logging roads, trails
Goblin fern *Botrychium mormo*	G3	SC	RE	Superior and Chippewa	1/131	Upland northern hardwoods: MAT, OLD, OLDER Quaking aspen: MAT, OLD, OLDER Paper birch: MAT, OLD, OLDER	Perennial fern; Mesic deciduous forest with thick leaf layer, open understory
Blunt-lobed grapefern *Botrychium oneidense*	G4	E	P	Chippewa	1	Upland northern hardwoods: MAT, OLD, OLDER Black ash: MAT, OLD, OLDER	Perennial fern; Fluctuating woodland pools in maple/basswood
New England sedge *Carex novae-angliae*	G5	---	P	Superior	1 (USDA Forest Service	Upland northern hardwoods: MAT, OLD, OLDER (USDA Forest Service	Perennial graminoid; North Shore moist woods with sugar maple, also with birch, aspen, tall shrubs

Common name *Scientific name*	**Global[1] Rank**	**State[2] Rank**	**Global Distribution[3]**	**National Forest Distribution**	**Number of Occurrences (Sup./Chip.)[4]**	**Indicators[5]**	**Life History & Habitat Summary**
					2002)	2002)	(USDA Forest Service 2002)
Goldie's wood fern *Dryopteris goldiana*	G4	SC	D	Chippewa	9	Upland northern hardwoods: OLD, OLDER	Maple – basswood forest
White trout lily *Erythronium albidum*	G5	---	P	Chippewa	1	Upland northern hardwoods: OLD, OLDER	Perennial herb; Maple-basswood forest with red and bur oak
One-flowered broomrape *Orobanche uniflora*	G5	SC	D	Chippewa	1	Upland northern hardwoods: ALL? White oak, northern red oak, mixed oaks: ALL?	Perennial herb; Transition zone between northern hardwood forest and white cedar swamp
Chilean sweet cicely *Osmorhiza berteroi*	G5	T	D	Superior	3	Upland northern hardwoods: OLD, OLDER	Perennial herb; Northern hardwood forest dominated by sugar maple; on North Shore.
Braun's holly fern *Polystichum braunii*	G5	E	CB	Superior	3	Upland northern hardwoods: MAT, OLD, OLDER	Perennial fern; Cool, shady cliffs and slopes in northern hardwoods
Guild 8. Dry-mesic upland forest: deciduous, coniferous, or mixed							
Rough-fruited fairy bells *Disporum trachycarpum*	G5	---	D	Superior	1	Jack pine: MAT, OLD, OLDER	Perennial herb; Semi-open jack pine forest with aspen, birch, shallow rocky soils, in east Border Lakes subsection
Canada yew *Taxus canadensis*	G5	---	W	Superior and Chippewa	13/29	Upland northern hardwoods: MAT, OLD, OLDER Quaking aspen: MAT, OLD, OLDER Paper birch: MAT, OLD, OLDER White cedar: MAT, OLD, OLDER Mixed swamp conifer: MAT, OLD, OLDER Black ash: MAT, OLD, OLDER White tailed deer	Shrub; Wide variety of uplands and lowlands, including cedar & ash swamps, talus and cliffs, northern hardwoods, aspen/birch forest (Walton 2001, Schmoller 2001)
Barren strawberry *Waldsteinia fragarioides*	G5	SC	P	Superior	3	Upland forest (all forest types): IMMA, MAT, OLD, OLDER	Perennial herb; Upland coniferous and deciduous forests, in recently harvested areas, established plantations, and areas with no recent harvest
Unguilded							
a Dog lichen *Peltigera venosa*	---	SC	P	Superior	1	None	Soil and moist cliffs, exposed root wads.
a lichen sp. *Pseudocyphellaria crocata*	---	E	D	Superior	1	None	Mossy rocks, trees in partially shaded, moist, frequently foggy habitats.

[1] Global rankings as assigned by Natural Heritage Network (NatureServe 2002). G1=critically imperiled, G2=imperiled, G3=vulnerable, G4=apparently secure, G5=secure, T=ranks for subspecies, ?= inexact numeric rank, Q=questionable taxonomy, G#G#= range of ranks. See NatureServe website for complete definitions. "---" indicates the plant is not tracked on NatureServe website.
[2] Minnesota state rankings (Minnesota DNR 1996). E=endangered, T=threatened, SC=special concern, NON=tracked but not listed, "---"indicates the plant in not tracked in Minnesota.
[3] CB=circumboreal, circumpolar, D=disjunct, P=peripheral, RE=regional endemic, SD=sparsely distributed, W=widely distributed
[4] The number of occurrences includes only those presumed to be extant, and does not include those occurrences found before 1960. This is the number of occurrences within proclamation boundaries.
[5] IMMA=Immature, MAT=Mature, ALL=All age classes of forest vegetation. For specific ages associated with each class and forest type, see USDA Forest Service 2000b.

Peltigera venosa conservation assessment (USDA Forest Service 2002n), *Pseudocyphellaria crocata* conservation assessment (USDA Forest Service 2002o), *Ramalina thrausta* conservation assessment (USDA Forest Service 2002p), *Sticta fuliginosa* conservation assessment (USDA Forest Service 2002f), and *Usnea longissima* conservation assessment (USDA Forest Service 2002q). In addition, updated rare species data from the Minnesota Natural Heritage Program (MN DNR 2003) was considered in the final version of the BE. This data changes annually, such as when new rare plant occurrences are found. The primary change from the 2001 data to the 2003 data was that a few more occurrences of several sensitive plants were found. The presence of these few new occurrences were not enough to change any of the outcomes or determinations of effect for sensitive plants. Therefore, the 2001 Minnesota Natural Heritage Program data is used in the BE. The 2003 Minnesota Natural Heritage Program is in the planning record.

Unless noted otherwise, the number of occurrences in table 3 were taken either from Minnesota Natural Heritage Program Data (MN DNR 2001), from Chippewa National Forest Sensitive Plant Habitats (USDA Forest Service 2001a), or USDA Forest Service (2000d). Occurrence data for Vasey's rush were compiled from: Walton (1999a), Walton (2000a), Walton (1999b), and Bell Herbarium (2002). Occurrence data for Canada yew on the Superior were compiled from: Walton (2001), Schmoller (2001), and unpublished rare plant survey results (USDA Forest Service 2002c). Unless otherwise noted, the indicator descriptions (i.e. forest type and age) found in table 3 were taken from information collected from taxonomic experts through the SVE process (vascular plants) or (for lichens) the Lichen PVA Panel Notes (USDA Forest Service 2000d) and Wetmore (2001).

GUILDS

The 66 sensitive plants inhabit a diverse array of habitats, vary in their distribution across the landscape, and range widely in population density. Furthermore, they face a variety of human-induced or moderated threats that vary in severity. Finally, the amount of current scientific information available also varies greatly among species. To simplify and facilitate analysis, the sensitive plants were grouped into guilds based on the primary habitat used by each species and, in some cases, an ecological process that acts as an important common influence on the group. The guilds are displayed in table 3. Some species like Canada yew occupy a variety of upland and lowland habitats, and could have been placed in several guilds. In such cases, the primary habitat was selected as the guild, but the complexity of its habitat use was captured by choosing indicators that represent its range of habitats.

ANALYSIS PROCESS

The analysis process for evaluating effects of alternatives A through G on sensitive plants is described in detail in USDA Forest Service (2002i). Briefly, the analysis focuses on the ecological conditions that would contribute to the long-term persistence of these species on Forest Service lands. The historical, current, and likely future abundance and distribution of suitable ecological conditions is evaluated for each sensitive plant, and the likelihood of persistence is summarized by assigning 100 likelihood points to a continuum of five outcomes (A-E), spreading the points between outcomes when necessary to account for uncertainty. Outcomes are based on likely effects on conditions that are under the control of management by the Forest Service. Because the majority of sensitive plants are habitat specialists and would not

be well-distributed under even optimal conditions, they require a more narrow continuum of outcomes C through E for the historical condition; only triangle grapefern and goblin fern on the Chippewa, Canada yew on both Forests, and barren strawberry on the Superior had a historical distribution of suitable habitat that was more abundant and broadly distributed than outcome C. The outcome statements for conditions on National Forest land and for conditions on all ownerships in the cumulative effects area are given below.

Outcomes Based on Conditions on National Forest Lands

- Outcome A. *Suitable ecological conditions are broadly distributed and of high abundance across the historical range of the species within the planning area. The combination of distribution and abundance of ecological conditions provides opportunity for continuous or nearly continuous intraspecific interactions for the species.*

- Outcome B. *Suitable ecological conditions are either broadly distributed or of high abundance across the historical range of the species within the planning area, but there are gaps where suitable ecological conditions are absent or only present in low abundance. However, the disjunct areas of suitable ecological conditions are typically large enough and close enough to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range within the planning area.*

- Outcome C. *Suitable ecological conditions are distributed frequently as patches and/or exist at low abundance. Gaps where suitable ecological conditions are either absent, or present in low abundance, are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition, reduction in overall species range from historical within the planning area may have resulted from this isolation.*

- Outcome D. *Suitable ecological conditions are frequently isolated and/or exist at very low abundance. While some of the subpopulations associated with these ecological conditions may be self-sustaining, there is limited opportunity for population interactions among many of the suitable environmental patches. For species for which this is not the historical condition within the planning area, reduction in overall species range from historical condition within the planning area may have resulted from this isolation.*

- Outcome E. *Suitable ecological conditions are highly isolated and exist at very low abundance, with little or no possibility of population interactions among suitable environmental patches, resulting in strong potential for extirpations within many of the patches, and little likelihood of re-colonization of such patches. There has likely been a reduction in overall species range from historical within the planning area, except for some rare, local endemics that may have persisted in this condition since the historical period.*

Outcomes Based on Conditions on All Ownerships in the Cumulative Effects Area

- Outcome A. *The combination of environmental and population conditions provides opportunity for the species to be broadly distributed and of high abundance across its historical range within the cumulative effects analysis area. There is potential for continuous or nearly continuous intraspecific interactions at high population size.*

- Outcome B. *The combination of environmental and population conditions provide opportunity for the species to be broadly distributed and/or of high abundance across its historical range within the cumulative effects analysis area, but there are gaps where populations are potentially absent or present only in low density as a result of environmental or population conditions. However, the disjunct areas of higher potential population density are typically large enough and close enough to other subpopulations*

to permit dispersal among subpopulations and potentially to allow the species to interact as a metapopulation across its historical range within the cumulative effects analysis area.

- Outcome C. *The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by patchiness and/or areas of low abundance. Gaps where the likelihood of population occurrence is low or zero are large enough that some subpopulations are isolated, limiting opportunity for species interactions. There is opportunity for subpopulations in most of the species range to interact as a metapopulation, but some subpopulations are so disjunct or of such low density that they are essentially isolated from other populations. For species for which this is not the historical condition within the planning area, reduction in overall species range from historical condition may have resulted from this isolation.*

- Outcome D. *The combination of environmental and population conditions restrict the potential distribution of the species, which is characterized by areas with high potential for population isolation and/or very low potential abundance. While some of these subpopulations may be self-sustaining, gaps where the likelihood of population occurrence is low or zero are large enough that there is limited opportunity for interactions among them. For species for which this is not the historical condition within the planning area, reduction in overall species range from historical has likely resulted from this isolation.*

- Outcome E. *The combination of environmental and population conditions restricts the potential distribution of the species, which is characterized by high levels of isolation and very low potential abundance. Gaps where the likelihood of population occurrence is low or zero are large enough there is little or no possibility of interactions, strong potential for extirpations, and little likelihood of recolonization. There has likely been a reduction in overall species range from historical within the planning area, except for some rare, local endemics that may have persisted in this condition since the historical period.*

Panels of taxonomic experts were convened in late April/early May 2002 to estimate likely outcomes for species. These outcome determinations were considered, along with information sources discussed below, in making final outcome determinations for species. Forest Service biologists made final outcome determinations.

Substantial uncertainty was involved in estimating historical outcomes because there is little to no published information describing the historical distributions of the rare plants considered in this analysis. Historical and current outcome judgments were made as described in USDA Forest Service (2002i). Additional documents used to estimate historical outcomes included: documents describing the range of natural variation of vegetation (Frelich 1998), distribution of vegetation types at the time of the General Land Office Surveys (MNDNR 1988), distribution of peatlands (Kierstead 1992), tree species abundance during the GLO Surveys (found in the landscape ecosystem objectives in Chapter 2 of the draft Forest Plans for the Chippewa and Superior), and maps showing the distribution of landscape ecosystems in the Drift and Lake Plains and Northern Superior Uplands (project files). Additional documents used to judge current outcomes included: trends for different vegetation types found in comparisons of GLO survey data to Forest Inventory Analysis (FIA) data (found in the landscape ecosystem objectives in Chapter 2 of the draft Forest Plans for the Chippewa and Superior), Frelich (1998), Bradof (1992) and Heinselman (1996).

INDICATORS

For sensitive plants of forested habitats, the indicators used to determine likely future outcomes and analyze the effects of the alternatives were acres of a given forest type and age that represent

suitable habitat for the species. These indicators were drawn from information gathered at the first SVE panels, and were augmented when possible by my personal observations and professional botanical expertise. For some plants (e.g. blunt lobed grapefern), other factors such as being on the periphery of the species range or lack of knowledge of the species habitat needs affected the evaluation of the indicator; such instances are noted in the effects analysis. For three future time points (20 years, 50 years, and 100 years), the computer model Dualplan generated the projected acreage and age class of these indicators, and it was these model outputs that were compared among alternatives. Model data is found in FEIS section 3.3.1.c and in FEIS Appendix D in the tables describing acres of Management Indicator Habitats.

For aquatic, riparian, wetland, and cliff species, the amount and distribution of habitat was not modeled because it would not change much over the time frame of the analysis as the result of Forest Service actions. When possible, indicators that are closely related to threats faced by a species (e.g. water access represents the amount of recreational use, which threatens some aquatic and wetland species) were chosen to evaluate the effects of the alternatives. The levels of water access for the different alternatives are found in FEIS section 3.8.4.b; these levels of water access are used in the analysis in this BE. For some riparian species, the acreage of riparian timber harvest was modeled, and the model outputs were compared among alternatives to assess effects; model outputs for riparian timber harvest are found in the analysis of indicator 3 in FEIS section 3.6.1.b. For other species where this was not possible, potential threats were evaluated in relation to how different alternatives would likely affect ecological processes important to species viability. Likely future outcomes and effects were evaluated at three future time points as described above.

THREATS

Threats are defined as those activities, Forest Service or otherwise, or natural conditions that currently or potentially have direct, indirect, or cumulative negative effects on the likelihood of persistence of sensitive plant species or their habitat. All known or reasonably suspected potential threats are displayed for each sensitive plant species in a table in Appendix 1. Unless specifically stated otherwise in the analysis, this BE addresses only threats that are under the control of Forest Service management and not threats such as climate change which are beyond the control of the Forest Service.

Information about species specific threats was taken from the following sources: species literature reviews conducted between October 1999 and March 2000, SVE panel notes, Michigan moonwort conservation assessment (USDA Forest Service 2001b), common moonwort conservation assessment (USDA Forest Service 2001c), pale moonwort conservation assessment (USDA Forest Service 2001d), ternate grapefern conservation assessment (USDA Forest Service 2001e), least grapefern conservation assessment (USDA Forest Service 2001f), goblin fern conservation assessment (USDA Forest Service 2001g), blunt-lobed grapefern conservation assessment (USDA Forest Service 2001h), draft *Menegazzia terebrata* conservation assessment (USDA Forest Service 2002d), ram's head lady slipper conservation assessment (USDA Forest Service 2000a), and the auricled twayblade conservation assessment (USDA Forest Service 2001i). A brief explanation of the potential threat categories follows.

- Timber harvest – impacts to habitat from ground disturbance associated with logging and

its associated activities, such as construction of landings, skidding, site prep, potential erosion/sedimentation, impacts of dense sugar maple regeneration on rare species (Schulz et al. 2001)

- Road/trail construction – impacts to habitat from ground disturbance associated with construction and maintenance of permanent and temporary roads, and trail construction and maintenance, including potential erosion/sedimentation
- Non-native invasive species – competition from non-native invasive plants and noxious weeds, and impacts to habitat from exotic earthworms
- Recreation – impacts to habitat from ground disturbance associated with recreation, such as boat wakes, trampling at campsites or beaches, rock climbing, ATV use, driving on Forest Service roads
- Climate change – loss of habitat caused by climate change
- Small population problems – impacts to population persistence caused by problems associated with small populations, such as genetic drift, inbreeding depression, and demographic stochasticity
- Succession – loss of habitat caused by successional changes
- Hydrologic alteration – impacts to habitat caused by changes in hydrology, such as natural or human-made impoundments (which could alter levels of shoreline fluctuations), wetland draining, or increases in water yield due to upland timber harvest
- Development – impacts to habitat from ground disturbance caused by development, such as building construction
- Pollution – impacts to habitat from pollution, such as acid rain, or eutrophication of lakes caused by nutrient enrichment
- Collection – impacts to plant populations caused by plant collection
- Mining – impacts to habitat from ground disturbance caused by mining, such as gravel pit development
- Prescribed/wildfire – impacts to habitat from wildfires or use of prescribed fire, either from the fire itself or from construction of fireline or possible erosion/sedimentation, for example
- Herbivory – impacts to plant populations caused by herbivory, such as deer herbivory on Canada yew seedlings
- Herbicide application – impacts to plant populations from intentional or unintentional herbicide application
- Insect and disease – impacts to plant populations from herbivorous insects or plant pathogens
- Drought – impacts to habitat and plant populations from drought
- Agriculture – impacts to habitat from agricultural land use
- Fire exclusion – impacts to habitat from fire prevention, resulting in alteration of historical fire regimes
- Windthrow – impacts to habitat from windthrow/blowdown events
- Erosion – impacts to habitat from large scale erosion events such as landslides

ENVIRONMENTAL CONSEQUENCES

Direct, indirect, and cumulative effects for all the species are discussed below. Outcome

rankings can be found in table 1, and these represent outcomes at 20 years, 50 years, and 100 years in the future. Determinations of effect are presented below for species at 20 years in the future. Rationales for these outcomes are discussed below.

GUILD 1. SHALLOW WATER/LITTORAL ZONE - FLUCTUATING SHORE

ALPINE MILKVETCH (*ASTRAGALUS ALPINUS*)

Direct/Indirect Effects

Historical Outcome

With only one occurrence of this plant on the Forest, the habitat needs for this plant are not well understood. Since the Forest is at the southern edge of its range in the Midwest, its habitat has probably historically been scarce and highly isolated.

Current Outcome

Although the amount of habitat has probably not changed much from historical conditions, direct impacts from ATV use and indirect impacts from timber harvest have probably occurred. However, these effects have not been great enough to cause the current outcome to differ from the historical outcome.

Effects Common to All Alternatives

Because of the scarcity and isolation of ecological conditions suitable for this species, it would continue to face threats to its persistence on the Forest under all alternatives. Standards and guidelines would protect this species from direct timber harvest impacts. Forest management activities would not have a major impact on water level fluctuations, which are an important ecological process for this species, because riparian area standards and guidelines would maintain riparian buffers. Direct impacts to suitable habitat from ATV use would probably be less in alternatives B thru G than in alternative A, since unrestricted cross-country use would be permitted on the Superior in alternative A. However, these minor differences between alternatives would not affect the overall outcome for this species.

KATAHDIN SEDGE (*CAREX KATAHDINENSIS*)

Direct/Indirect Effects

Historical Outcome

This species has probably always had a patchy distribution of suitable beach habitat. However, on the big lakes there were probably opportunities for metapopulation interactions.

Current Outcome

The amount of habitat has probably not changed greatly from historical conditions, and much of it occurs in the BWCAW. There probably have been some minor to moderate impacts to sandy beaches from recreational use; however, the impacts have probably not been great enough to lower the outcome.

Effects Common to All Alternatives

Alternatives A, C, and E would have the highest amounts of recreational water access, and the other alternatives would have less. However, the differences in recreational impacts between alternatives would probably be negligible. Because there are few management-related threats to habitat or important ecological processes (i.e. water level fluctuations) for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives. One occurrence of this plant has been found in an ephemeral pond, and standards and guidelines for riparian areas and TES species would

protect such habitat, if future rare plant surveys reveal such habitat to be important and not just an outlier.

CREEPING RUSH (*JUNCUS SUBTILIS*)

Direct/Indirect Effects

Historical Outcome

There is one extant occurrence of this plant on the Superior, and the Forest is at the periphery of the species range. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest and the fact that the Forest is at the periphery of the species' range, its habitat has probably historically been more scarce and highly isolated in this portion of its range (outcome D).

Current Outcome

Despite having only one known occurrence, the amount of habitat has probably not changed greatly from historical conditions, and much of it occurs in the BWCAW. There probably have been some minor to moderate impacts to sandy beaches from recreational use; however, the impacts have probably not been great enough to lower the outcome.

Effects Common to All Alternatives

Alternatives A, C, and E would have the highest amounts of recreational water access, and the other alternatives would have less. However, the differences in recreational impacts between alternatives would probably be negligible. Because there are few management-related threats to habitat or important ecological processes (i.e. water level fluctuations) for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

AMERICAN SHOREGRASS (*LITTORELLA UNIFLORA*)

Direct/Indirect Effects

Historical Outcome

This species has probably always had a patchy distribution of suitable oligotrophic, shallow water habitat. However, on large lakes on the Forest there were probably opportunities for metapopulation interactions.

Current Outcome

The amount of habitat has probably not changed greatly from historical conditions, and much of it occurs in the BWCAW. There probably have been some minor to moderate impacts to its habitat from recreational water use (motorboat wakes); however, the impacts have probably not been great enough to lower the outcome for this plant.

Effects Common to All Alternatives

Alternatives A, C, and E would have the highest amounts of recreational water access, and the other alternatives would have less. However, the differences in recreational impacts between alternatives would probably be negligible. Because there are few management-related threats to habitat or important ecological processes (i.e. water level fluctuations) for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

AWLWORT (*SUBULARIA AQUATICA*)

Direct/Indirect Effects

Historical Outcome

Superior National Forest: This species has probably always had a patchy distribution of suitable oligotrophic, shallow water habitat. However, on large lakes there were probably opportunities for metapopulation interactions. Chippewa National Forest: Suitable ecological conditions for this species are rarer on the Chippewa because oligotrophic lakes are relatively uncommon (USDA Forest Service 2002e). Suitable habitat is isolated and is not abundant.

Current Outcome

Superior and Chippewa National Forests: The amount of habitat has probably not changed greatly from historical conditions. There probably have been some minor to moderate impacts to its habitat from recreational water use (motorboat wakes); however, the impacts have probably not been great enough to lower the outcome for this plant.

Effects Common to All Alternatives

Superior and Chippewa National Forests: Alternatives A, C, and E would have the highest amounts of recreational water access, and the other alternatives would have less. However, the differences in recreational impacts between alternatives would probably be negligible. Because there would be few management-related threats to habitat or important ecological processes (i.e. water level fluctuations) for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

Cumulative Effects for Plants in Shallow Water Guild

The cumulative effects of the Forest Plan alternatives on the distribution and abundance of ecological conditions for plants within the shallow water/littoral zone guild would be minor. There are a few additional occurrences of American shoregrass and awlwort in the cumulative effects analysis areas, but no additional occurrences of the other guild members.

The historical outcomes for cumulative effects for species within this guild would be the same as the historical outcomes for direct/indirect effects. The historical distribution and abundance of habitat within each Forest's respective analysis area (i.e. for the Chippewa, the Drift and Lake Plains, and for the Superior, the Northern Superior Uplands) probably closely parallels the historical distribution and abundance of habitat for analysis of direct/indirect effects. The primary reason for this is because lands within an ecological classification system (ECS) section share a number of basic characteristics (e.g. bedrock features, land forming processes, etc.); therefore, a type of habitat that is widespread and common in one portion of the section would probably be widespread and common throughout the section.

The current outcomes for cumulative effects for species within this guild would be the same as the current outcomes for direct/indirect effects, except for American shoregrass and awlwort on the Superior, which would have lower outcomes. Since historical times, similar actions have occurred within the cumulative effects analysis areas as occurred within the direct/indirect effects analysis areas. Past lakeshore development (resulting in shoreline development and water pollution) as well as recreational impacts (e.g. boat wakes, camping on sandy beaches) have probably impacted habitat for this guild within the cumulative effects analysis area. For the two most broadly distributed plants in this guild, American shoregrass and the occurrences of awlwort on the Superior, these impacts resulted in a decrease in distribution and abundance of suitable ecological conditions (i.e. outcome lowered from C to D). For the other species in the guild, these impacts did not result in a substantial enough decrease in distribution and abundance

of habitat to lower the cumulative effects outcome; suitable habitat was probably patchy enough to have avoided impacts from the types of threats described above.

Future levels of recreational water use in the cumulative effects analysis areas would probably continue to increase by some unknown amount; this is based on projections by some entities, such as the State, that it would continue to maintain current access points and develop new ones (see analysis of water access in Chapter 3.8 of FEIS). Furthermore, the desire for lakeshore residences would probably continue to increase. However, because the majority of good habitat for these species occurs on National Forest lands, these continued actions outside National Forest lands would only result in minor cumulative impacts for all the alternatives. The outcome by alternative for each species would be the same as the current cumulative effects outcomes.

Determination of Effects

For all of the species in this guild, all the alternatives may impact individuals but are not likely to cause a trend to federal listing or loss of viability.

GUILD 2. RIPARIAN - AQUATIC, OPEN MARSH, AND ALDER/SHRUB DOMINATED

FLOATING MARSH-MARIGOLD (*CALTHA NATANS*)

Direct/Indirect Effects

Historical Outcome

Historically, this species probably had a patchy distribution of suitable habitat. However, there were probably opportunities for metapopulation interactions where populations occurred in the same watershed because seeds could be dispersed downstream.

Current Outcome

Logging activities have probably impacted this species' riparian habitat, primarily through hydrologic changes caused by road construction in riparian areas, increased water yields, or riparian harvest. A number of historical populations in the planning area have been extirpated in the last century (Coffin and Pfannmuller 1988). This declining population trend suggests that this species has increased threats to its persistence compared to historical conditions, primarily because of habitat degradation.

Effects Common to All Alternatives

Alternatives A, C, and E would have the highest amounts of recreational water access, and the other alternatives would have less. Recreational water use could impact this species (e.g. boat wakes), but such impacts would be relatively minor compared to potential impacts from timber harvest. Alternatives A and C would have the greatest amounts of timber harvest occurring in riparian areas, and alternatives A, C, and F would have riparian standards and guidelines that allow more disturbance compared to alternatives B, D, E, and G. TES species standards and guidelines would protect occurrences from direct impacts under all alternatives, but indirect impacts (e.g. increased sedimentation) would be highest for alternatives A and C. The indirect impacts of the higher levels of timber harvest in alternatives A and C would cause a lower outcome for these alternatives.

DWARF WATER LILY (*NYMPHAEA LEIBERGII*)

Direct/Indirect Effects

Historical Outcome

Historically, this species probably had a patchy distribution of suitable habitat. However, there were probably opportunities for metapopulation interactions where populations occurred in the same watershed because seeds could be dispersed downstream.

Current Outcome

Logging activities have probably impacted this species riparian habitat, primarily through hydrologic changes caused by road construction in riparian areas, increased water yields, or riparian harvest. Consequently, there is an increased threat to its persistence compared to historical conditions.

Effects Common to All Alternatives

Alternatives A, C, and E would have the highest amounts of recreational water access, and the other alternatives would have less. Recreational water use could impact this species (e.g. boat wakes), but such impacts would be relatively minor compared to potential impacts from timber harvest. Alternatives A and C would have the greatest amounts of timber harvest occurring in riparian areas, and alternatives A, C, and F would have riparian standards and guidelines that allow more disturbance compared to alternatives B, D, E, and G. TES species standards and guidelines would protect occurrences from direct impacts under all alternatives, but indirect impacts (e.g. increased sedimentation) would be highest for alternatives A and C. The indirect impacts of the higher levels of timber harvest in alternatives A and C would cause a lower outcome for these alternatives.

AURICLED TWAYBLADE (*LISTERA AURICULATA*)

Direct/Indirect Effects

Historical Outcome

Historically, this species probably had a patchy distribution of suitable habitat. However, there were probably opportunities for metapopulation interactions where populations occurred in the same watershed because seeds could be dispersed downstream.

Current Outcome

Logging activities have probably impacted this species riparian habitat, primarily through hydrologic changes caused by road construction in riparian areas, increased water yields, or riparian harvest. Consequently, there is an increased threat to its persistence compared to historical conditions.

Effects Common to All Alternatives

Alternatives A and C would have the greatest amounts of timber harvest occurring in riparian areas, and alternatives A, C, and F would have riparian standards and guidelines that allow more disturbance compared to alternatives B, D, E, and G. TES species standards and guidelines would protect occurrences from direct impacts under all alternatives, but indirect impacts (e.g. increased sedimentation) would be highest for alternatives A and C because they would have the highest levels of timber harvest in riparian areas. The indirect impacts of timber harvest would cause a lower outcome for alternatives A and C.

Cumulative Effects for Plants in the Riparian Guild

The cumulative effects of the Forest Plan alternatives on the distribution and abundance of ecological conditions for plants within the riparian guild would be minor. There are a few additional occurrences of all three guild members in the cumulative effects analysis area.

The historical outcomes for cumulative effects for species within this guild would be the same as

the historical outcomes for direct/indirect effects. The historical distribution and abundance of habitat within the Superior's analysis area (i.e. the Northern Superior Uplands) probably closely parallels the historical distribution and abundance of habitat for analysis of direct/indirect effects. The primary reason for this is because lands within an ecological classification system (ECS) section share a number of basic characteristics (e.g. bedrock features, land forming processes, etc.); therefore, a type of habitat that is widespread and common in one portion of the section would probably be widespread and common throughout the section.

The current outcomes for cumulative effects for species within this guild would be the same as the current outcomes for direct/indirect effects. Since historical times, similar actions have occurred within the cumulative effects analysis area as occurred within the direct/indirect effects analysis area. Past timber harvest and road construction in riparian areas have altered riparian conditions across the cumulative effects analysis area (see analysis of watershed health in Chapter 3.6 of FEIS), resulting in a decrease in distribution and abundance of suitable ecological conditions for plants in this guild. These impacts parallel the decrease in abundance and distribution of ecological conditions in the direct/indirect effects analysis areas.

Future timber harvest in riparian zones in the cumulative effects analysis area would occur on all ownerships, but the cumulative effects of these actions on plants of this guild would be minor. Outside the Forest boundary, the level of riparian harvest would be determined by the management goals of the different landowners; these actions would be the same for all alternatives. Within the Forest boundary, alternatives A and C would have the highest levels of riparian timber harvest. Operationally, impacts throughout the analysis area would be minimized by voluntary adherence to Best Management Practices (BMPs – MN FRC 1999). Alternatives B, D, E, and G would have additional protective riparian standards and guidelines. These impacts parallel the decrease in abundance and distribution of ecological conditions in the direct/indirect effects analysis area. The cumulative impacts of alternatives A and C would be greater than those for the remaining alternatives; the outcome by alternative for each species would be the same as the outcome for the direct/indirect effects analysis.

Determination of Effects

For all of the species in this guild, all the alternatives may impact individuals but are not likely to cause a trend to federal listing or loss of viability.

GUILD 3. NONFOREST WETLAND, DISTURBED WETLAND, AND FLUCTUATING SHORE – PREDOMINANTLY OPEN

SWAMP BEGGAR TICKS (*BIDENS DISCOIDEA*)

Direct/Indirect Effects

Historical Outcome

There is one extant occurrence of this plant on the Superior, and the Forest is at the periphery of the species range. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest and the fact that the Forest is at the periphery of the species' range, its habitat has probably historically been more scarce and highly isolated in this portion of its range (outcome D).

Current Outcome

Historical logging activities could have impacted this species swamp habitat, and there is one 1953 collection on the Forest that has not been relocated and is probably extirpated. Therefore, suitable ecological conditions for this species are probably very rare and highly isolated (outcome E).

Effects Common to All Alternatives

Standards and guidelines would protect this species from lowland road impacts. Forest management activities would not have a major impact on water level fluctuations, which are an important ecological process for this species, because riparian area standards and guidelines would maintain riparian buffers. However, ecological conditions for this species would continue to be very scarce and highly isolated, so this plant would continue to face threats to its persistence on the Forest.

POND REEDGRASS (*CALAMAGROSTIS LACUSTRIS*)

Direct/Indirect Effects

Historical Outcome

There is one extant occurrence of this plant on the Superior, and several historical occurrences that have not been revisited. There is also some question about the validity of this taxon (USDA Forest Service 1999b), and this uncertainty increases the difficulty of making outcome judgements. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest and difficulties in identification, its habitat has probably historically been scarcer and more highly isolated in this portion of its range (outcome D).

Current Outcome

Hydrologic processes such as flooding that maintain an open habitat are important to this species; this process has probably not changed drastically from historical conditions. Distribution of suitable habitat for this species is probably similar to historical conditions, although lowland roads could have impacted suitable habitat to some degree.

Effects Common to All Alternatives

The abundance and distribution of ecological conditions for this species are not expected to differ much by alternative, since standards and guidelines would protect this species from lowland road impacts, and hydrologic processes would be protected from impacts from future forest management activities by riparian area standards and guidelines. The resolution of taxonomic questions about this species would improve the ability to identify this species and eliminate some of the uncertainty involved in determining this outcome.

NEAT SPIKE-RUSH (*ELEOCHARIS NITIDA*)

Direct/Indirect Effects

Historical Outcome

This species has probably always had a patchy distribution of suitable wetland habitat. However, subpopulations were probably able to interact occasionally via seed dispersal by animals.

Current Outcome

The amount and distribution of habitat has probably not changed greatly from historical conditions. Most of the known occurrences on the Superior are in wet spots on roads and trails, so the use of this type of habitat could indicate an increase in suitable ecological conditions for this plant. However, the impacts caused by users of roads and trails probably offsets any increase in habitat availability. Thus, the current outcome for this species remains similar to its

historical outcome.

Effects Common to All Alternatives

The abundance and distribution of ecological conditions for this species are expected to remain patchy and of low abundance, similar to historical conditions. There are few management-related threats to its most important ecological process, water-level fluctuations. Recreational use could impact populations (e.g. portage trails that go through wetlands), but differences in recreational impacts between alternatives would probably be negligible as far as this species is concerned. Roads and trails would continue to be used as suitable habitat, and road and trail users would continue to impact populations and offset any increases in suitable habitat.

OLIVACEOUS SPIKE-RUSH (*ELEOCHARIS OLIVACEA*)

Direct/Indirect Effects

Historical Outcome

There is one extant occurrence of this plant on the Chippewa, and the Forest is at the periphery of the species range. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest and the fact that the Forest is at the periphery of the species' range, its habitat has probably historically been scarcer and more highly isolated in this portion of its range (outcome D).

Current Outcome

Wetland drainage, lowland roads, and beaver trapping may have caused a decrease in habitat for this plant, but such impacts probably only affected a fraction of the total suitable habitat available. Therefore, the amount and distribution of suitable ecological conditions is still roughly similar to historical conditions.

Effects Common to All Alternatives

With the exception of construction of lowland roads, there would be no direct impacts of management activities to suitable habitat, and indirect impacts from adjacent upland timber harvest would be minimized by riparian standards and guidelines. Lowland roads would only be used when snow cover or frozen ground would prevent soil damage. For these reasons, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

FEW-FLOWERED SPIKE-RUSH (*ELEOCHARIS QUINQUEFLORA*)

Direct/Indirect Effects

Historical Outcome

There is one extant occurrence of this plant on the Chippewa. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest, its habitat has probably historically been scarcer and more highly isolated in this portion of its range (outcome D).

Current Outcome

Recreational impacts (e.g. boat wakes, trampling) and lowland roads may have caused a decrease in habitat for this plant, but such impacts probably only affected a fraction of the total suitable habitat available. Therefore, the amount and distribution of suitable ecological conditions is still roughly similar to historical conditions.

Effects Common to All Alternatives

Alternatives A, C, and E would have the highest amounts of recreational water access, and the other alternatives would have less. However, the differences in recreational impacts to this plant

between alternatives would probably be negligible. Because management-related threats to habitat or important ecological processes (i.e. water level fluctuations) would be minimized by riparian standards and guidelines, the amount and distribution of suitable ecological conditions for this plant would not change appreciably from current outcomes in response to any of the alternatives

MOOR RUSH (*JUNCUS STYGIUS*)

Direct/Indirect Effects

Historical Outcome

There is one occurrence of this plant on the Superior. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest, its habitat has probably historically been scarcer and more highly isolated in this portion of its range (outcome D).

Current Outcome

The amount and distribution of suitable ecological conditions for this plant have probably not changed much compared to the historical condition. Historical logging activities probably had little impact on suitable habitat, since the species primarily occurs in non-forested peatlands. Lowland road construction may have impacted some suitable habitat, but most likely only a fraction of it.

Effects Common to All Alternatives

Because there would be few management-related threats to habitat or important ecological processes for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

VASEY'S RUSH (*JUNCUS VASEYI*)

Direct/Indirect Effects

Historical Outcome

This species has probably always had a patchy distribution of suitable wetland habitat. However, subpopulations were probably able to interact occasionally via seed dispersal by animals or water flow.

Current Outcome

The amount and distribution of habitat has probably not changed greatly from historical conditions. Most of the known occurrences on the Superior are in wet spots on trails or in road ditches, so the use of this type of habitat could indicate an increase in suitable ecological conditions for this plant. However, the impacts caused by users of roads and trails probably offsets any increase in habitat availability. Thus, the current outcome for this species remains similar to its historical outcome.

Effects Common to All Alternatives

The abundance and distribution of ecological conditions for this species are expected to remain patchy and of low abundance, similar to historical conditions. Road and trail use and maintenance could impact populations, but differences in such impacts between alternatives would probably be negligible as far as this plant is concerned. Roads and trails would continue to be used as suitable habitat, and road and trail users would continue to impact populations and offset any increases in suitable habitat.

FALL DROPSEED MUHLY (*MUHLENBERGIA UNIFLORA*)

Direct/Indirect Effects

Historical Outcome

This species can occur both on floating mats and sandy beaches, and suitable habitat has probably historically been patchily distributed and of low abundance across the Superior.

Current Outcome

The amount and distribution of suitable ecological conditions for this plant have probably not changed much compared to the historical condition. Recreational use of sandy beaches has probably contributed to a slight decrease in quality and abundance of this type of habitat, but availability of floating mat habitat has probably not changed much compared to the historical condition.

Effects Common to All Alternatives

Alternatives A, C, and E would have the highest amounts of recreational water access, and the other alternatives would have less. However, the differences in recreational impacts to this plant between alternatives would probably be negligible. Because the habitat and important ecological processes (i.e. water level fluctuations) for this plant would be protected by riparian standards and guidelines, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives

CLUB-SPUR ORCHID (*PLATANTHERA CLAVELLATA*)

Direct/Indirect Effects

Historical Outcome

Superior National Forest: This species has probably always had a patchy distribution of suitable open peatland habitat. However, subpopulations were probably able to interact occasionally via wind dispersal of seeds or pollinators traveling between populations. Chippewa National Forest: There is one extant occurrence of this plant on the Chippewa. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest, its habitat has probably historically been scarcer and more highly isolated in this portion of its range (outcome D).

Current Outcome

Superior and Chippewa National Forests: The amount and distribution of suitable ecological conditions for this plant have probably not changed much compared to the historical condition. Almost half of the known occurrences on the Superior are in winter logging roads, so the use of this type of habitat could indicate an increase in suitable ecological conditions for this plant, since this plant likes very little tree canopy cover. However, the impacts caused by users of roads and trails probably offsets any increase in habitat availability. Thus, the current outcome for this species remains similar to its historical outcome.

Effects Common to All Alternatives

Superior and Chippewa National Forests: The abundance and distribution of ecological conditions for this species are expected to remain similar to current conditions. Winter roads and trails would continue to be used as suitable habitat, and road and trail users would continue to impact populations and offset any increases in suitable habitat. Aside from lowland road construction and use, there would be few management-related threats to suitable habitat.

NORTHERN BUR-REED (*SPARGANIUM GLOMERATUM*)

Direct/Indirect Effects

Historical Outcome

Superior and Chippewa National Forests: This species has probably always had a patchy distribution of suitable open muck habitat.

Current Outcome

Superior and Chippewa National Forests: The amount and distribution of suitable ecological conditions for this plant have probably not changed much compared to the historical condition. About one quarter of the known occurrences on both Forests are in ditches adjacent to roads, so the use of this type of habitat could indicate an increase in suitable ecological conditions for this plant, since it likes very little tree canopy cover. However, the impacts caused by road use and maintenance probably offset any increase in habitat availability. Thus, the current outcome for this species remains similar to its historical outcome.

Effects Common to All Alternatives

Superior and Chippewa National Forests: The abundance and distribution of ecological conditions for this species are expected to remain similar to current conditions. Ditches adjacent to roads would continue to be used as suitable habitat, and road use and maintenance would continue to impact populations and offset any increases in suitable habitat. Aside from road use and maintenance, there would be few management-related threats to suitable habitat.

LANCE-LEAVED VIOLET (*VIOLA LANCEOLATA*)

Direct/Indirect Effects

Historical Outcome

There are two extant occurrences of this plant on the Superior, and the Forest is at the periphery of the species range. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest and the fact that the Forest is at the periphery of the species' range, its habitat has probably historically been scarcer and highly isolated in this portion of its range (outcome D).

Current Outcome

Despite having only two known occurrences, the amount of habitat has probably not changed greatly from historical conditions. However, there probably have been some minor to moderate impacts to lakeshores/beaches from recreational use. The current outcome for this species remains similar to its historical outcome.

Effects Common to All Alternatives

Alternatives A, C, and E would have the highest amounts of recreational water access, and the other alternatives would have less. However, the differences in recreational impacts to this plant between alternatives would probably be negligible. Because there are few management-related threats to habitat or important ecological processes (i.e. water level fluctuations) for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

Cumulative Effects for Plants in the Nonforest Wetland Guild

The cumulative effects of the Forest Plan alternatives on the distribution and abundance of ecological conditions for plants within the nonforest wetland guild would be minor. For all the species but swamp beggar ticks, pond reedgrass, fall dropseed muhly, and northern bur-reed, there are a few additional occurrences of the species within the cumulative effects analysis areas.

For northern bur-reed, there are 25 additional occurrences within the Northern Superior Uplands and nine additional occurrences within the Drift and Lake Plains. There are no additional occurrences of swamp beggar ticks, pond reedgrass, and fall dropseed muhly.

The historical outcomes for cumulative effects for species within this guild would be the same as the historical outcomes for direct/indirect effects. The historical distribution and abundance of habitat within each Forest's respective analysis area (i.e. for the Chippewa, the Drift and Lake Plains, and for the Superior, the Northern Superior Uplands) probably closely parallels the historical distribution and abundance of habitat for analysis of direct/indirect effects. The primary reason for this is because lands within an ecological classification system (ECS) section share a number of basic characteristics (e.g. bedrock features, land forming processes, etc.); therefore, a type of habitat that is widespread and common in one portion of the section would probably be widespread and common throughout the section.

The current outcomes for cumulative effects for species within this guild would be the same as the current outcomes for direct/indirect effects. Since historical times, similar actions have occurred within the cumulative effects analysis areas as occurred within the direct/indirect effects analysis areas. Past construction of lowland winter roads was the primary action that affected current conditions for this guild across the cumulative effects analysis area. However, except for swamp beggar ticks, the impacts from such actions would have been minor since use would have been primarily in frozen conditions, and the distribution and abundance of suitable ecological conditions for these plants would have paralleled that for the direct/indirect effects analysis areas. For swamp beggar ticks, there has been a decline in the number of known occurrences in the cumulative effects analysis area, indicating a decline in the distribution and abundance of suitable ecological conditions.

Future actions that would impact this guild would consist primarily of lowland winter road construction occurring throughout the cumulative effects analysis areas; however, the cumulative effects of these actions would be minor and would not vary by alternative. Impacts would be minimized by voluntary adherence to BMPs (MN FRC 1999). The outcome by alternative for each species would be the same as the current cumulative effects outcomes.

Determination of Effects

For all of the species in this guild, all the alternatives may impact individuals but are not likely to cause a trend to federal listing or loss of viability.

GUILD 4. CLIFF, TALUS SLOPE, AND EXPOSED ROCK HABITAT

ARCTOPARMELIA CENTRIFUGA AND ARCTOPARMELIA SUBCENTRIFUGA

Direct/Indirect Effects

Historical Outcome

There are two extant occurrences of *A. centrifuga* and one occurrence of *A. subcentrifuga* on the Superior, and the Forest is at the southern periphery of the species' ranges. Suitable habitat for these species appears to be isolated and exist at very low abundance. Substantial uncertainty is involved in making this judgment, since relatively little searching has been done for lichens compared to vascular plants.

Current Outcome
Based on their habitat, there are relatively few threats for these lichens. It is possible that mining or air pollution could have had some impacts on these species, but the amount and distribution of suitable ecological conditions for these lichens have probably not changed much compared to the historical condition.
Effects Common to All Alternatives
Because there are few management-related threats to habitat or important ecological processes for these lichens, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

LONG-LEAVED ARNICA (*ARNICA LONCHOPHYLLA*)
Direct/Indirect Effects
Historical Outcome
This species is an arctic/alpine disjunct that occurs only along the shore of Lake Superior. Suitable habitat for this species has probably always been highly isolated and of very low abundance, with very little chance for metapopulation interactions.
Current Outcome
Based on its habitat, there are relatively few threats for this plant. It is possible that some recreational activities (e.g. rock climbing) could have had some impacts on this species, but the amount and distribution of suitable ecological conditions for this plant have probably not changed much compared to the historical condition.
Effects Common to All Alternatives
Because there are few management-related threats to habitat or important ecological processes for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

MAIDENHAIR SPLEENWORT (*ASPLENIUM TRICHOMANES*)
Direct/Indirect Effects
Historical Outcome
This species has a widely scattered distribution in North America, and is peripheral in northeast Minnesota, occurring only on the Rove Formation in the Border Lakes region of the Superior. Suitable habitat for this species has probably always been highly isolated and of very low abundance, with very little chance for metapopulation interactions.
Current Outcome
Based on its habitat, there are relatively few threats for this plant. It is possible that some recreational activities (e.g. rock climbing) could have had some impacts on this species, but the amount and distribution of suitable ecological conditions for this plant have probably not changed much compared to the historical condition.
Effects Common to All Alternatives
Because there are few management-related threats to habitat or important ecological processes for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

ROSS' SEDGE (*CAREX ROSSII*)
Direct/Indirect Effects
Historical Outcome

This species is disjunct in Minnesota. The potential distribution of this species on the Superior is uncertain. Apparently suitable rocky habitat can be found across the Forest, but it is only known from the east end of the Border Lakes region. Sedges are difficult to identify in general, and this one can only be identified for a brief time in early summer. Although its range is uncertain on the Forest, I make the assumption (until there is evidence to the contrary) that it occurs only in the Border Lakes region. Hence, suitable habitat for this species has probably frequently been isolated and of very low abundance, with limited opportunity for metapopulation interactions.

Current Outcome

Based on its habitat, there are relatively few threats for this plant. It is possible that some recreational activities or past timber harvest could have had some impacts on suitable habitat, but the amount and distribution of suitable ecological conditions for this plant have probably not changed much compared to the historical condition.

Effects Common to All Alternatives

Because there are few management-related threats to habitat or important ecological processes for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

CLADONIA WAINOI

Direct/Indirect Effects

Historical Outcome

There are two occurrences of this lichen on the Superior, and the Forest is at the southern periphery of the species' range. Suitable habitat for this species appears to be isolated and exist at very low abundance. Substantial uncertainty is involved in making this judgment, since relatively little searching has been done for lichens compared to vascular plants.

Current Outcome

Based on its habitat, there are relatively few threats for this lichen. It is possible that past timber harvest or recreational activities (e.g. hiking trails through populations) could have had some impacts on this species, but the amount and distribution of suitable ecological conditions for this lichen has probably not changed much compared to the historical condition.

Effects Common to All Alternatives

Because there are few management-related threats to habitat or important ecological processes for this lichen, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

LARGE LEAVED SANDWORT *(MOEHRINGIA MACROPHYLLA)*

Direct/Indirect Effects

Historical Outcome

This species is widespread in North America, but disjunct in Minnesota. Its habitat, cliffs and rocky outcrops, are infrequent features across the Superior's landscape. Hence, suitable habitat for this species has probably frequently been isolated and of very low abundance, with limited opportunity for metapopulation interactions.

Current Outcome

Based on its habitat, there are relatively few management-related threats for this plant. It is possible that past timber harvest or recreational activities (e.g. hiking trails through populations) could have had some impacts on this species, but the amount and distribution of suitable ecological conditions for this lichen have probably not changed much compared to the historical

condition.

Effects Common to All Alternatives

Because there are few management-related threats to habitat or important ecological processes for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

STICKY LOCOWEED (*OXYTROPIS VISCIDA*)

Direct/Indirect Effects

Historical Outcome

This species is an arctic/alpine disjunct that occurs only in one location in the Border Lakes subsection. Suitable habitat for this species has probably always been highly isolated and of very low abundance, with very little chance for metapopulation interactions.

Current Outcome

Based on its habitat, there are relatively few threats for this plant. It is possible that some recreational activities (e.g. rock climbing) could have had some impacts on this species, but the amount and distribution of suitable ecological conditions for this plant have probably not changed much compared to the historical condition. It has persisted at this site since it was first collected over 50 years ago (Coffin and Pfannmuller 1988).

Effects Common to All Alternatives

Because there are few management-related threats to habitat or important ecological processes for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

NODDING SAXIFRAGE (*SAXIFRAGA CERNUA*)

Direct/Indirect Effects

Historical Outcome

This species is an arctic/alpine disjunct that occurs only in one location in the Border Lakes subsection. Suitable habitat for this species has probably always been highly isolated and of very low abundance, with very little chance for metapopulation interactions.

Current Outcome

Based on its habitat, there are relatively few threats for this plant. It is possible that some recreational activities (e.g. rock climbing) could have had some impacts on this species, but the amount and distribution of suitable ecological conditions for this plant have probably not changed much compared to the historical condition. It has persisted at this site since it was first collected over 70 years ago (Coffin and Pfannmuller 1988).

Effects Common to All Alternatives

Because there are few management-related threats to habitat or important ecological processes for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

ENCRUSTED SAXIFRAGE (*SAXIFRAGA PANICULATA*)

Direct/Indirect Effects

Historical Outcome

This species is an arctic/alpine disjunct that occurs only in the eastern portion of the Border Lakes subsection. Suitable habitat for this species has probably always been very isolated and of very low abundance, with limited opportunities for metapopulation interactions.

Current Outcome
Based on its habitat, there are relatively few threats for this plant. It is possible that some recreational activities (e.g. rock climbing) could have had some impacts on this species, but the amount and distribution of suitable ecological conditions for this plant have probably not changed much compared to the historical condition. It has persisted in this area since it was first collected over 60 years ago (Coffin and Pfannmuller 1988).
Effects Common to All Alternatives
Because there are few management-related threats to habitat or important ecological processes for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

FALSE-ASPHODEL (*TOFIELDIA PUSILLA*)
Direct/Indirect Effects
Historical Outcome
This species is an arctic/alpine disjunct that occurs only in sedge mats at the edge of pools along the rocky shore of Lake Superior. Suitable habitat for this species has probably always been highly isolated and of very low abundance, with very little chance for metapopulation interactions.
Current Outcome
Very little of this plant's shoreline habitat is managed by the Forest Service. For the one occurrence managed by the Forest Service, recreational activities threaten suitable habitat for this species. Recreational use of its habitat has had negative impacts on this species (Coffin and Pfannmuller 1988), and the amount and distribution of suitable ecological conditions for this plant (which were extremely limited to begin with) have probably declined compared to the historical condition.
Effects Common to All Alternatives
The management-related threats to this species under each of the alternatives would remain similar to current threat levels, and the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

SMOOTH WOODSIA (*WOODSIA GLABELLA*)
Direct/Indirect Effects
Historical Outcome
This species is an arctic/alpine disjunct that occurs in the planning area in only one location. Suitable habitat for this species has probably always been highly isolated and of very low abundance, with very little chance for metapopulation interactions.
Current Outcome
Based on its habitat, there are relatively few threats for this plant. It is possible that some recreational activities (e.g. rock climbing) could have had some impacts on this species, but the amount and distribution of suitable ecological conditions for this plant have probably not changed much compared to the historical condition.
Effects Common to All Alternatives
Because there are few management-related threats to habitat or important ecological processes for this plant, the amount and distribution of suitable ecological conditions would not change appreciably from current outcomes in response to any of the alternatives.

Cumulative Effects for Plants in the Cliffs, Talus, and Exposed Rock Guild

The cumulative effects of the Forest Plan alternatives on the distribution and abundance of ecological conditions for plants within the cliff guild would be minor, except for false asphodel. For all the species but *Arctoparmelia centrifuga*, *Arctoparmelia subcentrifuga*, Ross' sedge, Cladonia wainoi, sticky locoweed, and nodding saxifrage, there are a few additional occurrences of the species within the cumulative effects analysis areas. There are no additional occurrences of the remaining species in the cumulative effects analysis area.

The historical outcomes for cumulative effects for species within this guild would be the same as the historical outcomes for direct/indirect effects. The historical distribution and abundance of habitat within the Northern Superior Uplands probably closely parallels the historical distribution and abundance of habitat for analysis of direct/indirect effects. Much of the cliff and rock outcrop habitat in northeast Minnesota occurs on the Superior in the Border Lakes and on the North Shore; there is some additional habitat outside Forest boundaries within the cumulative effects area, but its distribution is the same.

The current outcomes for cumulative effects for species within this guild would be the same as the current outcomes for direct/indirect effects. Since historical times, similar actions have occurred within the cumulative effects analysis areas as occurred within the direct/indirect effects analysis areas. Past mining, occasional timber harvest, rock climbing, and (for false asphodel) development on the North Shore were the primary past actions that affected current conditions for this guild across the cumulative effects analysis area. However, except for false asphodel, the impacts from such actions would have been minor since rock climbing is a fairly dispersed recreational activity, and because cliffs are frequently not suitable for other uses such as timber harvest. For false asphodel, there has been a good deal of shoreline development that has affected suitable habitat for this species. The cumulative distribution and abundance of suitable ecological conditions for all these plants but false asphodel parallels that for the direct/indirect effects analysis areas. For false asphodel, there has been a decline in the number of known occurrences (Coffin and Pfannmuller 1988) in the cumulative effects analysis area, indicating that suitable ecological conditions for this species continue to be highly isolated and extremely rare. However, the current cumulative effects outcome for false asphodel would remain the same as the historical cumulative effects outcome, which would be outcome E.

Future actions that would impact habitat for all species in this guild except false asphodel would consist primarily of rock climbing. However, the cumulative effects of these actions would be minor and would not vary by alternative. Recreation impacts from rock climbing tend to be concentrated along rock climbing routes, which are often quite dispersed, so impacts to suitable habitat would be minimized. The outcome by alternative for each species would be the same as the current cumulative effects outcomes.

There would be cumulative impacts to false asphodel under all the alternatives. Shoreline development on private lands and global warming could lead to downward trends for this species in Minnesota. Both of these actions are beyond Forest Service control, but they would be a cumulative impact under each alternative. The small amount of false asphodel habitat managed by the Forest Service would continue to be protected by standards and guidelines. Furthermore, suitable habitat in state parks along the North Shore would continue to be protected. If

cumulative effects caused a downward trend and the plant was lost from the state, there would not likely be a trend toward federal listing or loss of viability of the species, since this plant occurs in Michigan and Montana and is considered secure in Canada.

Determination of Effects

For all of the species in this guild, all the alternatives may impact individuals but are not likely to cause a trend to federal listing or loss of viability.

GUILD 5. UPLAND DISTURBED, BARRENS, OR EARLY SUCCESSIONAL FOREST HABITAT

POINTED MOONWORT (*BOTRYCHIUM ACUMINATUM*)
COMMON MOONWORT (*BOTRYCHIUM LUNARIA*)
MICHIGAN MOONWORT (*BOTRYCHIUM MICHIGANENSE*)
PALE MOONWORT (*BOTRYCHIUM PALLIDUM*)
TERNATE GRAPEFERN (*BOTRYCHIUM RUGULOSUM*)
LEAST GRAPEFERN (*BOTRYCHIUM SIMPLEX*)

Direct/Indirect Effects

Historical Outcome

Superior National Forest (Superior has all six species): The vast majority of occurrences of these plants on the Superior are found in habitats which experienced some heavy ground disturbance (e.g. roadside ditch, old log landing, old building sites, old roads, old field, edges of trails, and gravel pits) in the past but which are currently dominated by graminoids and forbs. Few if any of the current occurrences are known from sites that originated from a natural disturbance (e.g. wildfire, windthrow), although such sites may exist and have not been found yet due to the difficulty of locating these small, inconspicuous plants. The open, early successional habitats occupied by this group of *Botrychiums* have probably historically been very isolated and of very low abundance, with limited opportunities for metapopulation interactions.

Chippewa National Forest (Chippewa has pale moonwort, ternate and least grapeferns): The majority of the occurrences on the Chippewa are in disturbed areas similar to the Superior. However, a number of occurrences are found in forested habitats (e.g. maple/basswood forest, red pine plantation, and white cedar plantation). I make the assumption that since early successional and forested habitats are currently occupied on the Chippewa, both types of habitats were occupied historically. Because a broader array of habitats was used, suitable ecological conditions for these *Botrychiums* were probably more abundant and broadly distributed on the Chippewa than on the Superior.

Current Outcome

Superior National Forest: Historical natural disturbances such as wildfire and windthrow created early successional forest habitat in a variety of patch sizes. Early successional forest habitat on the current landscape is dominated by patches of human origin that are on average smaller than historical patches (see discussion of spatial patterns in Chapter 3.2 in the FEIS for more detail). Historically, disturbance and succession created a mosaic of suitable habitat for this suite of plants that shifted across the landscape. Today, early successional habitat still shifts across the landscape, but more early successional habitat is maintained in that state through repeated disturbance of, for example, roadside ditches or log landings. In the short term, such disturbances that create or maintain early successional habitat could impact populations of these

plants. However, in the long term more suitable habitat is available to be occupied by or recolonized by any surviving plants. Although disturbance regimes and patch sizes have changed from historical conditions, the fact that disturbances are still occurring across the landscape and these *Botrychiums* are occupying them probably means that the current amount and distribution of suitable ecological conditions is similar to historical conditions.
Chippewa National Forest: A similar argument about disturbance patterns can be made for the Chippewa. However, currently suitable forested habitat is being impacted by exotic earthworms. The influence of these earthworms is not completely certain for these species, but I conservatively estimate that they would lower the current outcome for this group of plants, since suitable habitat conditions would be scarcer and more isolated.

Effects Common to All Alternatives

Superior National Forest: In each alternative, standards and guidelines would protect known occurrences of these plants. It is difficult to quantify the amount and types of disturbance that would be occurring in the different alternatives. Qualitatively, however, based on their themes, alternatives B and D would have the least amount of ground disturbance; therefore, these alternatives would have lower outcomes for these plants. The remaining alternatives would probably support ecological conditions similar to the current condition.

Alternatives B and D would have lower outcomes for all the *Botrychium* species in this guild. However, suitable habitat would still be sufficiently abundant and well distributed under these alternatives to prevent a trend toward federal listing or loss of viability, even for the very rare pointed moonwort. Pointed moonwort is a regional endemic with a global Natural Heritage conservation rank of G1 (critically imperiled); it is extremely rare, has few individuals and populations globally, and is only known from a very narrow global distribution around Lake Superior. The Superior National Forest populations are critical to the persistence of this extremely rare species. Despite its rarity, the objectives, standards and guidelines described for all alternatives would help maintain the likelihood of persistence of this species, in particular the restoration objectives for sensitive plants. Furthermore, alternatives A thru G would involve construction of several hundred to several thousand miles of OML 1 and temporary roads (see FEIS appendix F). The ground disturbance associated with road construction would help maintain sufficient abundance and distribution of suitable habitat, even in alternatives B and D, to prevent a trend to federal listing or loss of viability for pointed moonwort.

Chippewa National Forest: In each alternative, Forest Plan objectives, standards and guidelines would protect known occurrences of these plants. The impact of earthworms on suitable habitat would continue across all alternatives. Different amounts and types of ground disturbance would be occurring in all alternatives, with the least amount occurring in alternatives B and D. This would mean less habitat for these plants in alternatives B and D; however, it would also mean lower rate of earthworm spread in these alternatives. In the time frame of this analysis, the outcomes for all the alternatives, while trending downward, would still on average be the same as for the current condition.

BLACK HAWTHORN (*CRATAEGUS DOUGLASII*)

Direct/Indirect Effects

Historical Outcome

This disjunct species is restricted to within 2-3 miles of Lake Superior, presumably because of

the moderating effects of the lake on the local climate (Coffin and Pfannmuller 1988). Within this area, suitable ecological conditions were probably patchily distributed at low abundance (outcome C) historically. However, in the whole planning area, suitable ecological conditions were probably very isolated and of very low abundance (outcome D) historically.

Current Outcome

The amount and distribution of suitable ecological conditions for this plant have probably declined compared to the historical condition. Historical logging activities and wildfires probably impacted both the upland and riparian habitat for this plant. Many of the current populations are small.

Effects Common to All Alternatives

For all the alternatives, the amount and distribution of suitable ecological conditions would be similar to the historical outcome. Strengthened riparian standards and guidelines would improve riparian conditions under alternatives B, D, E, and G. Since the species thrives in openings, the timber harvest emphasis in alternatives A and C would increase suitable habitat as well. Known occurrences would be protected under all alternatives with standards and guidelines.

Cumulative Effects for Plants in the Upland Disturbed Guild

The cumulative effects of the Forest Plan alternatives on the distribution and abundance of ecological conditions for plants within the upland disturbed guild would be minor. All the species within the guild have a few additional occurrences within the cumulative effects analysis areas, except for black hawthorn, which has 19 additional occurrences.

The historical outcomes for cumulative effects for species within this guild would be the same as the historical outcomes for direct/indirect effects. The historical distribution and abundance of habitat within each Forest's respective analysis area (i.e. for the Chippewa, the Drift and Lake Plains, and for the Superior, the Northern Superior Uplands) probably closely parallels the historical distribution and abundance of habitat for analysis of direct/indirect effects. The primary reason for this is because the disturbance processes (upon which these species depend) were landscape scale processes that did not differ between the cumulative and direct/indirect effects analysis areas; therefore, historical distribution and abundance of habitat would not have differed between these two analysis areas.

The current outcomes for cumulative effects for species within this guild would be the same as the current outcomes for direct/indirect effects. Since historical times, similar types of disturbance have occurred within the cumulative effects analysis areas as occurred within the direct/indirect effects analysis areas. For example, patterns of timber harvest that created numerous small early successional patches did not differ substantially (at least from the perspective of these species) inside or outside of Forest boundaries. Furthermore, earthworm impacts on the Chippewa have occurred both inside and outside of Forest boundaries. However, as described in the direct/indirect effects analysis, these disturbances have probably been similar enough to natural disturbance patterns to help keep the distribution and abundance of suitable ecological conditions (and hence the outcomes) for the cumulative effects area the same as for the direct/indirect effects area.

On the Chippewa, the cumulative effects outcomes for the alternatives would be the same as the outcomes from the direct/indirect effects analysis for each species. Future actions that create

habitat outside of Forest boundaries would be offset by the negative impacts of exotic earthworm invasion, similar to the situation inside Forest boundaries (see rationale for direct/indirect effects analysis). The net cumulative result would be a continuation of current distribution and abundance of suitable ecological conditions.

On the Superior, the cumulative effects outcomes for alternatives B and D would be slightly improved over the alternative B and D outcomes for direct/indirect effects; there would be no difference between cumulative effects outcomes and direct/indirect effects outcomes for the remaining alternatives. For alternatives B and D, future actions that create habitat outside of Forest boundaries would compensate for any decrease in habitat inside Forest boundaries resulting from these alternatives, thus raising the outcome for these alternatives (from outcome E to outcome D). For the remaining alternatives, future actions that create habitat outside of Forest boundaries would not change the distribution and abundance of suitable ecological conditions for these species. In summary, there would be beneficial to negligible cumulative effects of the alternatives on these species.

Determination of Effects

For all of the species in this guild, all the alternatives may impact individuals but are not likely to cause a trend to federal listing or loss of viability.

GUILD 6A. FORESTED WETLAND – BLACK SPRUCE, TAMARACK, AND MIXED CONIFER

CALOPLACA PARVULA

Direct/Indirect Effects

Historical Outcome

There are two occurrences of this endemic lichen on the Superior. Suitable habitat for this species appears to be isolated and exist at very low abundance. Substantial uncertainty is involved in making this judgment, since relatively little searching has been done for lichens compared to vascular plants.

Current Outcome

Based on its habitat, there are relatively few current threats for this lichen. However, since historical times, it is likely that road building and timber harvest have impacted black ash stands, which are suitable habitat for this species. Suitable ecological conditions are currently highly isolated and exist at very low abundance, making population interactions extremely unlikely.

Effects Common to All Alternatives

Under all the alternatives, the approximately 16,000 acres of existing black ash stands would remain as black ash. The only harvest that would occur would be partial cuts such as thinning, single tree selection, or firewood cutting. Suitable habitat would be further protected under all alternatives by a guideline that prohibits harvest in stands with known occurrences of *Caloplaca parvula* unless harvest enhances habitat for the species, and by riparian standards relating to road construction which are applicable in all alternatives. Despite these protections, suitable habitat for this lichen would not recover to historical conditions during the time scale of this analysis.

WHITE ADDER'S MOUTH (*MALAXIS BRACHYPODA*)

Direct/Indirect Effects

Historical Outcome

Historically, this species probably had a patchy distribution of suitable forested wetland habitat that occurred over the landscape at low abundance.

Current Outcome

Since historical times, timber harvest, drainage, and road building have impacted suitable swamp conifer habitat (Bradof 1992, Frelich 1998) and reduced the amount and distribution of suitable ecological conditions for this species. Road construction, drainage, and/or timber harvest have altered the hydrology of some forested wetland stands, resulting in a shift in dominance from trees to other species such as alder or cattails, thus reducing the acreage of this forest type and creating unsuitable habitat for this orchid.

Effects Common to All Alternatives

Under all the alternatives, lowland white cedar would be protected with a guideline restricting the harvest of this species unless regeneration was likely to be successful. For lowland hardwood and lowland conifer habitats, the acreage of mature and older stands would increase for all the alternatives compared to current conditions; the increase in suitable ecological conditions would be greater under alternatives B, D, E, F, and G than in A and C. Despite the improvement in suitable habitat, the outcome for all alternatives would remain unchanged from current conditions for the time frame of this analysis since suitable habitat would continue to exist as frequently isolated, low abundance patches.

WESTERN JACOB'S LADDER (*POLEMONIUM OCCIDENTALE SSP. LACUSTRE*)

Direct/Indirect Effects

Historical Outcome

Not all lowland cedar or mixed conifer swamps are suitable habitat for this species, based on what we know of current populations (Carlson and Sather 2001). Therefore, historical suitable ecological conditions for this plant probably existed as highly isolated, very low abundance patches, with little or no possibility of metapopulation interactions.

Current Outcome

The amount and distribution of suitable ecological conditions for this extremely rare plant have probably decreased compared to the historical condition. Extensive surveys from 1992-1995 found only 2 new populations in Minnesota. Currently only 4 populations are known from northeast Minnesota, with only 1 occurring in the planning area.

Effects Common to All Alternatives

Under all the alternatives, lowland white cedar would be protected with a guideline restricting the harvest of this species unless regeneration was likely to be successful. For lowland conifer habitats, the acreage of seedling and sapling/pole stands would be greatest initially in alternatives A and C, but would decrease with time. Less habitat would be available initially in the other alternatives, but the amounts would remain steady over time. Despite the apparent availability of young lowland conifer habitat, the outcome for all alternatives would remain unchanged from current conditions since not all lowland conifer or lowland cedar swamps provide suitable habitat; suitable habitat would continue to exist as highly isolated, very low abundance patches.

SMALL SHINLEAF (*PYROLA MINOR*)

Direct/Indirect Effects

Historical Outcome

Historically, this species probably had a patchy distribution of older black spruce swamp habitat that occurred over the landscape at low abundance.

Current Outcome

Since historical times, timber harvest, drainage, and road building have impacted suitable swamp conifer habitat (Bradof 1992, Frelich 1998, Heinselman 1996) and reduced the amount and distribution of suitable ecological conditions for this species. Road construction, drainage, and/or timber harvest have altered the hydrology of some forested wetland stands, resulting in a shift in dominance from trees to other species such as alder or cattails, thus reducing the acreage of this forest type and creating unsuitable habitat for this plant.

Effects Common to All Alternatives

For lowland black spruce habitats, the acreage of mature and older stands would increase in the long term for all the alternatives compared to current conditions; the increase in suitable ecological conditions would be greatest under alternative D, with lesser increases in alternatives A, B, C, and G, and the least increases in alternatives E and F. Despite the improvement in suitable habitat, the outcome for all alternatives would remain unchanged from current conditions for the time frame of this analysis since suitable habitat would continue to exist as frequently isolated, low abundance patches.

CLOUDBERRY (*RUBUS CHAMAEMORUS*)

Direct/Indirect Effects

Historical Outcome

Not all lowland black spruce or mixed conifer swamps are suitable habitat for this species, which hits the very southern edge of its range along the northern edge of the Superior. Suitable lowland conifer forest habitat occurs only along the northern portion of the Superior. Historically, suitable ecological conditions for this plant probably existed frequently as isolated, very low abundance patches, with limited opportunities for metapopulation interactions.

Current Outcome

Since historical times, timber harvest, drainage, and road building have impacted suitable swamp conifer habitat (Bradof 1992, Frelich 1998, Heinselman 1996) and reduced the amount and distribution of suitable ecological conditions for this species. Road construction, drainage, and/or timber harvest have altered the hydrology of some forested wetland stands, resulting in a shift in dominance from trees to other species such as alder or cattails, thus reducing the acreage of this forest type and creating unsuitable habitat for this plant.

Effects Common to All Alternatives

For lowland black spruce habitats, the acreage of mature and older stands would increase for all the alternatives compared to current conditions; the increase in suitable ecological conditions would be greatest under alternative D, with lesser increases in alternatives A, B, C, and G, and the least increases in alternatives E and F. Despite the improvement in suitable habitat, the outcome for all alternatives would remain unchanged from current conditions since suitable habitat would continue to exist as highly isolated, very low abundance patches.

STICTA FULIGINOSA

Direct/Indirect Effects

Historical Outcome

There are two occurrences of this lichen on the Superior. Suitable habitat for this species appears to be isolated and exist at very low abundance. Substantial uncertainty is involved in making this judgment, since relatively little searching has been done for lichens compared to vascular plants.

Current Outcome

Based on its habitat, there are relatively few current threats for this lichen. However, since historical times, it is likely that road building and timber harvest have impacted old growth lowland white cedar and black ash stands, which are suitable habitat for this species. Three occurrences (all dating from approximately 100 years ago) within the planning area have not been relocated and have probably been extirpated (USDA Forest Service 2002f). Suitable ecological conditions are currently highly isolated and exist at very low abundance, making population interactions extremely unlikely.

Effects Common to All Alternatives

Under all the alternatives, lowland white cedar would be protected with a guideline restricting the harvest of this species unless regeneration was likely to be successful. Under all the alternatives, the approximately 16,000 acres of existing black ash stands on the Superior would remain as black ash. The only harvest that would occur would be partial cuts such as thinning, single tree selection, or firewood cutting. Suitable habitat would be further protected under all alternatives by a guideline that prohibits harvest in stands with known occurrences of *Sticta fuliginosa* unless harvest enhances habitat for the species, and by riparian standards relating to road construction which are applicable in all alternatives. Despite these protections, suitable habitat for this lichen would not recover to historical conditions during the time scale of this analysis.

Cumulative Effects for Plants in the Forested Wetland Guild

Please see the end of the next section for the cumulative effects discussion for Guild 6a: Forested wetland – black spruce, tamarack, and mixed conifer, and for Guild 6b: Forested wetland – white cedar dominated. The determination of effects for the forested wetland guilds follows the cumulative effects.

GUILD 6B. FORESTED WETLAND – WHITE CEDAR DOMINATED

FAIRY SLIPPER (*CALYPSO BULBOSA*)

Direct/Indirect Effects

Historical Outcome

Superior and Chippewa National Forests: Historically, this species probably had a patchy distribution of suitable forested wetland habitat that occurred over the landscape at low abundance.

Current Outcome

Superior and Chippewa National Forests: Since historical times, timber harvest, drainage, and road building have impacted suitable swamp conifer habitat (Bradof 1992, Frelich 1998, MN FRC 1999a) and reduced the amount and distribution of suitable ecological conditions for this species. Road construction, drainage, and/or timber harvest have altered the hydrology of some

forested wetland stands, resulting in a shift in dominance from trees to other species such as alder or cattails, thus reducing the acreage of this forest type and creating unsuitable habitat for this orchid.

Effects Common to All Alternatives

Superior and Chippewa National Forests: Under all the alternatives, lowland white cedar would be protected with a guideline restricting the harvest of this species unless regeneration was likely to be successful. For lowland black spruce and mixed swamp conifer habitats, the acreage of mature and older stands would increase for all the alternatives compared to current conditions. On the Superior, the increase in suitable ecological conditions would be greatest under alternative D, with lesser increases in alternatives A, B, C, and G, and the least increases in alternatives E and F. On the Chippewa, the increase in suitable ecological conditions would be greater under alternatives B, D, E, F, and G than in A and C.

In addition to increases in suitable habitat, some alternatives would result in changes in deer population numbers, which could influence this species since it is thought to be sensitive to deer browsing (Miller et al. (1992), NatureServe (2002)). On the Chippewa, alternatives B and D would result in lower deer numbers, thus benefiting this plant. Alternatives A and C would result in higher deer numbers, thus potentially impacting suitable habitat for this plant. Alternatives E, F, and G would probably maintain existing deer numbers, thus continuing the current situation. On the Superior, alternatives B and D would result in lower deer numbers, thus benefiting this plant. Alternatives A, C, and E would result in higher deer numbers, thus potentially impacting suitable habitat for this plant. Alternatives F and G would probably maintain existing deer numbers, thus continuing the current situation.

Despite the improvement in suitable habitat, the outcome for alternatives B, D, E (Chippewa NF), F, and G would remain unchanged from current conditions for the time frame of this analysis since suitable habitat would continue to exist as frequently isolated, very low abundance patches. The negative influence of deer herbivory for alternatives A, C, and E (Superior NF) would probably result in a decline in suitable ecological conditions from the current condition to outcome E. However, the distribution and abundance of suitable habitat would still probably be adequate to provide for the viability of this species in these alternatives..

CERTRARIA AURESCENS

Direct/Indirect Effects

Historical Outcome

There are seven extant occurrences of this lichen on the Superior, and the Forest is at the periphery of the species range. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest and the fact that the Forest is at the periphery of the species' range, its habitat has probably historically been more scarce and highly isolated in this portion of its range (outcome D). Substantial uncertainty is involved in making this judgment, since relatively little searching has been done for lichens compared to vascular plants.

Current Outcome

Based on its habitat, there are relatively few current threats for this lichen. However, since historical times, timber harvest, drainage, and road building have impacted old growth lowland white cedar and black spruce stands (Bradof 1992, Frelich 1998, MN FRC 1999a), which are

suitable habitat for this species. Suitable ecological conditions are currently highly isolated and exist at very low abundance, making population interactions extremely unlikely.

Effects Common to All Alternatives

Under all the alternatives, lowland white cedar would be protected with a guideline restricting the harvest of this species unless regeneration was likely to be successful. For lowland black spruce and mixed swamp conifer habitats, the acreage of mature and older stands would increase for all the alternatives compared to current conditions; the increase in suitable ecological conditions would be greatest under alternative D, with lesser increases in alternatives A, B, C, and G, and the least increases in alternatives E and F. Suitable habitat would be further protected under all alternatives by a guideline that prohibits harvest in stands with known occurrences of *Certraria aurescens* unless harvest enhances habitat for the species, and by riparian standards relating to road construction which would be applicable in all alternatives. Despite these protections, suitable habitat for this lichen would not recover to historical conditions during the time scale of this analysis.

RAM'S HEAD LADYSLIPPER (*CYPRIPEDIUM ARIETINUM*)

Direct/Indirect Effects

Historical Outcome

Superior and Chippewa National Forests: This species occupies a variety of lowland and upland habitats currently, and I assume that it did so historically as well. Historically in this portion of the species' range, lowland white cedar forests were probably the primary habitat, with upland jack pine, red pine, and white pine forests as secondary habitats (MNNHP 2001). Suitable ecological conditions were probably historically distributed as patches at low abundance across the landscape, since even in an outwardly suitable habitat such as jack pine forest, suitable mycorrhizae are necessary for seed germination and establishment of ram's head ladyslipper to occur; the identity and distribution of these mycorrhizae remain uncertain, so the outcome for this plant was probably a C.

Current Outcome

Superior and Chippewa National Forests: Since historical times, road building, timber harvest, and wildfire have impacted suitable habitat (Frelich 1998, MN FRC 1999a) and reduced the amount and distribution of suitable ecological conditions for this species. Road construction and/or timber harvest have altered the hydrology of some forested wetland stands, resulting in a shift in dominance from trees to other species such as alder or cattails, thus reducing the acreage of this forest type and creating unsuitable habitat for this orchid. Timber harvest and wildfires that occurred earlier in the 20th century have decreased the amount of suitable upland conifer habitat (MN FRC 1999a).

Effects Common to All Alternatives

Superior and Chippewa National Forests: Under all the alternatives, lowland white cedar would be protected with a guideline restricting the harvest of this species unless regeneration was likely to be successful. Suitable upland conifer habitat would increase in acreage under all the alternatives on both forests, with greater increases under alternatives B, D, E, F, and G than under A and C.

In addition to increases in suitable habitat, some alternatives would result in changes in deer population numbers, which could influence this species since it is thought to be sensitive to deer browsing (Miller et al. (1992), NatureServe (2002)). On the Chippewa, alternatives B and D

would result in lower deer numbers, thus benefiting this plant. Alternatives A and C would result in higher deer numbers, thus potentially impacting suitable habitat for this plant. Alternatives E, F, and G would probably maintain existing deer numbers, thus continuing the current situation. On the Superior, alternatives B and D would result in lower deer numbers, thus benefiting this plant. Alternatives A, C, and E would result in higher deer numbers, thus potentially impacting suitable habitat for this plant. Alternatives F and G would probably maintain existing deer numbers, thus continuing the current situation.

Despite the improvement in suitable ecological conditions, for alternatives B, D, E (Chippewa NF), F, and G, none of the habitat improvements would be great enough to raise the outcome above the current level during the timeframe of this analysis. The negative influence of deer herbivory for alternatives A, C, and E (Superior NF) would probably result in a decline in suitable ecological conditions from the current condition to outcome E. However, the distribution and abundance of suitable habitat would still probably be adequate to provide for the viability of this species in these alternatives.

LIMESTONE OAK FERN (*GYMNOCARPIUM ROBERTIANUM*)

Direct/Indirect Effects

Historical Outcome

Historically, this species probably had a patchy distribution of suitable forested wetland habitat that occurred over the landscape at low abundance.

Current Outcome

Since historical times, timber harvest, drainage, and road building have impacted suitable swamp conifer habitat (Bradof 1992, Frelich 1998, MN FRC 1999a) and reduced the amount and distribution of suitable ecological conditions for this species. Road construction, drainage, and/or timber harvest have altered the hydrology of some forested wetland stands, resulting in a shift in dominance from trees to other species such as alder or cattails, thus reducing the acreage of this forest type and creating unsuitable habitat for this fern.

Effects Common to All Alternatives

Under all the alternatives, lowland white cedar would be protected with a guideline restricting the harvest of this species unless regeneration was likely to be successful. For the mixed swamp conifer habitat, the acreage of mature and older stands would increase for all the alternatives compared to current conditions; the increase in suitable ecological conditions would be greater under alternatives B, D, E, F, and G than in A and C. Despite the improvement in suitable habitat, the outcome for all alternatives would remain unchanged from current conditions for the time frame of this analysis since suitable habitat would continue to exist as frequently isolated, very low abundance patches.

MENEGAZZIA TEREBRATA

Direct/Indirect Effects

Historical Outcome

There are six extant occurrences of this lichen on the Superior, and the Forest is at the periphery of the species range. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest and the fact that the Forest is at the periphery of the species' range, its habitat has probably historically been scarcer and more highly isolated in this portion of its range (outcome D). Substantial uncertainty

is involved in making this judgment, since relatively little searching has been done for lichens compared to vascular plants.

Current Outcome

Based on its habitat, there are relatively few current threats for this lichen. However, since historical times, timber harvest, drainage, and road building have impacted old growth lowland white cedar stands (Bradof 1992, Frelich 1998, MN FRC 1999a), which are suitable habitat for this species. Suitable ecological conditions are currently highly isolated and exist at very low abundance, making population interactions extremely unlikely.

Effects Common to All Alternatives

Under all the alternatives, lowland white cedar would be protected with a guideline restricting the harvest of this species unless regeneration was likely to be successful. Suitable habitat would be further protected under all alternatives by a guideline that prohibits harvest in stands with known occurrences of *Menegazzia terebrata* unless harvest enhances habitat for the species, and by riparian standards relating to road construction which would be applicable in all alternatives. Despite these protections, suitable habitat for this lichen would not recover to historical conditions during the time scale of this analysis.

RAMALINA THRAUSTA

Direct/Indirect Effects

Historical Outcome

There are two extant occurrences of this lichen on the Superior, and the Forest is at the periphery of the species range. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest and the fact that the Forest is at the periphery of the species' range, its habitat has probably historically been scarcer and highly isolated in this portion of its range (outcome D). Substantial uncertainty is involved in making this judgment, since relatively little searching has been done for lichens compared to vascular plants.

Current Outcome

Based on its habitat, there are relatively few current threats for this lichen. However, since historical times, timber harvest, drainage, and road building have impacted old growth lowland white cedar and mixed swamp conifer stands (Bradof 1992, Frelich 1998, MN FRC 1999a), which are suitable habitat for this species. Suitable ecological conditions are currently highly isolated and exist at very low abundance, making population interactions extremely unlikely.

Effects Common to All Alternatives

Under all the alternatives, lowland white cedar would be protected with a guideline restricting the harvest of this species unless regeneration was likely to be successful. For the mixed swamp conifer habitat, the acreage of mature and older stands would increase for all the alternatives compared to current conditions; the increase in suitable ecological conditions would be greatest under alternative D, with lesser increases in alternatives A, B, C, and G, and the least increases in alternatives E and F. Suitable habitat would be further protected under all alternatives by a guideline that would prohibit harvest in stands with known occurrences of *Ramalina thrausta* unless harvest enhances habitat for the species, and by riparian standards relating to road construction which would be applicable in all alternatives. Despite these protections and improvement in suitable habitat, suitable habitat for this lichen would not recover to historical conditions during the time scale of this analysis.

USNEA LONGISSIMA

Direct/Indirect Effects

Historical Outcome

There are four extant occurrences of this lichen on the Superior, and the Forest is at the periphery of the species range. Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest and the fact that the Forest is at the periphery of the species' range, its habitat has probably historically been scarcer and highly isolated in this portion of its range (outcome D). Substantial uncertainty is involved in making this judgment, since relatively little searching has been done for lichens compared to vascular plants.

Current Outcome

Based on its habitat, there are relatively few current threats for this lichen. However, since historical times, timber harvest, drainage, and road building have impacted old growth lowland white cedar and mixed swamp conifer stands (Bradof 1992, Frelich 1998, MN FRC 1999a), which are suitable habitat for this species. Suitable ecological conditions are currently highly isolated and exist at very low abundance, making population interactions extremely unlikely.

Effects Common to All Alternatives

Under all the alternatives, lowland white cedar would be protected with a guideline restricting the harvest of this species unless regeneration was likely to be successful. For the mixed swamp conifer habitat, the acreage of mature and older stands would increase for all the alternatives compared to current conditions; the increase in suitable ecological conditions would be greatest under alternative D, with lesser increases in alternatives A, B, C, and G, and the least increases in alternatives E and F. Suitable habitat would be further protected under all alternatives by a guideline that would prohibit harvest in stands with known occurrences of *Usnea longissima* unless harvest enhances habitat for the species, and by riparian standards relating to road construction which would be applicable in all alternatives. Despite these protections and improvement in suitable habitat, suitable habitat for this lichen would not recover to historical conditions during the time scale of this analysis.

Cumulative Effects for Plants in the Forested Wetland Guild

The cumulative effects of the Forest Plan alternatives on the distribution and abundance of ecological conditions for plants within the forested wetland guild would be minor. Except for limestone oak fern, there are a few additional known occurrences of each species in this guild within the cumulative effects analysis area.

The historical outcomes for cumulative effects for species within this guild would be the same as the historical outcomes for direct/indirect effects. The historical distribution and abundance of habitat within each Forest's respective analysis area (i.e. for the Chippewa, the Drift and Lake Plains, and for the Superior, the Northern Superior Uplands) closely parallels the historical distribution and abundance of habitat for analysis of direct/indirect effects. The primary reason for this is because lands within an ecological classification system (ECS) section share a number of basic characteristics (e.g. bedrock features, land forming processes, etc.); therefore, a type of habitat that is widespread and common in one portion of the section would probably be widespread and common throughout the section.

The current outcomes for cumulative effects for species within this guild would be the same as

the current outcomes for direct/indirect effects. Since historical times, similar actions have occurred within the cumulative effects analysis area as occurred within the direct/indirect effects analysis area. Past wetland drainage, road construction, and timber harvest have altered hydrologic conditions in forested wetlands across each cumulative effects analysis area (Bradof 1992, Frelich 1998, Heinselman 1996, MN FRC 1999a), resulting in a decrease in distribution and abundance of suitable ecological conditions for plants in this guild. These impacts parallel the decrease in abundance and distribution of ecological conditions in the direct/indirect effects analysis areas.

Future timber harvest in forested wetlands in the cumulative effects analysis areas would occur on all ownerships, but the cumulative effects of these actions would be minor. Operationally, impacts would be minimized by voluntary adherence to BMPs (MN FRC 1999b). Within each cumulative effects analysis area, section-wide changes in forest cover and composition would be reviewed and monitored as part of the Minnesota Forest Resources Council's landscape planning process. Different forest owners across the landscape within each section would cooperate to meet landscape-wide vegetation goals, thereby minimizing cumulative impacts to ecological conditions for species within this guild. The outcome by alternative for each species would be the same as the outcome for the direct/indirect effects analysis.

Determination of Effects

For all of the species in this guild, all the alternatives may impact individuals but are not likely to cause a trend to federal listing or loss of viability.

GUILD 7. MESIC HARDWOOD DOMINATED FOREST

MOSCHATEL *(ADOXA MOSCHATELLINA)*

Direct/Indirect Effects

Historical Outcome

Historically, suitable habitat for this plant has been distributed as patches that existed at low abundance. Although suitable northern hardwoods habitat was scattered among many of the landscape ecosystems, the largest concentrations of northern hardwoods were along the North Shore and the Laurentian Divide.

Current Outcome

Since historical times, timber harvest has resulted in younger, more even-aged, fragmented mesic northern hardwood forests that occupy a smaller portion of the landscape (Frelich 1998). Consequently, suitable ecological conditions for this plant are frequently isolated and exist at very low abundance, which limits opportunities for population interactions.

Effects Common to All Alternatives

Under all the alternatives, suitable ecological conditions would increase for this plant. The increases would be greatest for alternatives D, with alternatives B, E, F, and G increasing somewhat less, and alternatives A and C increasing the least. Some researchers have documented impacts of dense sugar maple regeneration on understory plant species (Schulz et al. 2001). Competition from sugar maple saplings created by firewood harvest openings could have some negative indirect impacts on suitable habitat for this species. However, standards for sensitive plants would protect this species under all the alternatives. Despite the overall improvement in suitable habitat, the outcome for all alternatives would remain unchanged from

current conditions for the time frame of this analysis since suitable habitat would continue to exist as frequently isolated, very low abundance patches.

TRIANGLE GRAPEFERN *(BOTRYCHIUM LANCEOLATUM)*

Direct/Indirect Effects

Historical Outcome

Superior and Chippewa National Forests: Historically, suitable habitat for this plant on the Superior was probably distributed as patches that existed at low abundance. Although suitable northern hardwoods habitat was scattered among many of the landscape ecosystems, the largest concentrations of northern hardwoods were along the North Shore and the Laurentian Divide. On the Chippewa suitable habitat was more broadly distributed and less patchy than on the Superior.

Current Outcome

Superior and Chippewa National Forests: Since historical times, timber harvest has resulted in younger, more even-aged, fragmented mesic northern hardwood forests that occupy a smaller portion of the landscape (Frelich 1998). Consequently, on both forests suitable ecological conditions for this plant are frequently isolated and exist at very low abundance, which limits opportunities for population interactions.

Effects Common to All Alternatives

Superior and Chippewa National Forests: Several factors would influence the effects of the alternatives on this plant: increasing availability of northern hardwoods habitat under all alternatives, the probable positive long term impact of disturbance on the plant (evidenced by occurrences in healed-over disturbances on the Superior), and the probable negative consequences of non-native earthworm invasion. These factors and their interactions make the determination of effect complex and uncertain for this plant. On both forests, the increasing amount of mesic northern hardwood habitat combined with the disturbances occurring across the landscape from forest management would improve suitable ecological conditions for this plant in the long term, although the impacts of non-native earthworms would probably limit this improvement. Some researchers have documented impacts of dense sugar maple regeneration on understory plant species (Schulz et al. 2001). Competition from sugar maple saplings created by firewood harvest openings could have some negative indirect impacts on suitable habitat for this species. Despite overall improvements in suitable ecological conditions, during the time frame of the analysis the outcomes for all alternatives would remain similar to the current conditions.

GOBLIN FERN *(BOTRYCHIUM MORMO)*

Direct/Indirect Effects

Historical Outcome

Superior and Chippewa National Forests: Historically, suitable habitat for this plant on the Superior was probably distributed as highly isolated, very low abundance patches (outcome E). Although suitable northern hardwoods habitat was more broadly distributed on the Superior than this outcome suggests, the fact that there is currently only one known occurrence despite intensive searching suggests that some other factors may have limited its distribution on the Forest. On the Chippewa, suitable habitat was more broadly distributed and less patchy than on the Superior (outcome B).

Current Outcome

Superior and Chippewa National Forests: Since historical times, timber harvest has resulted in

younger, more even-aged, fragmented mesic northern hardwood forests that occupy a smaller portion of the landscape (Frelich 1998). Furthermore, the introduction of non-native earthworms has impacted suitable habitat and has likely caused the extirpation of some populations (USDA Forest Service 2002g, Gundale 2002). Consequently, on the Chippewa suitable ecological conditions for this plant are frequently isolated and exist at very low abundance, which limits opportunities for population interactions. On the Superior, current ecological conditions are distributed similarly to historical conditions.

Effects Common to All Alternatives

Superior National Forest: Under all the alternatives, conservation measures described in the Conservation Approach for this species (USDA Forest Service 2002g) would be applied as standards. However, because of the scarcity and isolation of ecological conditions suitable for this species, it would continue to face a threat to its persistence, and outcomes for all alternatives would be similar to the historical outcome.

Chippewa National Forest: Under all the alternatives, conservation measures described in the Conservation Approach for this species (USDA Forest Service 2002g) would be applied as standards. Although the acreage of mesic northern hardwood habitat would increase over time for all alternatives, the impacts of exotic earthworms would continue, and are likely to increase over time (USDA Forest Service 2002g). Over the long term, exotic earthworms would probably cause declining suitable ecological conditions for this plant, with greater declines for alternatives A and C due to higher levels of timber harvest and road construction and subsequently greater earthworm spread. Suitable ecological conditions would decrease enough in alternatives A and C to result in outcome E; despite declines in suitable ecological conditions under the remaining alternatives, the outcomes would remain unchanged from current conditions for the time frame of this analysis.

On the Chippewa, alternatives A and C would have lower outcomes for goblin fern than the other alternatives. Despite the downward trend in suitable habitat, ecological conditions for this rare plant would still be sufficiently abundant and well distributed under these alternatives to prevent a trend toward federal listing or loss of viability. Goblin fern is a regional endemic with a global Natural Heritage conservation rank of G3 (vulnerable); it is very rare and local throughout its range, and is only known from a very narrow global distribution of northern Minnesota, northern Wisconsin, and northern Michigan, and one occurrence in Quebec. There are 131 occurrences on the Chippewa, and some populations are large. The Chippewa has nearly half of the known occurrences rangewide (USDA Forest Service 2002g), and goblin fern occurrences on the Chippewa are being invaded by non-native earthworms, as are goblin fern occurrences in most other parts of the species range (USDA Forest Service 2002g). There are documented negative impacts of earthworm invasion on goblin fern populations. Despite its rarity and earthworm impacts, the objectives, standards and guidelines described for all alternatives would help maintain the likelihood of persistence of this species, in particular the standards for protecting goblin fern from management impacts and minimizing earthworm spread.

BLUNT LOBED GRAPEFERN *(BOTRYCHIUM ONEIDENSE)*

Direct/Indirect Effects

Historical Outcome

Although suitable northern hardwoods habitat was broadly distributed on the Chippewa, the fact

that there is currently only one known occurrence makes it difficult to judge whether the historical distribution on the Forest was broader or narrower than at present. The Forest is at the periphery of the species' range; this suggests that much of the northern hardwoods habitat on the Forest is not suitable. Suitable ecological conditions for this plant were probably distributed as highly isolated, very low abundance patches.

Current Outcome

Since historical times, timber harvest has resulted in younger, more even-aged, fragmented mesic northern hardwood forests that occupy a smaller portion of the landscape (Frelich 1998). Furthermore, the introduction of non-native earthworms has impacted suitable habitat and may have affected some populations of this grapefern. The current ecological conditions are distributed similarly to historical conditions.

Effects Common to All Alternatives

A guideline that leaves an uncut buffer around vernal ponds in northern hardwoods and the standards for sensitive plants would protect this species under all the alternatives. However, because of the scarcity and isolation of ecological conditions suitable for this species, and because of the continuing threat of exotic earthworms, this plant would continue to face threats to its persistence on the Forest, and outcomes for all alternatives would be similar to the historical outcome.

NEW ENGLAND SEDGE *(CAREX NOVAE-ANGLIAE)*

Direct/Indirect Effects

Historical Outcome

Although suitable northern hardwoods habitat was distributed as patches that existed at low abundance, the fact that there is currently only one known occurrence makes it difficult to judge whether the historical distribution on the Forest was broader or narrower than at present. The Forest is at the periphery of the species' range; this suggests that much of the northern hardwoods habitat on the Forest is not suitable. Suitable ecological conditions for this plant were probably distributed as highly isolated, very low abundance patches.

Current Outcome

Since historical times, timber harvest has resulted in younger, more even-aged, fragmented mesic northern hardwood forests that occupy a smaller portion of the landscape (Frelich 1998). The current ecological conditions are distributed similarly to historical conditions.

Effects Common to All Alternatives

Standards for sensitive plants would protect this species under all the alternatives. However, until more occurrences of this species are found, it would continue to face threats to its persistence on the Forest, and outcomes for all alternatives would be similar to the historical outcome.

GOLDIE'S WOOD FERN *(DRYOPTERIS GOLDIANA)*

Direct/Indirect Effects

Historical Outcome

Although suitable northern hardwoods habitat was broadly distributed, this fern is currently found only within 0.4 miles of very large lakes, and is thought to be restricted to the climatic influence zone of very large water bodies in this northern disjunct portion of its range (USDA Forest Service 2001a). Therefore, suitable ecological conditions for this plant were probably much scarcer and more isolated than the amount of northern hardwoods forest might suggest.

Current Outcome
Since historical times, timber harvest has resulted in younger, more even-aged, fragmented mesic northern hardwood forests that occupy a smaller portion of the landscape (Frelich 1998). The current ecological conditions are highly isolated and distributed at very low abundance.
Effects Common to All Alternatives
Slightly more suitable northern hardwood forest habitat would be available under alternatives B, D, E, F, and G. Some researchers have documented impacts of dense sugar maple regeneration on understory plant species (Schulz et al. 2001). Competition from sugar maple saplings created by timber harvest openings could have some negative indirect impacts on suitable habitat for this species. However, standards for sensitive plants would protect this species under all the alternatives. The differences between alternatives in the amount of suitable northern hardwood forest habitat would not be great enough during the time frame of this analysis to change the outcome for any alternative from the current outcome.

WHITE TROUT LILY *(ERYTHRONIUM ALBIDUM)*
Direct/Indirect Effects
Historical Outcome
Although suitable northern hardwoods habitat was broadly distributed on the Chippewa, the fact that there is currently only one known occurrence makes it difficult to judge whether the historical distribution on the Forest was broader or narrower than at present. The Forest is at the periphery of the species' range; this suggests that much of the northern hardwoods habitat on the Forest is not suitable. Suitable ecological conditions for this plant were probably distributed as highly isolated, very low abundance patches.
Current Outcome
Since historical times, timber harvest has resulted in younger, more even-aged, fragmented mesic northern hardwood forests that occupy a smaller portion of the landscape (Frelich 1998). The current ecological conditions are distributed similarly to historical conditions.
Effects Common to All Alternatives
Standards for sensitive plants would protect this species under all the alternatives. However, until more occurrences of this species are found, it would continue to face threats to its persistence on the Forest, and outcomes for all alternatives would be similar to the historical outcome.

ONE-FLOWERED BROOMRAPE *(OROBANCHE UNIFLORA)*
Direct/Indirect Effects
Historical Outcome
Although suitable northern hardwoods habitat was broadly distributed, the fact that there is currently only one known occurrence makes it difficult to judge whether the historical distribution on the Forest was broader or narrower than at present. The known occurrence is disjunct from the species more southern statewide range; this suggests that much of the northern hardwoods habitat on the Forest is not suitable. Suitable ecological conditions for this plant were probably distributed as highly isolated, very low abundance patches.
Current Outcome
Since historical times, timber harvest has resulted in younger, more even-aged, fragmented mesic northern hardwood forests that occupy a smaller portion of the landscape (Frelich 1998). The current ecological conditions are distributed similarly to historical conditions.

Effects Common to All Alternatives
Standards for sensitive plants would protect this species under all the alternatives. However, until more occurrences of this species are found, it would continue to face threats to its persistence on the Forest, and outcomes for all alternatives would be similar to the historical outcome.

CHILEAN SWEET CICELY *(OSMORHIZA BERTEROI)*
Direct/Indirect Effects
Historical Outcome
Historically, suitable habitat for this plant was distributed as patches that existed at low abundance. It is limited to northern hardwoods habitats along the North Shore.
Current Outcome
Since historical times, timber harvest has resulted in younger, more even-aged, fragmented mesic northern hardwood forests that occupy a smaller portion of the landscape (Frelich 1998). Consequently, suitable ecological conditions for this plant are frequently isolated and exist at very low abundance, which limits opportunities for population interactions.
Effects Common to All Alternatives
Under all the alternatives, suitable ecological conditions would increase for this plant. The increases would be greatest for alternatives D, with alternatives B, E, F, and G increasing somewhat less, and alternatives A and C increasing the least. Some researchers have documented impacts of dense sugar maple regeneration on understory plant species (Schulz et al. 2001). Competition from sugar maple saplings created by firewood harvest openings could have some negative indirect impacts on suitable habitat for this species. However, standards for sensitive plants would protect this species under all the alternatives. Despite the overall improvement in suitable habitat, the outcome for all alternatives would remain unchanged from current conditions for the time frame of this analysis since suitable habitat would continue to exist as frequently isolated, very low abundance patches.

BRAUN'S HOLLY FERN *(POLYSTICHUM BRAUNII)*
Direct/Indirect Effects
Historical Outcome
Historically, suitable habitat for this plant was distributed as patches that existed at low abundance. It is limited to northern hardwoods habitats along the North Shore.
Current Outcome
Since historical times, timber harvest has resulted in younger, more even-aged, fragmented mesic northern hardwood forests that occupy a smaller portion of the landscape (Frelich 1998). Consequently, suitable ecological conditions for this plant are frequently isolated and exist at very low abundance, which limits opportunities for population interactions.
Effects Common to All Alternatives
Under all the alternatives, suitable ecological conditions would increase for this plant. The increases would be greatest for alternative D, with alternatives B, E, F, and G increasing somewhat less, and alternatives A and C increasing the least. Some researchers have documented impacts of dense sugar maple regeneration on understory plant species (Schulz et al. 2001). Competition from sugar maple saplings created by firewood harvest openings could have some negative indirect impacts on suitable habitat for this species. However, standards for sensitive plants would protect this species under all the alternatives. Despite the overall

improvement in suitable habitat, the outcome for all alternatives would remain unchanged from current conditions for the time frame of this analysis since suitable habitat would continue to exist as frequently isolated, very low abundance patches.

Cumulative Effects for Plants in the Mesic Hardwood-Dominated Forest Guild

The cumulative effects of the Forest Plan alternatives on the distribution and abundance of ecological conditions for plants within the mesic hardwood guild would be minor. Except for moschatel, triangle grapefern, goblin fern on the Chippewa, Chilean sweet cicely, and Braun's holly fern, there are no additional known occurrences of any of these plants within the cumulative effects analysis area, despite available suitable habitat. For moschatel, triangle grapefern on the Superior, goblin fern on the Chippewa, Chilean sweet cicely, and Braun's holly fern, there are a few additional occurrences within the analysis area. For triangle grapefern on the Chippewa, there are 21 additional occurrences in the analysis area.

The historical outcomes for cumulative effects for species within this guild would be the same as the historical outcomes for direct/indirect effects. The historical distribution and abundance of habitat within each Forest's respective analysis area (i.e. for the Chippewa, the Drift and Lake Plains, and for the Superior, the Northern Superior Uplands) probably closely parallels the historical distribution and abundance of habitat for analysis of direct/indirect effects. The primary reason for this is because lands within an ecological classification system (ECS) section share a number of basic characteristics (e.g. bedrock features, land forming processes, etc.); therefore, a type of habitat that is widespread and common in one portion of the section would probably be widespread and common throughout the section.

The current outcomes for cumulative effects for species within this guild would be the same as the current outcomes for direct/indirect effects. Since historical times, similar actions have occurred within the cumulative effects analysis area as occurred within the direct/indirect effects analysis area. Past timber harvest has resulted in younger, more even-aged, fragmented mesic northern hardwood forests that occupy a smaller portion of the landscape (Freilich 1998). The introduction of exotic earthworms has also degraded habitat for goblin fern (USDA Forest Service 2002g) and possibly for triangle grapefern. These actions have resulted in a decrease in distribution and abundance of suitable ecological conditions for plants in this guild, except for goblin fern on the Superior, blunt lobed grapefern, New England sedge, white trout lily, and one-flowered broomrape, which have probably always had a limited distribution and abundance of suitable ecological conditions in the cumulative effects analysis areas. These impacts parallel the changes in abundance and distribution of ecological conditions in the direct/indirect effects analysis areas.

Future timber harvest in mesic hardwoods in the cumulative effects analysis areas would occur on all ownerships, but the cumulative effects of these actions would be minor. Operationally, impacts would be minimized by voluntary adherence to BMPs (MN FRC 1999b). Within each cumulative effects analysis area, section-wide changes in forest cover and composition would be reviewed and monitored as part of the Minnesota Forest Resources Council's landscape planning process. Different forest owners across the landscape within each section would cooperate to meet landscape-wide vegetation goals, thereby minimizing cumulative impacts to ecological conditions for species within this guild. The outcome by alternative for each species would be

the same as the outcome for the direct/indirect effects analysis.

Determination of Effects

For all of the species in this guild, all the alternatives may impact individuals but are not likely to cause a trend to federal listing or loss of viability.

GUILD 8. DRY-MESIC UPLAND FOREST: DECIDUOUS, CONIFEROUS, OR MIXED

ROUGH-FRUITED FAIRY BELLS *(DISPORUM TRACHYCARPUM)*

Direct/Indirect Effects

Historical Outcome

Currently, there is only one known occurrence of this western disjunct in Minnesota. The next nearest occurrence is Isle Royale, Michigan (Gerdes 2002). Suitable habitat for this species appears to be of low abundance and patchily distributed (outcome C), but given the scarcity of the species on the Forest and its disjunct distribution, its habitat has probably historically been much scarcer and highly isolated in this portion of its range (outcome E).

Current Outcome

Given the limited knowledge that we have about this plant's distribution (it was only discovered in Minnesota in 1999), the amount and distribution of suitable ecological conditions at present is similar to historical conditions. This could change in the future if this plant is found to be more broadly distributed than it currently is.

Effects Common to All Alternatives

Standards for sensitive plants would protect this species under all the alternatives. However, until more occurrences of this species are found, it would continue to face threats to its persistence on the Forest, and outcomes for all alternatives would be similar to the historical outcome.

CANADA YEW *(TAXUS CANADENSIS)*

Direct/Indirect Effects

Historical Outcome

Superior and Chippewa National Forests: This species uses a wide variety of upland and lowland habitats, and is very sensitive to deer browsing (USDA Forest Service 2000c). Since it occupies a variety of common habitats, and since historical deer populations were much lower than present deer populations (USDA Forest Service 2002h), suitable ecological conditions for this plant were probably broadly distributed across each forest.

Current Outcome

Superior and Chippewa National Forests: For both Forests, suitable ecological conditions for this species are very isolated and frequently exist at low abundance. Since historical times, there have been shifts in the acreage and age class structure of different forest types that constitute habitat for this plant. Currently younger more even-aged mesic northern hardwood forests occupy a smaller portion of the landscape, while the acreage of aspen and birch has increased (Frelich 1998). Lowland conifer forests also occupy less acreage now than in historical times (Frelich 1998). Timber harvest, wildfires that occurred after logging in the late 19th and early 20th centuries, drainage, and road building (Bradof 1992, Frelich 1998, MN FRC 1999a) have caused these changes in forest cover and composition. The changes in forest cover have resulted in less lowland habitat and younger upland forest habitat than is optimal for Canada yew. The

ground disturbing activities noted above, timber harvest and wildfires, would have also directly impacted some populations of Canada yew, which is sensitive to burning and ground disturbance. However, the primary ecological factor that has led to decreased suitable ecological conditions for this shrub were the increases in deer populations that occurred in northern Minnesota in the 20th century (USDA Forest Service 2000c). Many Canada yew populations on the Superior and Chippewa are small and composed of small, non-reproductive, browsed plants (pers. obs, Walton 2001, USDA Forest Service 2001a). There has been a marked decline in suitable ecological conditions for this shrub since historical times.

Effects Common to All Alternatives

For both Forests, alternatives B and D would result in increases in suitable ecological conditions for Canada yew (outcome C) due to declines in deer habitat suitability. Decreases in deer habitat and subsequent decreases in deer numbers would have a positive effect on Canada yew. Alternative E on the Chippewa, and alternatives F and G on both Forests would result in roughly stable ecological conditions for Canada yew (outcome D), and the abundance and distribution of suitable habitat would be similar to current conditions since deer habitat suitability, and presumably deer numbers, would remain similar to current conditions. Alternative E on the Superior, and alternatives A and C on both Forests would result in a decrease in the abundance and distribution of suitable ecological conditions for Canada yew (outcome E) because these alternatives would result in increases in suitable habitat for deer. Increases in deer habitat and subsequent increases in deer numbers would have a negative effect on Canada yew due to increased browse pressure (see FEIS chapter 3.3 for analysis of deer habitat trends).

Standards for sensitive plants would protect this species from direct threats of management activities under all the alternatives. Despite the declines in suitable ecological conditions that would occur under alternative E on the Superior and alternatives A and C on both Forests, there would be no trend to federal listing or loss of viability for Canada yew as a species due to its broad range in the northeastern United States and Canada.

BARREN STRAWBERRY *(WALDSTEINIA FRAGARIOIDES)*

Direct/Indirect Effects

Historical Outcome

This species uses nearly every type of upland forest habitat and all age classes but seedling/open, and many current populations consist of 100's to 1000's of plants (MNNHP 2001). Consequently, suitable ecological conditions for this plant were probably historically broadly distributed across the Superior.

Current Outcome

Given the broad forest type and age class range occupied by this plant, it is clear that much suitable habitat for this plant still exists on the Superior. However, there are only three known occurrences of this species, and the habitat is much more fragmented by roads, small clearcuts, and mixed ownership patterns than it was historically. A number of occurrences are found in recently harvested areas or plantations, which suggests that this species can tolerate disturbance to some degree. Currently, suitable ecological conditions for this plant are patchily distributed.

Effects Common to All Alternatives

Standards for sensitive plants would protect this species under all the alternatives. Suitable upland forest habitat would continue to be patchily distributed across the Forest, although fragmentation would decrease over time as vegetation objectives for fewer, larger openings were

applied. However, until more occurrences of this species are found, the outcomes for all alternatives would be similar to the current outcome.

Cumulative Effects for Plants in the Dry-mesic Upland Forest Guild

The cumulative effects of the Forest Plan alternatives on the distribution and abundance of ecological conditions for plants within the dry-mesic upland forest guild would be minor. Canada yew and barren strawberry have a few additional known occurrences in the cumulative effects analysis areas, but there are no additional known occurrences of rough-fruited fairy bells.

The historical outcomes for cumulative effects for species within this guild would be the same as the historical outcomes for direct/indirect effects. The historical distribution and abundance of habitat within each Forest's respective analysis area (i.e. for the Chippewa, the Drift and Lake Plains, and for the Superior, the Northern Superior Uplands) probably closely parallels the historical distribution and abundance of habitat for analysis of direct/indirect effects. The primary reason for this is because lands within an ecological classification system (ECS) section share a number of basic characteristics (e.g. bedrock features, land forming processes, etc.); therefore, a type of habitat that is widespread and common in one portion of the section would probably be widespread and common throughout the section.

The current outcomes for cumulative effects for species within this guild would be the same as the current outcomes for direct/indirect effects. Since historical times, similar actions have occurred within the cumulative effects analysis area as occurred within the direct/indirect effects analysis area. Past timber harvest, wildfires, swamp drainage, road construction, and increases in white-tailed deer populations resulted in a decrease in the distribution and abundance of suitable ecological conditions for Canada yew in the cumulative effects analysis area. Past timber harvest resulted in a decrease suitable ecological conditions for barren strawberry, but not for rough-fruited fairy bells, which has probably always had a limited distribution and abundance of suitable ecological conditions in the cumulative effects analysis areas. These impacts parallel the changes in abundance and distribution of ecological conditions in the direct/indirect effects analysis areas.

Future timber harvest in the dry-mesic upland forest in the cumulative effects analysis areas would occur on all ownerships, but the cumulative effects of these actions would be minor. Operationally, impacts would be minimized by voluntary adherence to BMPs (MN FRC 1999b). Within each cumulative effects analysis area, section-wide changes in forest cover and composition would be reviewed and monitored as part of the Minnesota Forest Resources Council's landscape planning process. Different forest owners across the landscape within each section would cooperate to meet landscape-wide vegetation goals, thereby minimizing cumulative impacts to ecological conditions for species within this guild. The outcome by alternative for each species would be the same as the outcome for the direct/indirect effects analysis.

Determination of Effects

For all of the species in this guild, all the alternatives may impact individuals but are not likely to cause a trend to federal listing or loss of viability.

UNGUILDED

PELTIGERA VENOSA

Direct/Indirect Effects

Historical Outcome

There is one occurrence of this lichen on the Superior, and the Forest is at the southern periphery of the species' range. Suitable habitat for this species appears to be highly isolated and exist at very low abundance. Substantial uncertainty is involved in making this judgment, since relatively little searching has been done for lichens compared to vascular plants.

Current Outcome

Although suitable habitat for this species, such as the soil of exposed rootwads, is patchily distributed across the Forest (sometimes in large patches such as the 1999 Boundary Waters blowdown), there are few known occurrences. University of Minnesota graduate student Becky Knowles surveyed a portion of the Forest for lichens in the genus *Peltigera* in summer 2001; however, she found no occurrences of this species during her research (Knowles pers. comm.) It is possible that timber harvest or road construction could impact this species either by disturbing the substrate on which it grows or opening up the canopy too much. It is probable that suitable ecological conditions for this species remain highly isolated as in the historical condition.

Effects Common to All Alternatives

Standards for sensitive plants would protect this species under all the alternatives. However, until more occurrences of this species are found, it would continue to face threats to its persistence on the Forest, and outcomes for all alternatives would be similar to the historical outcome.

PSEUDOCYPHELLARIA CROCATA

Direct/Indirect Effects

Historical Outcome

There is one occurrence of this lichen on the Superior. Suitable habitat for this species appears to be highly isolated and exist at very low abundance. Substantial uncertainty is involved in making this judgment, since relatively little searching has been done for lichens compared to vascular plants.

Current Outcome

Logging and other landuses have reduced the number of extant occurrences across northeast Minnesota (Coffin and Pfannmuller 1988). Because the substrates on which this lichen occurs are quite variable, it is difficult to predict where it will occur (USDA Forest Service 2000d). Based on the documented decline in number of populations, it is probable that suitable ecological conditions for this species remain highly isolated as in the historical condition.

Effects Common to All Alternatives

Standards for sensitive plants would protect this species under all the alternatives. However, until more occurrences of this species are found, it would continue to face threats to its persistence on the Forest, and outcomes for all alternatives would be similar to the historical outcome.

Cumulative Effects for Species Not in a Guild

Cumulative effects for these two lichens are difficult to analyze, given the uncertainty created by the relative lack of ecological and distribution information that is available for these lichens

compared to many vascular plants. Past actions like timber harvest and road construction have caused documented declines in the number of occurrences for *Pseudocyphellaria crocata* (Coffin and Pfannmuller 1988) in the direct/indirect effects analysis area, so it is probable that such declines have occurred in the cumulative effects analysis area as well, where landuses have been similar. Surveys (Knowles pers. comm.) have not revealed any new locations of *Peltigera venosa* in the direct/indirect effects analysis area, so it seems unlikely that suitable ecological conditions are abundant in the cumulative effects analysis area either. Present and future actions off the Forest would probably continue to impact suitable habitat in the cumulative effects analysis area, making the occurrences on the Forest more important to future viability. Historical and current outcomes for cumulative effects are similar to those for direct/indirect effects; there is no evidence to suggest otherwise. Similarly, the cumulative effects outcomes among alternatives would probably be the same as those for direct/indirect effects.

Determination of Effects

For all of the species in this guild, all the alternatives may impact individuals but are not likely to cause a trend to federal listing or loss of viability.

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Appendix 1: Potential threats to Sensitive Plants

Table Appendix 1. POTENTIAL THREATS TO SENSITIVE PLANTS (X=primary threat, x=secondary threat)																						
Scientific Name	**Common Name**	**Timber harvest**	**Road/trail construction**	**Non native invasive species**	**Recreation**	**Climate change**	**Small population problems**	**Succession**	**Hydrologic alteration**	**Developme nt**	**Pollution**	**Collection**	**Mining**	**Prescribed/ wild fire**	**Herbivory**	**Herbicide application**	**Insect and disease**	**Drought**	**Agriculture**	**Fire exclusion**	**Windthrow**	**Erosion**
Guild 1. Shallow water/littoral zone - fluctuating shore																						
Astragalus alpinus	alpine milkvetch	x	x		**X**			x	**X**	x												
Carex katahdinensis	Katahdin sedge	x	x		**X**				**X**													
Juncus subtilis	creeping rush				**X**	x	x	x	**X**	x		x										
Littorella uniflora	American shore-plantain	x		x	**X**				**X**	x	**X**			x								
Subularia aquatica	awlwort	x	x	x	**X**				**X**	x	**X**			x		x						
Guild 2. Riparian - aquatic, open marsh, and alder/shrub dominated																						
Caltha natans	floating marsh-marigold	**X**	**X**	x	**X**				**X**	x		x										
Nymphaea leibergii	small white waterlily	x	x	x	**X**	x	x		**X**		x	x										
Listera auriculata	auricled twayblade	**X**	**X**		x				**X**			x										
Guild 3. Nonforest wetland, disturbed wetland, and fluctuating shore – predominantly open																						
Bidens discoidea	swamp beggar-ticks		**X**		x				**X**													
Calamagrostis lacustris	pond reed grass				x			**X**	**X**	x												
Eleocharis nitida	neat spike-rush		x		**X**	x		x														
Eleocharis olivacea	olivaceous spike-rush		**X**						**X**		x											
Eleocharis quinqueflora	few-flowered spike-rush				**X**			x	**X**													

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Juncus stygius	bog rush		**X**	x				x	**X**		x											
Juncus vaseyi	Vasey's rush		**X**		**X**			x														
Muhlenbergia uniflora	one-flowered muhly		**X**		x			x	**X**		x											
Platanthera clavellata	club spur orchid		**X**			x		x	**X**				x							x		
Sparganium glomeratum	Clustered bur-reed	x	**X**		x				**X**					x								
Viola lanceolata	lance-leaved violet	x	x		**X**	x	x	x	**X**	x				x				x				
Guild 4. Cliff, talus slope, and exposed rock habitat																						
Arctoparmelia centrifuga	lichen sp.		x		x	**X**	x				x		x									
Arctoparmelia subcentrifuga	lichen sp.		x		x	**X**	x				x		x									
Arnica lonchophylla	long-leaved arnica				x		x															
Asplenium trichomanes	maidenhair spleenwort				x		x															
Carex rossii	Ross's sedge	x			x		x															
Cladonia wainoi (=pseudorangiformis)	lichen sp.	x	x		x	**X**	x				x			x								
Moerhingia macrophylla	large-leaved sandwort	x			x		x						x									
Oxytropis viscida	sticky locoweed			x	x	x	x					x										
Saxifraga cernua	nodding saxifrage			x	x		x															x

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Saxifraga paniculata	encrusted saxifrage			x	x	x																
Tofieldia pusilla	small false asphodel				x	x	x			x	x	x										
Woodsia glabella	smooth woodsia				x	x	x			x												x
Guild 5. Upland disturbed, barrens, or early successional forest habitat																						
Botrychium acuminatum	pointed moonwort	**X**	**X**		x			**X**						x								
Botrychium lunaria	common moonwort	**X**	**X**	x				**X**				x		x	x	x		x				
Botrychium michiganense (hesperium)	moonwort	**X**	**X**		x			**X**						x								
Botrychium pallidum	pale moonwort	**X**	**X**	x	x			**X**		x									x			
Botrychium rugulosum	ternate grape-fern	**X**	**X**	x	x	x		**X**		x		x										
Botrychium simplex	least grape-fern	**X**	**X**	x	x			**X**						x				x				
Crataegus douglasii	black hawthorn	**X**	**X**				x															
Guild 6a. Forested wetland - black spruce, tamarack, and mixed conifer																						
Caloplaca parvula	lichen sp.	**X**	**X**			x	x		**X**		x											
Malaxis brachypoda	white adder's-mouth	**X**	**X**	x					**X**				x									
Polemonium occidentale ssp. lacustre	western Jacob's-ladder	**X**	**X**					x	**X**	x			x									
Pyrola minor	small shinleaf	**X**	**X**						**X**					x							x	

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Rubus chamaemorus	cloudberry	**X**	**X**			x			**X**				x				x					
Sticta fuliginosa	lichen sp.	**X**	**X**			x	x		x		x			x								
Guild 6b. Forested wetland - white cedar dominated																						
Calypso bulbosa	fairy slipper	**X**	**X**						x					x	x							
Cetraria aurescens	lichen sp.	**X**	**X**			**X**	x				x											
Cypripedium arietinum	ram's-head lady's slipper	**X**	x	x					x			**X**			x					x		
Gymnocarpium robertianum	limestone oak fern	**X**	**X**						x													
Menegazzia terebrata	lichen sp.	**X**	**X**			x	x	x	**X**		x											
Ramalina thrausta	lichen sp.	**X**	**X**				x		x		x			x								
Usnea longissima	lichen sp.	**X**	**X**				x		x		x			x								
Guild 7. Mesic hardwood dominated forest																						
Adoxa moschatellina	musk-root	**X**				x						x										
Botrychium lanceolatum	triangle grape-fern	**X**	**X**	**X**																		
Botrychium mormo	goblin fern	**X**	**X**	**X**		x												x				
Botrychium oneidense	blunt-lobed grape-fern	**X**	**X**	**X**				x				x		x	x	x		x				
Carex novae-angliae	New England sedge	x	x																			
Dryopteris goldiana	Goldie's fern	**X**		x						x		**X**										
Erthyronium albidum	white trout-lily	**X**		x																		

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Orobanche uniflora	one-flowered broomrape	**X**	x	x																		
Osmorhiza berteroi	Chilean sweet cicely	**X**													x							
Polystichum braunii	Braun's holly fern	**X**			x							**X**										
Guild 8. Dry-mesic upland forest: deciduous, coniferous, or mixed																						
Disporum trachycarpum	rough-fruited fairy bells				**X**		x															
Taxus canadensis	Canada yew	**X**	x			x								**X**	**X**							
Waldesteinia fragarioides	barren strawberry	**X**	x	x																**X**		
Unguilded																						
Peltigera venosa	lichen sp.	x	x		x	x	x				x											
Pseudocyphellaria crocata	lichen sp.	x				x	x				x											