Northern Superior Uplands

Section Forest Resources Management Plan

Preliminary Issues and Assessment Chapter 6: Ecological Information

MNDNR

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Minnesota Forest Resource Council. 2014. Northeast Landscape Conditions & Trends Report. Landscape Program Document #LT0114. Minnesota Forest Resource Council, St. Paul, Minnesota. Available online at the Minnesota Forest Resource Council web site www.frc.state.mn.us

Notes relating to this document:
This *Preliminary Issues and Assessment* document and color maps may be viewed as PDF files on the *Northern Northern Superior Uplands Section Forest Resources Management Plan* website at:
Northern Superior Uplands SFRMP
Information about the Section Resource Management Plan (SFRMP) process can be found at:
Information about SFRMP
Alternative Formats available on request.
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Contents

How graphics are labeled:

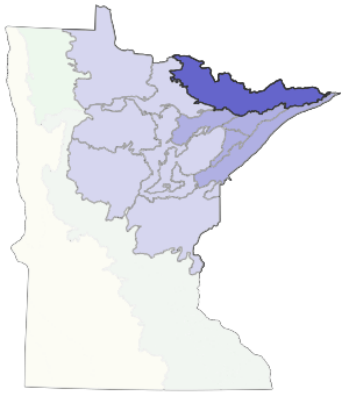
Graphics referring to all five subsections combined (Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, Toimi Uplands) are indicated by a "Northern Superior Uplands" after the chart designation.

Notes relating to this chapter:

Plan documents and color maps may be viewed as PDF files on the Northern Superior Uplands Subsection Forest Resource Management Plan (SFRMP) Web site at: http://www.dnr.state.mn.us/forestry/subsection/nsu/index.html . *Maps in this chapter depict information for an area within a "planning boundary." This boundary is designed to closely approximate the subsection while capturing data summary and planning efficiencies by using survey or jurisdiction lines in some cases.*

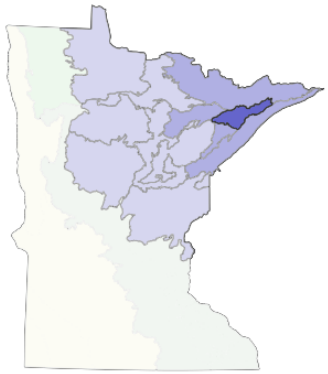
Printed documents will be available for review at the Minnesota DNR Grand Rapids Region Headquarters at 1201 E Hwy 2, Grand Rapids, Minnesota, and on compact disk by request to Lynn Sue Mizner at (218) 429-3022, or lynn.mizner@state.mn.us

Figure 6.1. The Five Subsections That Make Up the Northern Superior Uplands



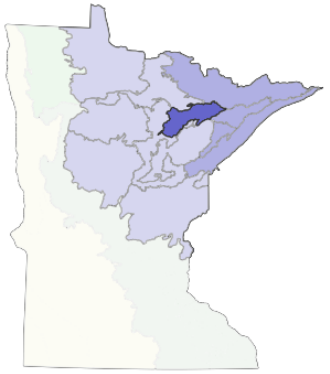
Border Lakes Subsection 212La

A description of the Border Lakes Subsection can be found at http://www.dnr.state.mn.us/ecs/212La/index.html



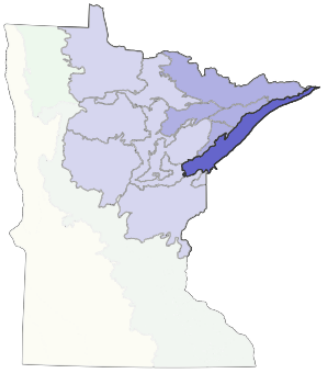
Laurentian Uplands Subsection 212Le

A description of the Laurentian Uplands can be found at http://www.dnr.state.mn.us/ecs/212Le/index.html



Nashwauk Uplands Subsection 212Lc

Information about the Nashwauk Uplands Subsection can be found at http://www.dnr.state.mn.us/ecs/212Lc/index.html



North Shore Highlands 212Lb

Information about the North Shore Highlands Subsection can be found at http://www.dnr.state.mn.us/ecs/212Lb/index.html

Toimi Uplands 212Ld

Information about the Toimi Uplands Subsection can be found at http://www.dnr.state.mn.us/ecs/212Ld/index.html

Land Type Associations

A Land Type Association (LTA) is an area of land with common characteristics such as glacial landform, depth to bedrock, bedrock type, topographic roughness, pre-European settlement vegetation, and surface water features (lakes, streams, and wetlands) or combinations of the above occurring in repeating patterns. LTAs range in size from 10,000 acres to 2,000,000 acres. Descriptions of the LTAs in the NSU Section are included in the appendices to this plan (Chapter 9).

Landform Descriptions

A glossary of the landforms used in the LTA descriptions follows the LTA descriptions in Appendix B in Chapter 9 of this Assessment.

Native Plant Communities of the Northern Superior Uplands

Minnesota's Native Plant Community Classification System

The process of revising the Minnesota Department of Natural Resources' native plant community classification system began in 1996 as a collaborative project among the Division of Ecological Resource's Natural Heritage and Nongame Research Program (NHNRP), the Minnesota County Biological Survey (now Minnesota Biological Survey or MBS), and the Division of Forestry's Ecological Land Classification Program (ELCP). The revised community classification is integrated with the ELCP's ecological land classification of Minnesota and is based on extensive analyses of vegetation plot data. The new classification replaces the plant community classification presented in *Minnesota's Native Vegetation: A Key to Natural Communities, Version 1.5*. The first volume of the new classification*, Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province,* was published in 2003 and includes the Northern Superior Uplands Subsections addressed in this plan. The field keys to Minnesota's forested plant communities contained within this field guide are being used with other ECS and native plant community (NPC) information to assist forest management decisions on state lands. A list of Native Plant Communities with their State Conservation Ranks (S-Ranks) is located in Appendix B of this Assessment.

Classification of Wooded Plant Communities

The delineation of wooded plant communities in the new classification is based on ordination analyses of vegetation plot data (relevé) which are housed in the DNR's Natural Heritage Information System. A total of 2,756 relevés were analyzed to develop the classification of wooded communities. These plot data reflect much of the variation in wooded plant communities across Minnesota, although there are some areas of the state for which few relevés exist. Analyses of the vegetation plot data were organized within the Ecological Classification System. The result is a classification of wooded plant communities that relates vegetation variation to physical features and processes of the landscape. The hierarchy of Minnesota's wooded plant community classification is:

Ecological System (such as Fire-Dependent Forest/Woodland System)
Floristic Region (such as Northern Floristic Region)
Native Plant Community Class (such as Northern Mesic Mixed Forest)
Native Plant Community Type (such as Aspen-Birch Forest, sometimes with subtypes)

Native plant community classifications differ from forest cover type classifications (such as those used in cooperative stand assessment forest inventory) in that they are based on all vascular plant species, not just the dominant canopy tree species.

Endangered, Threatened, and Special Concern Species

Purpose, Scope, and Relationships to State and Federal Laws

Minnesota's Endangered Species Statute (Minnesota Statutes, Section 84.0895) requires the Minnesota DNR to maintain a list of species that are at risk of disappearing from the State. Listed species are placed into one of three categories in decreasing order of concern: endangered, threatened, and special concern. Minnesota's List of Endangered, Threatened and Special Concern species was first established in 1984 and is periodically updated, with the most recent update effective August 2013. The resulting List of Endangered, Threatened, and Special Concern species is codified as Minnesota Rules, Chapter 6134. Tables 6.1 to 6.4 below provide a summary of rare species occurrences in the NSU.

Minnesota's Endangered Species Statute and the associated rules impose a variety of restrictions, a permit program, and several exemptions pertaining to species designated as *endangered* or *threatened*. These regulations are codified as Minnesota Rules, Parts 6212.1800 to 6212.2300. A person may not take, import, transport, or sell any portion of an endangered or threatened species. However, these acts may be allowed 1) by permit issued by the DNR, 2) for exempt plants on certain agricultural lands and plants destroyed in consequence of certain agricultural practices, and 3) for the accidental, unknowing destruction of designated plants. Persons are advised to read the full text of the statute and rules in order to understand all regulations pertaining to species that are designated as endangered, threatened, or species of special concern. For more information see about Minnesota's Endangered, Threatened, and Special Concern species, go to http://www.dnr.state.mn.us/ets/index.html

The federal Endangered Species Act of 1973, as amended (16 USC 1531_1544; see http://www.fws.gov/endangered/laws-policies/index.html) requires the U.S. Department of the Interior to identify species as endangered or threatened according to a set of definitions, and imposes a set of restrictions for those species. This is entirely separate from the State process. Two species that occur in the NSU are on the federal list of endangered or threatened species: Canada lynx and piping plover. Two species that occur in the NSU are currently being proposed to be added to the federal list of endangered or threatened species: northern long-eared bat and rufa red knot (bird). See: http://www.fws.gov/midwest/endangered/lists/minnesot-spp.html for more information about those four Minnesota species.

Minnesota Heritage Information System

The Minnesota DNR Natural Heritage Information System (NHIS) rare features database is the recognized standard in Minnesota for establishing presence or absence of rare species data for specific locations (i.e., environmental review). The NHIS is the primary source for rare species occurrences information

presented in Tables 6.1 to 6.4. These data were supplemented by input and review by Natural Heritage and Nongame Research Program (NHNRP) and Minnesota Biological Survey staff.

DNR Rare Species Guide

The DNR Natural Heritage and Nongame Research Program has created the Rare Species Guide (http://www.dnr.state.mn.us/rsg/index.html) that contains fact sheets on Minnesota's Endangered, Threatened, and Special Concern species. These fact sheets provide information such as life history, habitat use, and management considerations for each species. The Rare Species Guide is both an informational and technological update to the 1988 publication, *Minnesota's Endangered Flora and Fauna,* by Coffin and Pfannmuller. Fact sheets are not yet available for species added to the Endangered, Threatened, and Special Concern list during the list revision in 2013.

Species in Greatest Conservation Need

Minnesota's State Wildlife Action Plan (SWAP) identifies wildlife species that are considered Species in Greatest Conservation Need (SGCN) because they are rare, their populations are declining, or they face serious threats of decline (see http://www.dnr.state.mn.us/cwcs/index.html for SWAP and list of SGCN). The SWAP identifies problems, threats, and opportunities that face SGCN. It develops 10-year objectives for SGCN populations, habitats, and priority research and information needs, and it develops conservation actions that address the 10-year objectives. The information in SWAP is used to form SFRMP recommendations and decisions. The U.S. Congress has mandated that states develop a SWAP (which must be updated every 10 years) to be eligible for federal funding through the State Wildlife Grants program. The DNR is currently revising the SWAP, which will be completed in October 2015. The revised SWAP will be a 10-year operational plan that identifies priority conservation actions and priority conservation areas for SGCN.

NSU Rare Species Occurrences

Table 6.1. Minnesota listed animal species

Columns in this table display listed animal species by scientific name, common name, occurrence by subsection, state rank, and native plant community system in which they occur.

MINNESOTA LISTED SPECIES - ANIMALS								
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands								
		OCCURRENCE[1]						
SCIENTIFIC NAME	COMMON NAME	BL	LU	NU	NSH	TU	MN RANK[2]	NPC SYSTEM[3]
Charadrius melodus	Piping Plover				O		END	LK
Cicindela hirticollis rhodensis	Hairy-necked Tiger Beetle				O		END	LSS
Actinonaias ligamentina	Mucket				O		THR	AR
Chilostigma itascae	Headwaters Chilostigman Caddisfly		O				THR	
Emydoidea blandingii	Blanding's Turtle	O			O		THR	AR, MR, O
Glyptemys insculpta	Wood Turtle		O		O	O	THR	AR, RV, MH, FD
Limnephilus rossi	A Northern Caddisfly				O		THR	
Sterna hirundo	Common Tern	O			O		THR	AL
Accipiter gentilis	Northern Goshawk	O	O	O	O	O	SPC	FD, MH
Acipenser fulvescens	Lake Sturgeon	O			O		SPC	AR, AL
Aegolius funereus	Boreal Owl	O	O		O		SPC	FD, MH, FP, AP
Buteo lineatus	Red-shouldered Hawk				O		SPC	MH, FF, MR
Cicindela denikei	Laurentian Tiger Beetle	O	O				SPC	O
Coregonus kiyi	Kiyi				O		SPC	AL
Coregonus zenithicus	Shortjaw Cisco	O			O		SPC	AL
Coturnicops noveboracensis	Yellow Rail				O		SPC	MR, WM

MINNESOTA LISTED SPECIES - ANIMALS								
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands								
		OCCURRENCE[1]						
SCIENTIFIC NAME	**COMMON NAME**	**BL**	**LU**	**NU**	**NSH**	**TU**	**MN RANK[2]**	**NPC SYSTEM[3]**
Cygnus buccinator	Trumpeter Swan	O	O	O	O		SPC	A
Erebia mancinus	Disa Alpine		O		O	O	SPC	FP
Falco peregrinus	Peregrine Falcon	O		O	O		SPC	CT, LK
Hemidactylium scutatum	Four-toed Salamander				O	O	SPC	MH, FP (shrub swamp)
Ichthyomyzon fossor	Northern Brook Lamprey	O		O			SPC	AR
Lasmigona compressa	Creek Heelsplitter	O	O	O	O	O	SPC	AR
Ligumia recta	Black Sandshell	O	O	O	O	O	SPC	AR
Lycaeides idas nabokovi	Nabokov's Blue	O	O		O	O	SPC	O
Myotis septentrionalis	Northern Long-eared Bat	O			O		SPC	
Ophiogomphus anomalus	Extra-striped Snaketail	O			O		SPC	AR
Oxyethira itascae	A Purse Casemaker Caddisfly				O		SPC	A
Perimyotis subflavus	Tri-colored Bat				O		SPC	
Phenacomys ungava	Eastern Heather Vole	O	O				SPC	
Pyrgus centaureae freija	Grizzled Skipper				O		SPC	
Sorex fumeus	Smoky Shrew	O	O		O		SPC	
Synaptomys borealis	Northern Bog Lemming	O					SPC	AP, OP, FP

Table 6.2 Minnesota "Watchlist" animal species

Columns in this table display species' scientific name, common name, occurrence by subsection, state rank, and native plant community system in which they occur.

MINNESOTA WATCHLIST SPECIES - ANIMALS								
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands								
		OCCURRENCE[1]						
SCIENTIFIC NAME	COMMON NAME	BL	LU	NU	NSH	TU	MN RANK[2]	NPC SYSTEM[3]
Bartramia longicauda	Upland Sandpiper	O					Watchlist	O
Bat Colony	Bat Concentration	O			O		Watchlist	
Botaurus lentiginosus	American Bittern	O	O	O	O		Watchlist	MR, WM
Colonial Waterbird Nesting Area	Colonial Waterbird Nesting Site	O	O	O	O	O	Watchlist	A, MR, WF, FF, LK
Grus canadensis	Sandhill Crane		O		O		Watchlist	MR, WM
Haliaeetus leucocephalus	Bald Eagle	O	O	O	O	O	Watchlist	U
Hydroptila novicola	A Caddisfly	O			O	O	Watchlist	
Microtus chrotorrhinus	Rock Vole	O	O	O	O		Watchlist	FD, MH
Setophaga caerulescens	Black-throated Blue Warbler	O	O	O	O		Watchlist	MH
Strix nebulosa	Great Gray Owl	O	O		O	O	Watchlist	FP, AP, FD

Table 6.3. Minnesota listed plant and fungus species

Columns in this table display species' scientific name, common name, occurrence by subsection and State rank.

MINNESOTA LISTED SPECIES - PLANTS & FUNGI							
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**BL**	**LU**	**NU**	**NSH**	**TU**	**MN RANK[2]**
Allium schoenoprasum	wild chives				O	O	END
Astragalus alpinus var. *alpinus*	alpine milk-vetch		O				END
Botrychium ascendens	upswept moonwort			O			END
Botrychium lineare	slender moonwort			O			END
Calamagrostis purpurascens	purple reedgrass	O					END
Caloplaca parvula	a species of lichen	O	O				END
Caltha natans	floating marsh marigold	O	O	O	O	O	END
Carex pallescens	pale sedge			O	O		END
Carex supina ssp. *spaniocarpa*	weak arctic sedge	O					END
Castilleja septentrionalis	northern paintbrush				O		END
Draba cana	hoary whitlow grass	O			O		END
Elodea bifoliata	two leaf waterweed				O		END
Erigeron acris var. *kamtschaticus*	bitter fleabane				O		END
Juncus subtilis	slender rush	O					END
Listera auriculata	auricled twayblade	O	O		O		END
Lobaria scrobiculata	textured lungwort		O				END
Osmorhiza berteroi	Chilean sweet cicely	O			O		END
Oxytropis viscida	sticky locoweed	O					END

MINNESOTA LISTED SPECIES - PLANTS & FUNGI							
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**BL**	**LU**	**NU**	**NSH**	**TU**	**MN RANK[2]**
Packera indecora	elegant groundsel	O			O		END
Parmelia stictica	a species of lichen				O		END
Polemonium occidentale ssp. *lacustre*	western Jacob's-ladder			O			END
Potamogeton confervoides	algae-like pondweed	O					END
Potamogeton oakesianus	Oakes' pondweed	O			O		END
Prosartes trachycarpa	rough-fruited fairybells	O					END
Pseudocyphellaria crocata	yellow specklebelly lichen	O	O		O		END
Sagina nodosa ssp. *borealis*	knotty pearlwort				O		END
Saxifraga cernua	nodding saxifrage	O					END
Schistostega pennata	luminous moss	O			O		END
Tofieldia pusilla	small false asphodel				O		END
Tsuga canadensis	eastern hemlock				O		END
Vaccinium uliginosum	alpine bilberry				O		END
Allocetraria oakesiana	yellow ribbon lichen		O		O		THR
Ammophila breviligulata ssp. *breviligulata*	beachgrass				O		THR
Arnica lonchophylla	long-leaved arnica	O			O		THR
Asplenium trichomanes ssp. *trichomanes*	maidenhair spleenwort	O			O		THR
Bistorta vivipara	alpine bistort				O		THR
Boechera retrofracta	Holboell's rock cress	O			O		THR
Botrychium lanceolatum ssp. *angustisegmentum*	narrow triangle moonwort		O	O	O	O	THR

MINNESOTA LISTED SPECIES - PLANTS & FUNGI							
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**BL**	**LU**	**NU**	**NSH**	**TU**	**MN RANK[2]**
Botrychium lunaria	common moonwort	O	O		O	O	THR
Botrychium mormo	goblin fern			O	O		THR
Botrychium oneidense	blunt-lobed grapefern	O		O			THR
Callitriche heterophylla	larger water starwort	O			O		THR
Cardamine pratensis	cuckoo flower	O		O			THR
Carex garberi	Garber's sedge				O		THR
Carex novae-angliae	New England sedge		O		O	O	THR
Carex rossii	Ross' sedge	O			O		THR
Crassula aquatica	water pigmyweed	O					THR
Cypripedium arietinum	ram's head orchid	O	O	O	O		THR
Deschampsia flexuosa	slender hair grass				O		THR
Eleocharis flavescens var. *olivacea*	olivaceous spikerush	O					THR
Eleocharis robbinsii	Robbins' spikerush	O					THR
Hudsonia tomentosa	beach heather				O		THR
Huperzia porophila	rock fir moss	O			O		THR
Luzula parviflora	small-flowered woodrush	O	O		O		THR
Moehringia macrophylla	large-leaved sandwort	O			O		THR
Nymphaea leibergii	small white waterlily		O		O		THR
Phacelia franklinii	Franklin's phacelia	O	O		O		THR
Piptatherum canadense	Canadian ricegrass	O	O			O	THR

MINNESOTA LISTED SPECIES - PLANTS & FUNGI							
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**BL**	**LU**	**NU**	**NSH**	**TU**	**MN RANK[2]**
Platanthera flava var. *herbiola*	tubercled rein orchid			O			THR
Polystichum braunii	Braun's holly fern	O			O		THR
Protopannaria pezizoides	brown-gray moss-shingle lichen				O		THR
Rubus chamaemorus	cloudberry	O			O	O	THR
Salix pellita	satiny willow				O		THR
Spiranthes casei var. *casei*	Case's ladies' tresses			O			THR
Subularia aquatica ssp. *americana*	awlwort	O	O				THR
Trichocolea tomentella	a species of lungwort				O		THR
Trichophorum clintonii	Clinton's bulrush	O					THR
Utricularia geminiscapa	hidden-fruited bladderwort	O	O				THR
Utricularia resupinata	lavender bladderwort	O	O	O			THR
Viola lanceolata var. *lanceolata*	lance-leaved violet	O			O		THR
Woodsia alpina	alpine woodsia	O			O		THR
Woodsia glabella	smooth woodsia	O			O		THR
Woodsia scopulina ssp. *laurentiana*	Rocky Mountain woodsia	O			O		THR
Adlumia fungosa	Allegheny vine				O		SPC
Ahtiana aurescens	eastern candlewax lichen	O	O	O	O		SPC
Anaptychia crinalis	hanging fringe lichen	O			O		SPC
Arctoparmelia centrifuga	concentric ring lichen		O				SPC
Bidens discoidea	discoid beggarticks	O			O		SPC

MINNESOTA LISTED SPECIES - PLANTS & FUNGI							
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**BL**	**LU**	**NU**	**NSH**	**TU**	**MN RANK[2]**
Botrychium acuminatum	tailed grapefern				O		SPC
Botrychium campestre	prairie moonwort		O	O			SPC
Botrychium minganense	Mingan moonwort	O	O	O	O	O	SPC
Botrychium pallidum	pale moonwort	O	O	O	O	O	SPC
Botrychium rugulosum	St. Lawrence grapefern	O	O	O	O	O	SPC
Botrychium simplex	least moonwort	O	O	O	O	O	SPC
Calamagrostis lacustris	narrow reedgrass	O			O		SPC
Carex exilis	coastal sedge		O	O	O		SPC
Carex flava	yellow sedge	O	O		O		SPC
Carex media	intermediate sedge	O	O		O		SPC
Carex michauxiana	Michaux's sedge	O	O		O	O	SPC
Carex ormostachya	necklace sedge	O		O	O	O	SPC
Carex praticola	prairie-dweller sedge	O					SPC
Carex scirpoidea	northern single-spike sedge				O		SPC
Carex xerantica	dry sedge	O					SPC
Cladium mariscoides	twig rush	O					SPC
Cladonia pseudorangiformis	a species of lichen	O	O				SPC
Crataegus douglasii	black hawthorn	O			O		SPC
Draba arabisans	Arabian whitlow grass	O			O		SPC
Drosera anglica	English sundew	O	O	O	O		SPC

MINNESOTA LISTED SPECIES - PLANTS & FUNGI							
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**BL**	**LU**	**NU**	**NSH**	**TU**	**MN RANK[2]**
Drosera linearis	linear-leaved sundew		O				SPC
Elatine triandra	three stamened waterwort	O			O		SPC
Eleocharis nitida	neat spikerush	O	O		O	O	SPC
Eleocharis quinqueflora	few-flowered spikerush	O	O	O	O		SPC
Euphrasia hudsoniana var. *ramosior*	Hudson Bay eyebright	O			O		SPC
Fimbristylis autumnalis	autumn fimbry	O	O				SPC
Frullania selwyniana	Selwyn's ear-leaf liverwort		O		O		SPC
Huperzia appalachiana	Appalachian fir moss	O			O		SPC
Juncus stygius var. *americanus*	bog rush	O	O	O	O	O	SPC
Juniperus horizontalis	creeping juniper	O			O		SPC
Listera convallarioides	broad-leaved twayblade				O		SPC
Littorella americana	American shore plantain	O	O	O	O	O	SPC
Malaxis monophyllos var. *brachypoda*	white adder's mouth	O			O		SPC
Menegazzia terebrata	port-hold lichen				O		SPC
Muhlenbergia uniflora	one-flowered muhly	O	O		O		SPC
Myriophyllum heterophyllum	broadleaf water milfoil	O					SPC
Najas gracillima	slender naiad	O		O	O		SPC
Osmorhiza depauperata	blunt-fruited sweet cicely	O			O		SPC
Peltigera venosa	fan lichen	O			O		SPC
Pinguicula vulgaris	butterwort				O		SPC

MINNESOTA LISTED SPECIES - PLANTS & FUNGI							
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	**COMMON NAME**	**BL**	**LU**	**NU**	**NSH**	**TU**	**MN RANK[2]**
Platanthera clavellata	small green wood orchid	O	O	O	O	O	SPC
Poa wolfii	Wolf's bluegrass				O		SPC
Pyrola minor	small shinleaf	O	O	O	O		SPC
Ramalina thrausta	angel's hair lichen		O		O		SPC
Ranunculus lapponicus	Lapland buttercup	O	O	O	O	O	SPC
Rubus vermontanus	Vermont blackberry		O				SPC
Sarcosoma globosum	a species of fungus	O					SPC
Saxifraga paniculata	encrusted saxifrage	O			O		SPC
Shepherdia canadensis	soapberry	O					SPC
Sticta fuliginosa	peppered moon lichen	O	O	O	O	O	SPC
Torreyochloa pallida	Torrey's mannagrass	O	O	O	O	O	SPC
Torreyochloa pallida var. *fernaldii*	Torrey's mannagrass	O	O	O	O	O	SPC
Trisetum spicatum	spike trisetum				O		SPC
Usnea longissima	Methuselah's beard lichen	O	O		O		SPC
Waldsteinia fragarioides var. *fragarioides*	barren strawberry	O	O	O	O	O	SPC
Woodsia oregana ssp. *cathcartiana*	Oregon woodsia	O			O		SPC
Xyris montana	montane yellow-eyed grass	O	O	O	O	O	SPC

Table 6.4. Minnesota "Watchlist" plant and fungus species

Columns in this table display species' scientific name, common name, occurrence by subsection, and State rank.

MINNESOTA WATCHLIST SPECIES - PLANTS & FUNGI							
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	COMMON NAME	BL	LU	NU	NSH	TU	MN RANK[2]
Actaea pachypoda	white baneberry			O	O		Watchlist
Adoxa moschatellina	moschatel				O		Watchlist
Agrostis scabra	rough bentgrass	O			O		Watchlist
Arethusa bulbosa	dragon's mouth	O	O	O	O	O	Watchlist
Artemisia campestris	field sagewort	O			O		Watchlist
Botrychium matricariifolium	matricary grapefern	O	O	O	O	O	Watchlist
Botrychium michiganense	Michigan moonwort	O	O	O	O	O	Watchlist
Carex conoidea	field sedge	O	O				Watchlist
Carex gynandra	nodding sedge	O	O		O		Watchlist
Carex woodii	Wood's sedge				O		Watchlist
Ceratophyllum echinatum	spiny coontail	O			O		Watchlist
Claytonia caroliniana	Carolina spring beauty	O	O		O	O	Watchlist
Cystopteris laurentiana	hybrid bladder fern				O		Watchlist
Geocaulon lividum	northern comandra	O	O		O		Watchlist
Huperzia x bartleyi	Bartley's clubmoss				O		Watchlist
Hypericum kalmianum	Kalm's St. John's-wort	O	O				Watchlist
Liparis liliifolia	lily-leaved twayblade			O			Watchlist
Lobaria quercizans	smooth lungwort	O	O	O	O	O	Watchlist
Myriophyllum tenellum	leafless water milfoil	O	O	O	O	O	Watchlist

MINNESOTA WATCHLIST SPECIES - PLANTS & FUNGI							
Border Lakes, Laurentian Uplands, Nashwauk Uplands, North Shore Highlands, and Toimi Uplands Subsections							
		OCCURRENCE[1]					
SCIENTIFIC NAME	COMMON NAME	BL	LU	NU	NSH	TU	MN RANK[2]
Potamogeton vaseyi	Vasey's pondweed	O	O	O	O	O	Watchlist
Ranunculus gmelinii	small yellow water crowfoot	O	O	O	O	O	Watchlist
Rhynchospora fusca	sooty-colored beak rush	O	O	O	O	O	Watchlist
Sagittaria graminea	grass-like arrowhead	O					Watchlist
Scirpus georgianus	Georgia bulrush	O					Watchlist
Scirpus pedicellatus	woolgrass	O	O	O	O	O	Watchlist
Sparganium glomeratum	clustered bur-reed	O	O	O	O	O	Watchlist
Splachnum ampullaceum	a species of moss	O	O				Watchlist
Tetraplodon angustatus	a species of dung moss	O					Watchlist
Thalictrum revolutum	purple meadow-rue	O					Watchlist
Tomenthypnum falcifolium	curved-leaved golden moss		O				Watchlist
Triglochin palustris	marsh arrowgrass			O			Watchlist
Utricularia gibba	humped bladderwort	O	O	O	O	O	Watchlist
Vitis riparia	wild grape	O					Watchlist

Key to Rare Features Codes In Tables 6.1 to 6.4

[1]Occurrence

O – Documented occurrence in the subsection

[2]MN Rank

END – Endangered. A species is considered endangered if the species is threatened with extinction throughout all or a significant portion of its range within Minnesota.

THR – Threatened. A species is considered threatened if the species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range within Minnesota.

SPC – Special Concern. A species is considered a species of special concern if, although the species is not endangered or threatened, it is extremely uncommon in Minnesota or has unique or highly specific habitat requirements and deserves careful monitoring of its status. Species on the periphery of their range not listed as threatened may be included in this category, along with those species that were once threatened or endangered but now have increasing or protected, stable populations.

Watchlist – Plant or animal species with no legal status, but for which data are being compiled in the Natural Heritage Information System because the species falls into one of the following categories:

The species is being considered for addition to the state list.

The species was removed from the state list but records for the species are still entered and maintained as a precautionary measure.

The species has been recently discovered in the state.

The species is presumed extirpated from the state.

[3]NPC (Native Plant Community) System

Most of the following codes were adapted from native plant community systems in *Field Guide to the Native Plant Communities of Minnesota: the Laurentian Mixed Forest Province*. Exceptions to this, created for the NSU SFRMP and not part of the field guide, include A, AL, AR, LSS, U, and O.

A – Aquatic general **AL** – Aquatic (lake) **AP** – Acid peatland (includes open bogs) **AR** – Aquatic (river) **CT** – Cliff (includes both forested and open) **FD** – Fire dependent forest **FF** – Floodplain forest **FP** – Forested/treed peatland (includes both rich and acid forested/treed peatlands) **LK** – Lakeshore **LSS** – Lake Superior Shore	**MH** – Mesic hardwood forest **MR** – Marsh **O** – Openings (natural and anthropogenic) **OP** – Open rich peatland (includes rich fens) **RV** – River shore **U** – Wide-ranging and/or associated with a wide variety of habitats **WF** – Wet forest **WM** – Wet meadow/carr (patchy graminoid and deciduous shrub on permanently wet, organic soil.)

Minnesota Rare Species Data Copyright and Limitations

Copyright (2014), State of Minnesota, Department of Natural Resources. Rare features data included in this Assessment were provided by the Natural Heritage and Nongame Research Program of the Division of Ecological and Water Resources, Minnesota Department of Natural Resources (DNR), and were

current as of February 2014. These data are not based on an exhaustive inventory of the state. The lack of data for any geographic area shall not be construed to mean that no significant features are present. In addition, there may be inaccuracies in the data, of which the DNR is not aware and shall not be held responsible for. Permission to use these data does not imply endorsement or approval by the DNR of any interpretations or products derived from the data.

Sources for Additional Rare Species Information

The Nature Conservancy. *Element Occurrence Abstracts*

NatureServe. A network connecting science with conservation that includes an online encyclopedia of rare plants and animals. http://www.natureserve.org/

U.S. Department of Agriculture – Forest Service Region 9. Regional Forester *Sensitive Species Conservation Assessment Documents*

Coffin B. and L. Pfannmuller, eds. 1988. *Minnesota's Endangered Flora and Fauna.* University of Minnesota Press, Minneapolis, Minnesota. 473 pp.

MN DNR. 2003. *Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province.* Ecological Land Classification Program, Minnesota County Biological Survey, and Natural Heritage and Nongame Research Program. MN DNR St. Paul, MN. 352 pp.

Minnesota Biological Survey

The Minnesota Biological Survey (MBS) systematically collects information on the distribution and ecology of rare plants, rare animals, native plant communities, and functional landscapes. MBS fieldwork has been completed in some counties and is in progress in other counties and regions within the NSU subsections. See Table 6.5 below for the status of the MBS in the NSU subsections. The SFRMP team will use MBS survey information available in the DNR NHIS database, the DNR data deli, and from other sources. Where MBS survey work is in progress, the SFRMP team will incorporate information into the planning process as it becomes available.

Information on MBS site delineation process and survey procedures can be found on the MBS website at http://www.dnr.state.mn.us/mbs/index.html.

Table 6.5. Status of MBS field surveys and data management in the NSU subsections

Columns in this table display status of field surveys, rare plant data, rare animal data, relevé data, preliminary sites, final sites, and site ranks by county and subsection.

County/Subsection	Field Surveys	Rare Plant Data	Rare Animal Data	Relevé Data	Preliminary Sites	Final Sites	Site Ranking
Border Lakes Subsection - Cook County		<		<		<	<
Border Lakes Subsection - Lake County		<		<		<	<
Border Lakes Subsection - St. Louis County	>>	>>		>>			
Carlton County							
Itasca County							
Koochiching County	>>	>>		>>			
Laurentian Uplands Subsection							
Nashwauk Uplands Subsection							
North Shore Highlands Subsection							
Toimi Uplands Subsection							

Legend for Table 6.5
Work Complete
Work Continuing
< Moderate amount of work to complete
>> Significant amount of work to complete
Work Initiated

Contact: Carmen Converse, **carmen.converse@dnr.state.mn.us,** (651) 296-9782
DNR Data Deli–Department of Natural Resources Data Deli (http://deli.dnr.state.mn.us/)

Special Management Areas

Representative Sample Area (RSA)

Representative Sample Areas (RSA) are required under Forest Stewardship Council (FSC) certification standards. RSAs are ecologically viable examples of native plant community types designated to maintain an ecological reference condition for managed NPC types. Management activities within RSAs must maintain or enhance the ecological condition of the NPC for which the RSA was identified. More information on RSAs can be found in Appendix E in Chapter 9 of this Assessment.

Table 6.6. Representative Sample Areas in the NSU subsections

Columns in this table display subsection, RSA name, acres, NPC type name, NPC Identification number, and State rank.

Subsection	Name	Acres	NPC Type Name	NPC ID	S-rank
North Shore Highlands					
	Cloquet River FDn32d	10.8	Jack Pine - Black Spruce Woodland (Sand)	FDn32d	S2
	Horseshoe Bay	39.8	Spruce - Fir Woodland (North Shore)	FDn32e	S1
	Little Cloquet River FFn57a	TBD	Black Ash - Silver Maple Terrace Forest	FFn57a	S3
Laurentian Uplands					
	Stony Lake	7.7	Jack Pine - Black Spruce Woodland (Sand)	FDn32d	S2

High Conservation Value Forests (HCVF)

High Conservation Value Forests (HCVF) are required under Forest Stewardship Council (FSC) certification standards. HCVFs are broadly defined as areas of outstanding biological or cultural significance. Management activities within HCVFs must maintain or enhance the high conservation values for which the HCVF was identified. DNR HCVFs are in a currently in a candidate status as HCVFs are currently being reviewed by stakeholders prior to final DNR HCVF designation. More information on HCVF can be found at http://www.dnr.state.mn.us/forestry/certification/hcvf.html.

Table 6.7. HCVF in the NSU subsections

Columns in this table display the NSU subsection names, the candidate HCVF names, and the total acreage on all ownerships for each unit.

Subsection	Candidate High Conservation Value Forest	Total Acres (All Ownerships)
Laurentian Uplands	Headwaters	12,525
	Spur End Fen - Osier Creek Lowland Conifers	7,841
	Temperance Pines	2,304
North Shore Highlands		
	Cloquet River Pequaywan	5,684
	Lookout - Egge Hardwood Ridges	1,683
	Lookout Mt. Ridge	712
	Lower Beaver - Fault Line Ridges	989
	Ninemile - Moose - Crooked Lakes and Ridges	1,830
	Onion River Hardwoods	738
	Poplar Agnes	784
	Swamp Lake - Andy Lake Hardwoods	5,390

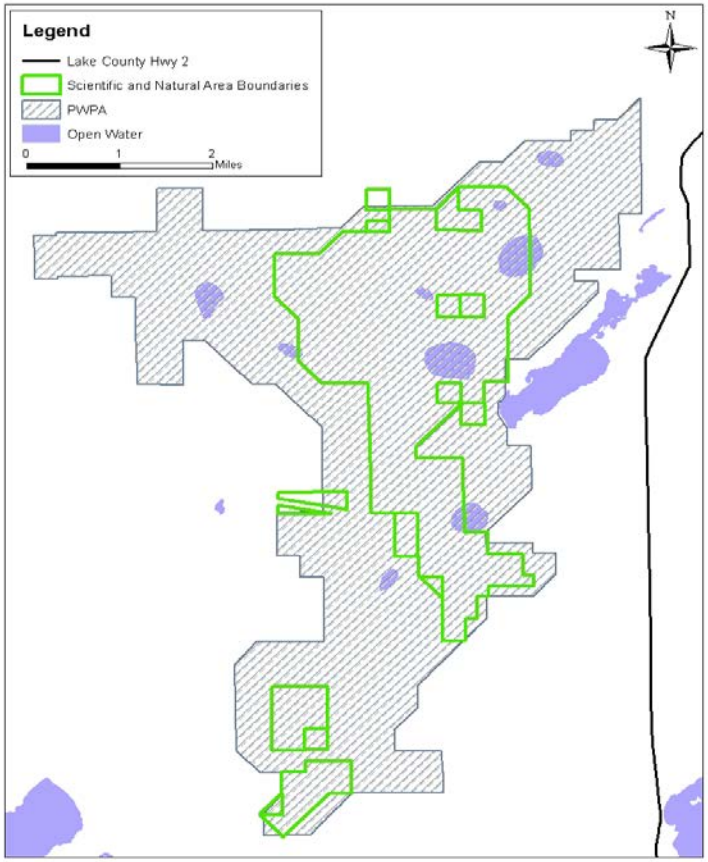
Peatland Watershed Protection Areas

Peatland Scientific and Natural Areas (SNA) and their associated Peatland Watershed Protection Areas (PWPA) were delineated by a Task Force on Peatlands of Special Interest, as described in the 1984 *Recommendations for the Protection of Ecologically Significant Peatlands in Minnesota*. More information can be found in Minnesota State Statues 84.035 and 84.036 and in DNR Rules 6132.200 and 6131.0100. The SFRMP process will not address the management of DNR lands within the boundaries of SNAs; however, it will address the management of PWPAs.

Because of the intimate interdependence between peatland features and the surrounding hydrologic regime, the Task Force on Peatlands of Special Interest recommended a two-level management approach. The processes that perpetuate the peatland ecosystem, as well as plant communities and rare species, are extremely sensitive to changes in water levels and water chemistry. Accordingly, adequate protection of significant peatland features requires

two types of protection. First, the peatland features must be protected directly from onsite physical disturbance. Second, the hydrology of the surrounding peatland area must be sufficiently protected in order to maintain the ecological integrity of the features under special protection. To accommodate this two-level approach, the Task Force defined two management zones; a core preservation zone (the designated peatland SNA) and a peatland watershed protection zone (the PWPA).

Figure 6.1. Map of the Sand Lake Peatland SNA and PWPA



The PWPA is the buffer surrounding the SNA required to maintain the ecological integrity of the SNA. Management in this area should be restricted to those activities unlikely to have a hydrologic impact on the SNA. General recommendations for timber harvest within the PWPA are as follows:

a. Winter harvest only unless silvicultural and ecological requirements dictate otherwise.

b. Standard review procedures (DNR Forest Coordination Framework) apply.

c. No over-the-counter sales or annual plan additions without interdisciplinary review.

d. Strongly discourage creation of new routes where existing routes are present. All winter roads will follow site-level guidelines whether existing or new.

e. Manage for science-based best practices for native plant communities.

f. Consider hydrology in decision making. For example, conduct ecological classification (ECS) on all stands within the WPA being proposed for any action.

The only PWPA in the NSU surrounds the Sand Lake Peatland SNA in the Laurentian Uplands subsection. The PWPA encompasses 13,845 acres.

G1-G2 Native Plant Communities (G1-G2 NPC)

G1-G2 Native Plant Communities (G1-G2 NPC) are ranked as critically imperiled (G1) or imperiled (G2) on a global scale. The protection of viable occurrences of G1-G2 NPCs is required under Sustainable Forestry Initiative (SFI) certification standards. Management activities within G1-G2 NPCs must maintain or enhance the ecological integrity of the NPC. More information on G1-G2 NPCs can be found in Appendix G in Chapter 9, Appendices to this Assessment. MHn45b (White Cedar – Yellow Birch) is the only G1-G2 NPC identified in the NSU subsections.

Table 6.8 G1-G2 NPC (MHn45b) in the NSU subsections

This table lists the three subsections in the NSU that contain the globally imperiled white cedar-yellow birch native plant community; the second and third columns display the number of forest stands and the acreage of each.

Subsection	# of stands	Total Acres
Toimi Uplands	3	20
Laurentian Uplands	8	364
North Shore Highlands	18	259

Management Opportunity Areas

Timber Management Emphasis

Aspen and conifer emphasis areas were delineated in the Border Lakes and North Shore Highlands SFRMPs. A description of their management intent can be found on page A37 of Appendix N from the North Shore SFRMP: http://files.dnr.state.mn.us/forestry/subsection/northshorearea/appendix.pdf

Table 6.9. Timber Management Emphasis Areas in the NSU subsections

The first column in this table lists the North Shore Highlands and Border Lakes subsections; three additional columns list the timber management emphasis areas by name, the number of DNR timber *stands*, and the number of acres in each area, respectively.

Subsection Plan	SMA Name/Code	# of DNR stands	Acres
North Shore Highlands	Aspen Emphasis Areas (AE)	389	8,085
	Conifer Emphasis Areas (CONE)	2,425	43,699
Border Lakes	Conifer Emphasis Areas (CONE)	500	11,692

Wildlife Management Emphasis

Moose and two types of deer habitat management areas (deer yards and general deer management areas) were delineated in the Border Lakes, North Shore, and North 4 SFRMPs. Ruffed grouse management areas were delineated during the same SFRMPs, but have been added to or altered since completion of the plans. A description of the management intent of these wildlife management opportunity areas can be found on page A38 of Appendix N from the North Shore SFRMP: http://files.dnr.state.mn.us/forestry/subsection/northshorearea/appendix.pdf

Table 6.10. Wildlife Management Opportunity Areas in the NSU subsections

The first column in this table lists the North Shore Highlands and Border Lakes subsections, and the North 4 SFRMP area; three additional columns list the wildlife management opportunity areas (formerly called special management areas) by name, the number of DNR timber *stands* in each, and the number of acres in each area.

Subsection Plan	SMA Name/Code	# of DNR stands	Acres
North Shore Highlands	Ruffed Grouse Management Areas (GMAR)	151	7,702*
	Moose Management Areas (MMA)	1,252	21,380
	Deer Management Areas (DMA)	425	10,009
	Deer Management Area, Yard (DMAY)	1	8
Border Lakes	Ruffed Grouse Management Areas (GMAR)*	144	3,655*
	Moose Management Areas (MMA)	20	547
	Deer Management Areas (DMA)	499	9,219
	Deer Management Area, Yard (DMAY)	459	6,753
North 4	Ruffed Grouse Management Areas (GMAR)	269	11,056*

* Includes acres on DNR and non-DNR (e.g. County, USFS) acreage

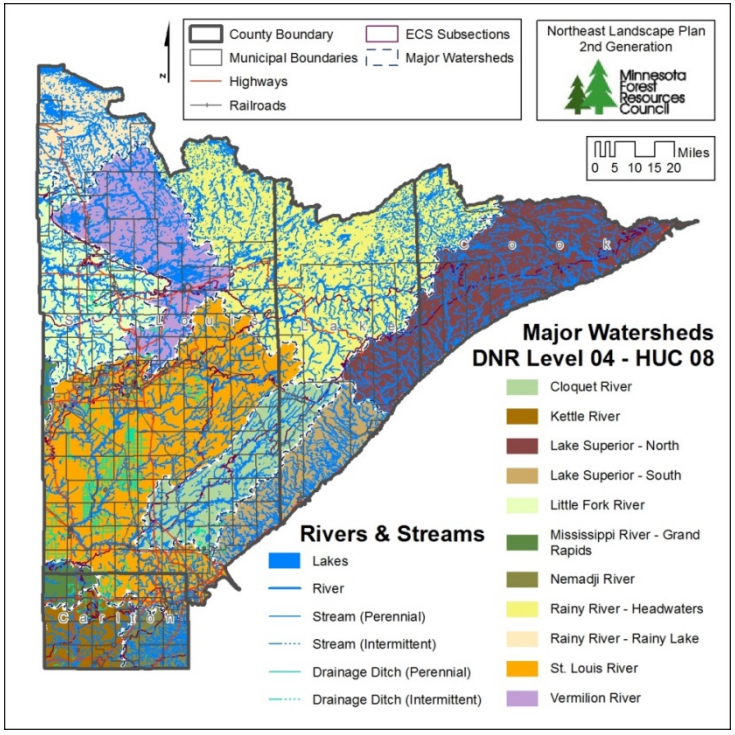
Watershed Assessment

Water quality in lakes and streams

The Northeast Landscape (75 percent of which overlaps the NSU Section) is an area of rich water resources. Water in this region flows north through the Rainy River to Hudson's Bay, east through the Great Lakes to the Atlantic Ocean, and south through the Mississippi River to the Gulf of Mexico These are three of the most important water basins in North America and forestry practices within them can directly affect stream and lake health.

Figure 6.2. Major watersheds in northeastern Minnesota

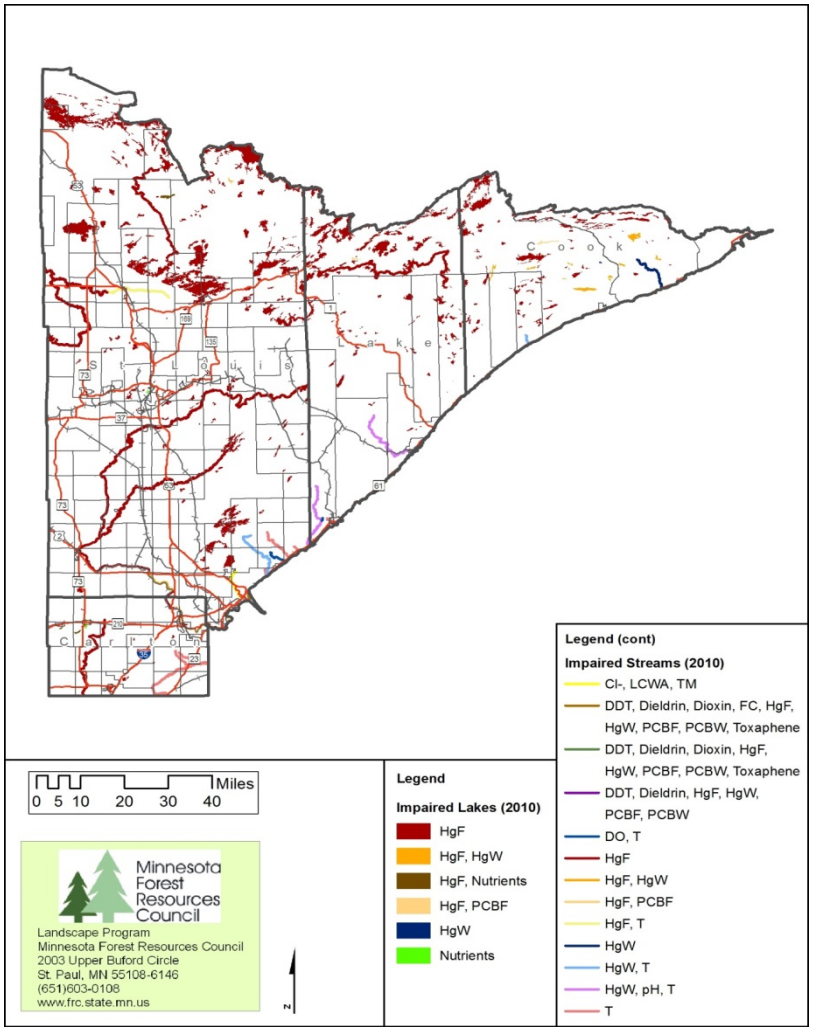
This map from the Minnesota Forest Resources Council Northeast Landscape Plan (2014) displays the major watersheds in the planning area



Minnesota DNR developed the Watershed Health Assessment Framework (WHAF) to provide a comprehensive overview of the ecological health of Minnesota's watersheds. By applying a consistent statewide approach, the WHAF expands understanding of processes and interactions that create healthy and unhealthy responses in Minnesota's watersheds. Health scores are used to provide a baseline for exploring patterns and relationships in emerging health trends. According to Watershed Health Assessment Framework, the waters of northeastern Minnesota are healthier than many other regions of the state; however, all watersheds at the Hydrologic Unit Code (HUC) level 08 have some degree of impairment as do many smaller sub-watersheds and important stream catchments. The Saint Louis River watershed scored lower than the other watersheds in the region

Figure 6.3. Impaired waters in the Northeast Landscape, 2010

This map from the Minnesota Forest Resources Council Northeast Landscape Plan (2014) displays impaired waters in the planning area.



The Minnesota Pollution Control Agency (MPCA) is the state agency responsible for protecting Minnesota's water quality. Water quality standards are fundamental tools that help protect Minnesota's abundant and valuable water resources from pollution. "*Beneficial uses*" are the uses that water resources and their associated aquatic communities provide. Under the federal Clean Water Act, states are required to monitor and assess their waters to determine if they meet water quality standards and thereby support the beneficial uses they are intended to provide. Waters that do not meet their designated uses because of water quality standard violations are impaired. States are then required to develop a list of impaired waters that require Total Maximum Daily Loads (TMDL) studies, and to submit an updated list to the U.S. Environmental Protection Agency every even-numbered year for approval. These studies identify both point and nonpoint sources of each pollutant that fails to meet water quality standards and define how much of the pollutant can be in the surface and/or ground water while still allowing the waterbody to meet its designated uses, such as drinking water, fishing, swimming, irrigation or industrial purposes. Rivers and streams may have several TMDLs, each one determining the limit for a different pollutant. Most of the impaired lakes and streams in the Northeast Landscape are the result of mercury in fish tissue

More information about impaired waters in Minnesota can be found at www.pca.state.mn.us/index.php/water/water-types-and-programs/minnesotas-impaired-waters-and-tmdls/minnesotas-impaired-waters-and-total-maximum-daily-loads-tmdls.html

In 2008, the MPCA adopted a watershed approach to restoring and protecting

Minnesota's rivers, lakes, and wetlands that complements its work on impaired waters. This watershed approach was recommended by Minnesota's Clean Water Council and directed by the Minnesota Legislature. This approach centers on intensive monitoring of each of Minnesota's 81 major watersheds on a continuous 10-year cycle. A primary product of this effort is the development and application of a Watershed Restoration and Protection Strategy (WRAPS) that contains strategies and actions designed to achieve and maintain water quality standards and goals. Partnerships with state agencies (including DNR) and various local units of government are critically necessary to the development and implementation of the WRAPS. More information about WRAPS can be found at http://www.pca.state.mn.us/index.php/water/water-types-and-programs/surface-water/watershed-approach/index.html

Forest cover and water quality

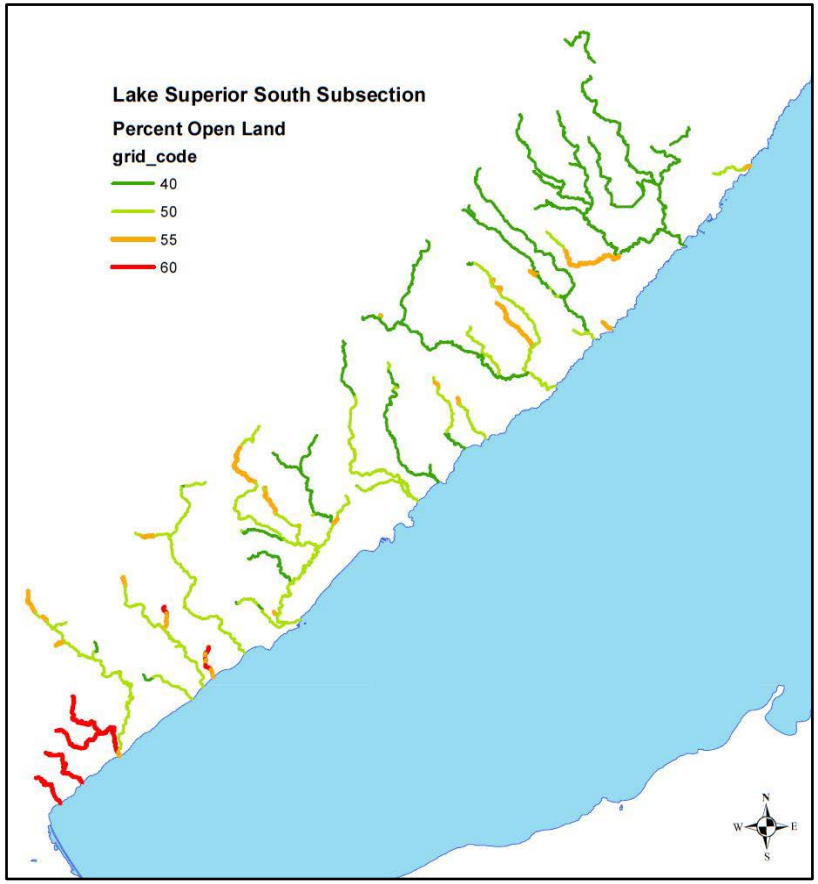
Forestlands can be a great storm filter and are a key component in sustaining high quality water and hydrology. Forests buffer pounding rains and hold soil in place which allows moisture to seep into the ground water and therefore reduce erosion and unwanted runoff. Beyond just having forested cover, the age distribution of forests within a watershed, can have an impact on water quality through effects on peak flows, loss of base flow, sedimentation and erosion, turbidity, nutrient levels, and water temperatures. These effects in turn can impact the health and distribution of fish and invertebrates within the watershed.

Changes in vegetation cover from forestland to farmland or young forest can cause snow to melt faster and allow rainfall to reach streams faster. These changes may not have an impact on peak flows during large flood events, but they do impact smaller peak flow events as well as annual peak flows. These impacts begin to appear as the percentage of open land or young forest within a watershed rises above 60% (Verry, 2000; *Land Fragmentation and Impacts to Streams and Fish in the Central and Upper Midwest*; Society of American Foresters).

Minnesota DNR Fisheries and Ecological & Water Resources and the EPA's Mid-Continent Ecology Division in Duluth have initiated work to identify points within watersheds in the southern portion of the Lake Superior basin that may be at risk due to impacts related to the amount of open land/young forest within the watershed. This work will inform forest management decisions within potentially impacted watersheds and possible outcomes of this use may include reforestation efforts in locations where such work can reduce the percentage of open land/young forest below the impact threshold, and coordination of timber sale activity across land ownerships to avoid increasing the amount of young forests at points within watersheds known to be at or above the impact threshold.

Figure 6.4. Percent open land in southern Lake Superior watersheds

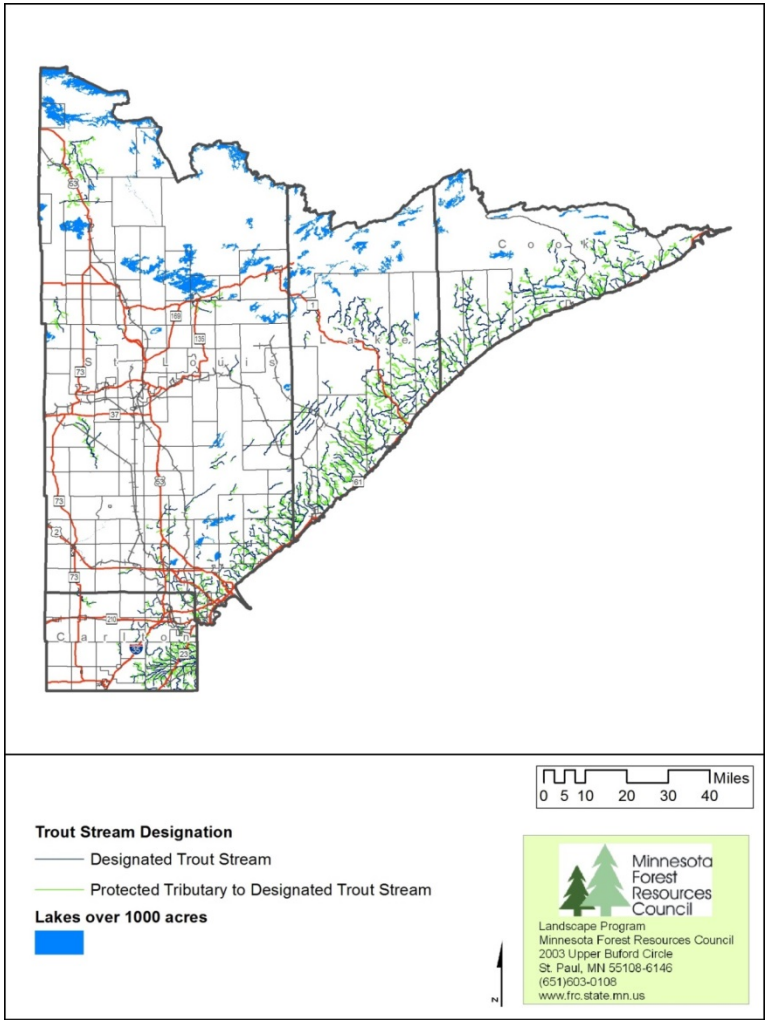
This map is taken from Figure 3.31 in the MFRC NE Landscape Plan Conditions and Trends (2014)



Following appropriate management practices in these riparian areas as outlined in the MFRC Voluntary Site-Level Forest Management Guidelines will contribute to keeping Northeast Minnesota's lakes, rivers, wetlands and fisheries healthy. These healthy forests maintain high quality aquatic systems such as cold water trout streams through shading and water temperature maintenance, erosion and nutrient loading reduction, and providing course woody debris and structural cover. The Northeast Landscape contains 2,153 miles of designated trout streams and an additional 1,270 protected tributaries to designated trout streams (See Figure 6.13).

Figure 6.5. Designated trout streams and protected tributaries in the Northeast Landscape

This map is taken from Figure 3.31 in the MFRC NE Landscape Plan Conditions and Trends (2014).



MFRC Voluntary Site-Level Forest Management Guidelines are available at:

www.frc.state.mn.us/documents/council/site-level/MFRC_FMG&Biomass_2007-12-17.pdf

Patch Assessment

There is broad consensus among scientists that managed forest landscapes are more fragmented and contain fewer large patches currently, than landscapes where spatial patterns are determined primarily by natural disturbance and physical factors. It is estimated that the average overall patch size has declined nearly 50 percent since the 1930s in northeastern and north-central Minnesota (Northern Superior Uplands and Drift and Lakes Plains sections).[1,2] Stand selection and treatment as part of the SFRMP process can significantly reduce forest habitat fragmentation and maintain and promote larger patches over time. The best available information on natural spatial patterns in these subsections was used as a guide to understanding the distribution of patch sizes, cover-type groupings, and age classes for patch management on state lands.[3] Although this plan considered management activities on other ownerships, patch management primarily focuses on identifying opportunities that exist on state land.

To guide patch management on state lands, *a **patch** is defined as one or more adjoining stands that is relatively homogenous in structure, primarily in height and density, and is similar in vegetation cover and age*. *A **future patch** is defined as a group of adjoining stands that do not currently meet the patch definition, but that will be managed to enhance patch attributes over time.*

Patches are defined by age, size, and general cover-type grouping; Patch ages are defined as old, intermediate, and young with an age range by category dependent on cover type. Patch sizes range from small (less than 40 acres) to large (greater than 640 acres). Patches may have smaller areas (e.g., 10-15 percent of the patch area) within them that are not in the same patch category as the main patch, such as inclusions, residual islands, legacy patches, corridors, and buffers.

Using Cooperative Stand Assessment (CSA) forest inventory data, the DNR Division of Forestry conducted an initial (current – 2014) patch assessment for state lands in these subsections. Patches were created in a GIS data layer by dissolving common stand boundaries between stands of the same cover-type group and age class. This initial patch assessment information was used as one of the tools for delineating the *current* patches on state lands in these subsections.

[1] Manolis, J. December 2003. *Project Summary: Results from the Minnesota Spatial Analysis and Modeling Project*. Minnesota Forest Resources Council and Minnesota DNR.
[2] MFRC. March 2003. *Recommended Desired Outcomes, Goals, and Strategies: Northeast Landscape Region*. Minnesota Forest Resources Council Landscape Program, Northeast Regional Landscape Committee.

Table 6.11. Patch size groupings for SFRMP

The first column lists the six size classes of patch in SFRMPs, and the second column lists the acreage range for each patch class.

Size Class	Acre Range
Class 0	>1,501
Class 1. Large	641 - 1,500
Class 2.	251 - 640 acres
Class 3	101 - 250 acres
Class 4	41 - 100 acres
Class 5. Small	< 40 acres

Figure 6.6. Current (2014) acres in each of five patch size classes by forest cover type group

The following four bar charts display the acres in size classes 0-5 for young, intermediate, and old patches in four cover type groupings: lowland hardwoods, lowland conifers, upland hardwoods, and upland conifers. *Data source: FIM 1(a) Northern Superior Uplands.*

Climate Change

Forest ecosystems in northern Minnesota are affected by climate change, and will continue to be throughout the timeframe of this plan. Although the impacts of climate change on a specific location will be influenced by variety of factors, including site conditions, forest health, and past management, forest systems which are adapted to a narrow range of conditions or contain few tree species are expected to be more vulnerable than communities adapted to a wide range of conditions or those with higher tree diversity. In general, projected climate change is likely to lead to declines in suitable habitat conditions for the region's boreal species like balsam fir, black spruce, and quaking aspen while suitable habitat conditions for species adapted to warmer climates like oaks may increase. Vulnerability determinations for Native Plant Community Systems (see page 6.6 in this chapter, and Appendix B in Ch. 9 of this assessment) range from low-moderate (Floodplain Forests) to high (Wet Forests, Forested Rich Peatlands, and Acid Peatlands) although local characteristics may amplify or buffer these predicted vulnerabilities. Additionally, the secondary effects of climate change, such as longer growing seasons or increased insect pest activity, may create new beneficial or stressful interactions.

Table 6.12. Climate change vulnerability determination summaries

Information in this table is taken from analysis in the Minnesota Forest Ecosystem Vulnerability Assessment and Synthesis produced by the Northern Institute of Applied Climate Science.

Climate change vulnerability determination summaries for the forest systems analyzed in the Minnesota Forest Ecosystem Vulnerability Assessment and Synthesis produced by the Northern Institute of Applied Climate Science.

Forest System	Potential Impacts	Adaptive Capacity	Vulnerability	Evidence	Agreement
Fire-Dependent Forest	Negative	Moderate-High	Moderate	Medium	Medium
Mesic Hardwood Forest	Moderate	Moderate-High	Moderate	Medium	Medium
Floodplain Forest	Moderate-Positive	Moderate	Low-Moderate	Limited-Medium	Medium
Wet Forest	Negative	Low	High	Limited-Medium	Medium
Forested Rich Peatland	Negative	Low	High	Medium	Medium-High
Acid Peatland	Negative	Low	High	Medium	Medium-High
Managed Aspen	Moderate-Negative	Moderate	Moderate-High	Medium	High
Managed Red Pine	Moderate-Negative	Moderate-Low	Moderate-High	Medium	Medium

Source: Handler et al. 2013; Forest Ecosystem Vulnerability Assessment and Synthesis (FEVAS)

Note: More information on native plant communities can be found at: www.dnr.state.mn.us/npc/classification.html

Table 6.13. Potential changes in suitable habitat for merchantable tree species

Predicted declines, increases, and mixed changes in forest tree species habitats in the NSU subsections based on climate change modeling scenarios. Data source is the Minnesota Forest Ecosystem Vulnerability Assessment and Synthesis produced by the USFS Northern Institute of Applied Climate Science.

	Tree Species	Model Predictions
Decline	Balsam Fir	Decrease to Large Decrease
	Balsam Popular	Large Decrease
	Black Spruce	Large Decrease
	Northern White Cedar	Decrease to Large Decrease
	Quaking Aspen	Decrease to Large Decrease
	Tamarack	Decrease
	White Spruce	Decrease
Increase	American Elm	Increase to Large Increase
	Bitternut Hickory	Large Increase
	Boxelder	Increase to Large Increase
	Eastern Cottonwood	Increase to Large Increase
	Eastern White Pine	Increase
	Northern Pin Oak	Large Increase
	Red Maple	Increase
	Silver Maple	Large Increase
	Sugar Maple	Increase to Large Increase
	White Ash	Large Increase
	White Oak	Large Increase
Mixed Results	American Basswood	No Change to Increase
	Bigtooth Aspen	No Change to Decrease

	Tree Species	Model Predictions
	Black Ash	No Change to Decrease
	Bur Oak	No Change to Increase
	Green Ash	No Change to Large Increase
	Jack Pine	No Change to Decrease
	Northern Red Oak	No Change to Increase
	Paper Birch	No Change to Large Decrease
	Red Pine	No Change to Increase
	Yellow Birch	Decrease to Large Increase

For more information on climate change in northeastern Minnesota, please refer to Appendix F of the MFRC Northeast Landscape Plan, the Forest Ecosystem Vulnerability Assessment and Synthesis (FEVAS), and Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers (FAR) at www.nrs.fs.fed.us/niacs/.