Appendix A
Northeast Landscape Planning Committee

This section provides an overview of the people involved with the Northeast Landscape Plan Revision.

A. Northeast Landscape Planning Committee Members

The Northeast Landscape Plan Revision involved a large number of people representing a wide range of interests. The following list includes committee members arraigned alphabetically by last name. In addition to those on this list, there were many others who supported the effort in various ways.

Committee Member	Organization	Committee Member	Organization
John Bathke	Private Landowner	Tim O'Hara	Minnesota Forest Industries
Greg Bernu	Carlton County	Paul Ojanen	North St. Louis County SWCD
Bruce Carlson	DNR - Eco. and Water Res.	Steve Olson	Fond du Lac Band
Dave Chura	MN Logger Education Program	Steve Persons	DNR - Fisheries
Paul Dubuque	DNR - Forestry	Tim Quincer	DNR - Wildlife
Chris Dunham	The Nature Conservancy	Lisa Radosevich-Craig	USFS - Superior NF
Gary Erickson	Sappi	Matt Radzak	Minnesota Power
Jim Hall	Cook County SWCD	Mark Reed	St. Louis County
George Host	UMD - Natural Resources Research Inst.	Mike Reichenbach	U of M - Extension
Michael Jimenez	USFS - Superior NF	Paul Sandstrom	Laurentian RC&D
Duane Lula	Citizen	Peter Taylor	USFS - Superior NF
Jim Manolis	DNR - Operations Services	Doug Thompson	The Nature Conservancy
Brad Matlack	Carlton County SWCD	Molly Thompson	Sugarloaf: North Shore Stewardship Assoc.
Mary McDermid	Private Landowner	Eric Todd	Packaging Corp. - Boise
Bill Nixon	Lake County	Mark Westphal	Carlton County
Lois Norrgard	Sierra Club	Mike Young	DNR - Forestry

B. Northeast Landscape Planning Subcommittee Members

In March 2014 the Northeast Landscape Planning Committee decided to postpone the public comment period to allow for further committee input on the document. The Committee requested that this work be accomplished by a Subcommittee of the Northeast Planning Committee. This subcommittee met six times to review this document prior to presenting it to the full Planning Committee. The following table indicates participants in this Subcommittee Plan Review Process.

Subcommittee Member	Organization	Subcommittee Member	Organization
John Bathke	Private Landowner	Tim Miller	Grand Portage Band
Greg Bernu	Carlton County	Tim O'Hara	Minnesota Forest Industries
Bruce Carlson	DNR - Eco. and Water Res.	Steve Olson	Fond du Lac Band
Dave Chura	MN Logger Education Prog.	Steve Persons	DNR - Fisheries
Paul Dubuque	DNR - Forestry	Tim Quincer	DNR - Wildlife
Chris Dunham	The Nature Conservancy	Paul Sandstrom	Laurentian RC&D
Gary Erickson	Sappi	Peter Taylor	USFS - Superior NF
George Host	UMD - Natural Resources Research Inst.	Molly Thompson	Sugarloaf: North Shore Stewardship Assoc.
Duane Lula	North Shore Forest Collaborative	Mike Young	DNR - Forestry
Jim Manolis	DNR - Management & Budget Services		

C. Staff Supporting the Northeast Landscape Plan Revision

Minnesota Forest Resource Council
- Dave Zumeta, Executive Director
- Lindberg Ekola, Landscape Program Manager
- Michael Lynch, Landscape Stewardship Forester
- Clarence Turner, Forest Planner
- Jeff Reinhart, GIS Coordinator
- Rachael Nicoll, Information Specialist
- Leslie McInenly, Information Specialist

University of Minnesota Boreal Forest and Community Resilience Project (participated in the initial stages of the plan revision)
- Emily Peters, Research Associate
- Kris Johnson, Research Associate
- Sarah Crow, Program Coordinator
- Cindy Zerger, Research Fellow
- Carissa Schively-Slotterbach, Associate Professor Humphrey School of Public Affairs
- Peter Reich, Regents Professor, Department of Forest Resources

Appendix B
Glossary

Age Class. An interval into which the age range of trees or forest stands is divided for classification or use (e.g., 0-10 years, 10-20 years, etc.). (DNR-SFRMP Definitions)

Age Class Distribution. The proportionate amount of various age classes of a forest or forest cover type within a defined geographic area (e.g., ECS subsection). (DNR-SFRMP Definitions)

Asset. A benefit or strength that enables progress towards Desired Future Conditions.

Average Annual Mortality of Growing Stock. Volume of growing stock trees that were alive at the time of the previous inventory and are dead in the current inventory. Tree death associated with insects, disease, fire, animals, weather, and other factors are included. (FIA Definitions)

Average Annual Net Growth. The average annual change in the volume of trees during the period between inventories. Components include the change in volume of trees that have met the minimum size requirements over the inventory period, plus the volume of trees reaching the minimum size (≥ 5.0 inches dbh) during the period (ingrowth), minus the volume of trees that died during the period, minus the volume of cull during the period. Mortality removals (trees killed in the harvesting process and left on site) and diversion removals (trees removed from the forest-land base due to a change from forest to non-forest land) are not included. (FIA Definitions)

Average Annual Removals of Growing Stock. Trees that were growing-stock trees on timberland at the time of the previous inventory and were removed from timberland by the time of the current inventory. Removals are cut and utilized trees, trees killed as a result of harvest operations but not utilized and live trees associated with land-use reclassifications. (FIA Definitions)

Basal Area. The cross-sectional area of a tree taken at the "base" of the tree (i.e., measured at 4.5 feet above the ground). Basal area is often used to measure and describe the density of trees within an geographic area using an estimate of the sum of the basal area of all trees cross-sectional expressed per unit of land area (e.g., basal area per acre). (DNR-SFRMP Definitions)

Biological Diversity. The variety and abundance of species, their genetic composition, and the communities and landscapes in which they occur, including the ecological structures, functions, and processes occurring at all of these levels. (Minnesota Statute Chapters 89 and 89A. Sustainable Forest Resources Act).

Coordination Committee. Portion of the Northeast Landscape Committee which will be responsible for coordinating the implementation of the Northeast Landscape Forest Resources Plan. This group is composed of a diversity of stakeholders representing the range of interests and ownerships in the region (MFRC Northeast Planning Committee).

Cover Type. Expressed as the tree species having the greatest presence (i.e., in terms of volume for older stands or number of trees for younger stands) in a forest stand. (DNR-SFRMP Definitions)

Crosswalk Table. A crosswalk table is a kind of table that allows for references to be built that allows the way data is categorized and stored in one database to be matched up with data in another database.

Desired Non-Native Species. Those species of plants or animals that are not indigenous to an area but wanted for their contribution to high social, economic, or cultural value. (USDA – Forest Service, Superior National Forest Plan)

Ecological Classification System (ECS). A method to identify, describe, and map units of land with different capabilities to support natural resources. This is done by integrating climatic, geologic, hydrologic, topographic, soil, and vegetation data. (DNR-SFRMP Definitions)

Even Aged. A forest stand composed of trees of primarily the same age or age class. A stand is considered even-aged if the difference in age between the youngest and oldest trees does not exceed 20 percent of the rotation age (e.g., for a stand with a rotation age of 50 years, the difference in age between the youngest and oldest trees should be 10 years). (DNR-SFRMP Definitions)

Forest Health. The perceived condition of a forest derived from concerns about such factors as its age, structure, composition, function, vigor, presence of unusual levels of insects and disease, and resilience to disturbance—*note* perception and interpretation of forest health are influenced by individual and cultural viewpoints, land management objectives, spatial and temporal scales, the relative health of the stands that comprise the forest, and the appearance of the forest at a point in time. ("The Dictionary of Forestry", John A. Helms, editor, Society of American Foresters.).

Forestland. Land at least 10-percent stocked by trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated. Forest land includes transition zones, such as areas between heavily forested and non-forested lands that are at least 10-percent stocked with trees and forest areas adjacent to urban and built-up lands. The minimum area for classification of forest land is 1 acre and 120 feet wide measured stem-to-stem from the outer-most edge. Unimproved roads and trails, streams, and clearings in forest areas are classified as forest if less than 120 feet wide. Forest land includes three sub-categories: timberland, reserved forestland, and other forestland. (FIA Definitions)

Forest Management. The regeneration, management, utilization, and/or conservation of forests to meet specific goals and objectives ("The Dictionary of Forestry", John A. Helms, editor, Society of American Foresters.).

Forest Resources. Those natural assets of forest lands, including timber and other forest crops; biological diversity; recreation; fish and wildlife habitat; wilderness; rare and distinctive flora and fauna; air; water; soil; climate; and educational, aesthetic, and historic values (Minnesota Statute Chapters 89 and 89A. Sustainable Forest Resources Act).

Forest Stand. A group of trees occupying a given area and sufficiently uniform in species composition, age, structure, site quality, and condition so as to be distinguishable from the forest on adjoining areas. (DNR-SFRMP Definitions)

Forest Spatial Patterns. The size, shape and arrangement of landscape patches. Patches may be any feature that can be mapped such as: Forest types, habitats, and vegetation communities; Landforms, soils, and aquatic systems; or Disturbances – both natural and human caused (MN DNR – Jim Manolis):

Fragmentation. Changes across a landscape that break large continuous areas of a particular land cover (e.g. forest) into smaller isolated patches. (Michael Kilgore, U of MN)

Growing Stock. All live trees of commercial species that meet minimum merchantability standards (at least 5 inches d.b.h.). In general, these trees have at least one solid 8-foot section, are reasonably free from defect on the merchantable bole, and at least 34% or more of the volume is merchantable. Excludes rough or rotten cull trees. (FIA Definitions)

Issue. A problem, challenge, or unresolved conflict that requires resolution to improve progress towards Desired Future Conditions.

Multiple Use. The principle of forest management by which forest resources are utilized in the combinations that will best meet the needs of the people of the state; including the harmonious and coordinated management of the forest resources, each with the other, without impairment of the productivity of the land and with consideration of the relative values of the resources, and not necessarily the combination of uses resulting in the greatest economic return or unit output. (Minnesota Statute Chapters 89 and 89A. Sustainable Forest Resources Act).

Old Growth Forests. Forests defined by age, structural characteristics, and relative lack of human disturbance. These forests are essentially free from catastrophic disturbances, contain old trees (generally over 120 years old), large snags, and downed trees. Additional detail on the management of old growth forests on DNR-administered lands are contained in *Old Growth Guidelines* (1994). (DNR-SFRMP Definitions)

Other Forestlands. Lands not capable of producing industrial wood at a sufficient rate. Relatively little of the forestland in the Northeast (3.6%) is 'other forestland'. (FIA Definitions)

Natural Area. A physical and biological area in nearly natural condition that exemplifies an ecological community and its associated vegetation and other biotic, soil, geologic and aquatic features. ("The Dictionary of Forestry", John A. Helms, editor, Society of American Foresters.)

Native Species. An indigenous species that is normally found as part of a particular ecosystem. ("The Dictionary of Forestry", John A. Helms, editor, Society of American Foresters.)

Parcelization. An increase in the number of land parcels in a given area (e.g. fragmentation of land ownership). Fragmentation does not necessarily result in parcelization and vice versa. (Michael Kilgore, U of MN)

Planning Committee. Portion of the Northeast Landscape Committee which participated in the revision process. This group was composed of a diversity of stakeholders representing the range of interests and ownerships in the region (MFRC Northeast Planning Committee).

Prescribed Burning. To deliberately burn wildlands (e.g., forests, prairie or savanna); in either their natural or their modified state) and under specified conditions within a predetermined area to meet management objectives for the site. (DNR-SFRMP Definitions)

Prescription. A written statement that specifies the practices to be implemented in a forest stand to meet management objectives. These specifications reflect the desired future condition at the site and landscape level and incorporate knowledge of the special attributes of the site. (DNR-SFRMP Definitions)

Range of Natural Variation Analysis (RNV). The Range of Natural Variation analysis is a method in which current forest age structure and composition are compared with the range of conditions that would exist under natural disturbances regimes. The RNV concept can be used for understanding ecosystems, ecosystem changes, and for assessing the effects of proposed management. (NRRI – study prepared for the MFRC's NE Landscape)

Reforestation. The process of natural or artificial forest regeneration, including securing seed, growing seedlings, preparing sites, planting seed, planting trees, removing deleterious growth and underbrush and other activities related to forest regeneration. (Minnesota Statute Chapters 89 and 89A. Sustainable Forest Resources Act).

Regeneration. The act of renewing tree cover by establishing young trees naturally(e.g., stump sprouts, root suckers, natural seeding) or artificially (e.g., tree planting, seeding). (DNR-SFRMP Definitions)

Regionally and Globally Significant Areas. Definition pending

Reproduction. Young stands of commercial tree species ranging from one foot high to 4.9 inches diameter at 4-1/2 feet above the ground and at least ten percent stocked. (Minnesota Statute Chapters 89 and 89A. Sustainable Forest Resources Act).

Reserved Forestland. Lands on which timber harvest is prohibited by statute or administrative regulation. (FIA Definitions)

Riparian Areas. The area of land and water forming a transition from aquatic to terrestrial ecosystems along streams, lakes, and open water wetlands. (DNR-SFRMP Definitions)

Rotation Age. The period of years between when a forest stand (i.e., primarily even-aged) is established (i.e., regeneration) and when it receives its final harvest. This time period is an administrative decision based on economics, site condition, growth rates, and other factors. (DNR-SFRMP Definitions)

Sampling Error Percent (FIA). Equals 100 multiplied by the square root of the variance divided by the sample estimate. Since sampling error is given in percent of the estimate, a large sampling error indicates that there is considerable uncertainty associated with the estimate. (FIA Definitions)

Silviculture. The theory and practice of controlling the establishment, composition, growth, and quality of forest stands to achieve certain desired conditions or management objectives. (DNR-SFRMP Definitions)

Spatial Analysis. The mapping and measuring of spatial patterns in a landscape or given area. (MN DNR – Jim Manolis)

Strategy. Strategies are general approaches or methods to accomplish the vegetative management goals which ultimately move the landscape toward achieving the overall vision or desired future conditions. Strategies provide land managers with written descriptions of the general tools and techniques suggested to accomplish the goals and provide a basis for the further development of the appropriate tactical methods.

Subsection. A subsection is one level within the Ecological Classification System (ECS). From largest to smallest in terms of geographic area, the ECS is comprised of the following levels: Province > Section > Subsection > Land Type Association > Land Type > Land Type Phase. Subsections are generally 1-4 million acres in size in Minnesota, with the average being 2.25 million acres. Seventeen subsections are scheduled for the SFRMP process (see subsection map and SFRMP schedule). (DNR-SFRMP Definitions)

Subsection Forest Resource Management Plans (SFRMP). A DNR plan for vegetation management on forest lands administered by DNR Forestry and Wildlife that uses ECS subsections as the basic unit of delineation. Initial focus will be to identify forest stands and road access needs for the duration of the seven-year plan. There is potential to be more comprehensive in the future. (DNR-SFRMP Definitions)

Sustainable. Meeting the needs of the present without compromising the ability of future generations to meet their own needs (Minnesota Statute Chapters 89 and 89A. Sustainable Forest Resources Act).

Sustainable Hydrology. Maintaining stable stream bankfull flow rates for 1.5 year average return interval runoff events (Proceedings of the MN Lake Superior Watershed Stream Science Symposium - 2014).

Sustained Yield. The principle of forest management for the achievement and maintenance in perpetuity of a high-level annual or regular periodic output of forest resources without impairment of the productivity of the land; allowing for periods of intensification of management to enhance the current or anticipated output of one or more of the resources. (Minnesota Statute Chapters 89 and 89A. Sustainable Forest Resources Act).

Thinning. A silvicultural treatment made to reduce the density of trees within a forest stand primarily to improve growth, enhance forest health, or recover potential mortality (e.g., selective thinning, row thinning, etc.). (DNR-SFRMP Definitions)

Timber. Trees that will produce forest products of value, whether standing or down, and including but not limited to logs, bolts, pulpwood, posts, poles, cordwood, lumber and decorative material. (Minnesota Statute Chapters 89 and 89A. Sustainable Forest Resources Act).

Timberland. Forest land that is producing or is capable of producing crops of industrial wood and not withdrawn from timber utilization by statute or administrative regulation. (Note: Areas qualifying as timberland are capable of producing in excess of 20 cubic feet per acre per year of industrial wood in natural stands. Currently inaccessible and inoperable areas are included, but these likely are a very small number of acres.) (FIA Definitions)

Watershed Health. Conditions which lead to functional and sustainable biology, connectivity, geomorphology, hydrology, and water quality (MN DNR – Ecological and Water Resources Division).

Appendix C
Bibliography

This section will be developed further to include web links to the following documents in the final document. Links to all of the listed documents can currently be found in Part 1 of the plan or accessed directly on the MFRC Northeast Landscape website (http://mn.gov/frc).

Reference documents ordered as they appear in the Northeast Landscape Plan:

- Systems Mapping
- Trends Exploration
- Resource Atlas
- Demographic Data Report
- Conditions and Trends Report
- Geospatial Modeling of Native Plant Communities of Minnesota's Laurentian Mixed Forest'
- UMD Labovitz School of Business and Economics reports
- Growing Stock Mortality in Northeast Landscape Timberland
- Forest Ecosystem Vulnerability Assessment and Synthesis (FEVAS)
- Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers (FAR).
- Presentations
- Forest Policy Inventory Report

Additional reports

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Appendix D
Native Plant Community Supplement

This section summarizes the ecological classification system used in this plan. For additional information see the Field Guide to Native Plant Communities of Minnesota, MN DNR 2003 or visit www.dnr.state.mn.us/ecs/index.html

A. Native Plant Communities (NPC)

A **native plant community** is a group of native plants that interact with each other and with their environment in ways not greatly altered by modern human activity or by introduced organisms. These groups of native plant species form recognizable units, such as hardwood forests, pine forests, or marshes, that tend to repeat over space and time. Native plant communities are classified and described by considering 1) vegetation, 2) hydrology, 3) landforms, 4) soils, and 5) natural disturbance regimes. Examples of natural disturbances include: wildfires, severe droughts, windstorms, and floods.

Sometimes referred to as native habitats or natural communities, native plant communities are named for the characteristic plant species within them or for characteristic environmental features. Examples of native plant communities in the Northeast Landscape include Northern Mesic Mixed Forest, Northern Poor Dry-Mesic Mixed Woodland, Northern Mesic Hardwood Forest, and Northern Rick Spruce Swamp. There are many kinds of vegetated areas that are not native plant communities. These include places where native species have largely been replaced by exotic or invasive species such as smooth brome grass, buckthorn, and purple loosestrife, and planted areas such as orchards, pine plantations, golf courses, and lawns. Other areas not considered to be native plant communities include areas where modern human activities such as farming, overgrazing, non-sustainable logging, and development have greatly altered the vegetation.

More information on NPC Classes can be found in the *'Field Guide to the Native Plant Communities of Minnesota'* or at www.dnr.state.mn.us/npc/classification.html

Native Plant Community Classification

In 2003, researchers in the Minnesota Department of Natural Resources (DNR) completed a classification of the native vegetation of Minnesota, Minnesota's Native Plant Community Classification (Version 2.0). The DNR's classification system is intended to provide a framework and common language for improving our ability to manage vegetation, to survey natural areas for biodiversity conservation, to identify research needs, and to promote study and appreciation of native vegetation in Minnesota. Version 2.0 of the DNR's native plant community classification is based strongly on plant species composition and was developed through analysis of extensive field data collected from sample plots in forests, prairies, wetlands, and other habitats. The classification is hierarchical, with vegetation units

described at levels ranging from broad landscape-level ecological systems to local communities (Table 3). One of the most important features of the new classification is the inclusion of ecological processes as an organizing principle.

The NPC classification has six levels (Table 3). **System Groups**, the highest level, were created to allow development of manageable field keys for lower levels of the classification. System Groups were formed by combining lower levels of the classification along major physiognomic and hydrologic splits in vegetation. **Ecological Systems** are groups of native plant communities that are unified by strong influence from a major ecological process or set of processes, especially nutrient cycling and natural disturbances. **Floristic Regions** are divisions within Ecological Systems that reflect the distribution of Minnesota's plant species into characteristically northern, northwestern, central, and southern groups, or floras. The important influences on these species distributions appear to be climate and paleohistory. **Native Plant Community Classes** are units of vegetation that generally have uniform soil texture, soil moisture, soil nutrients, topography, and disturbance regimes. For wooded vegetation, Native Plant Community Classes were developed by emphasizing understory vegetation more than canopy trees, under the hypothesis that in much of Minnesota understory plants are often more strongly tied to specific habitat conditions (such as levels of nutrients and moisture) than are canopy trees. **Native Plant Community Types** are defined by dominant canopy trees, variation in substrate, or fine-scale differences in environmental factors such as moisture or nutrients. Type distinctions were also made to describe geographic patterns within a Class. **Native Plant Community Subtypes** are based on finer distinctions in canopy composition, substrates, or other environmental factors. In some instances, Subtypes represent apparent trends within a Type for which more study and collection of data are needed. In other instances Subtypes are well-documented, fine-scale units of vegetation that are useful for work such as rare plant habitat surveys.

Table 3. Native Plant Community (NPC) classification hierarchy.

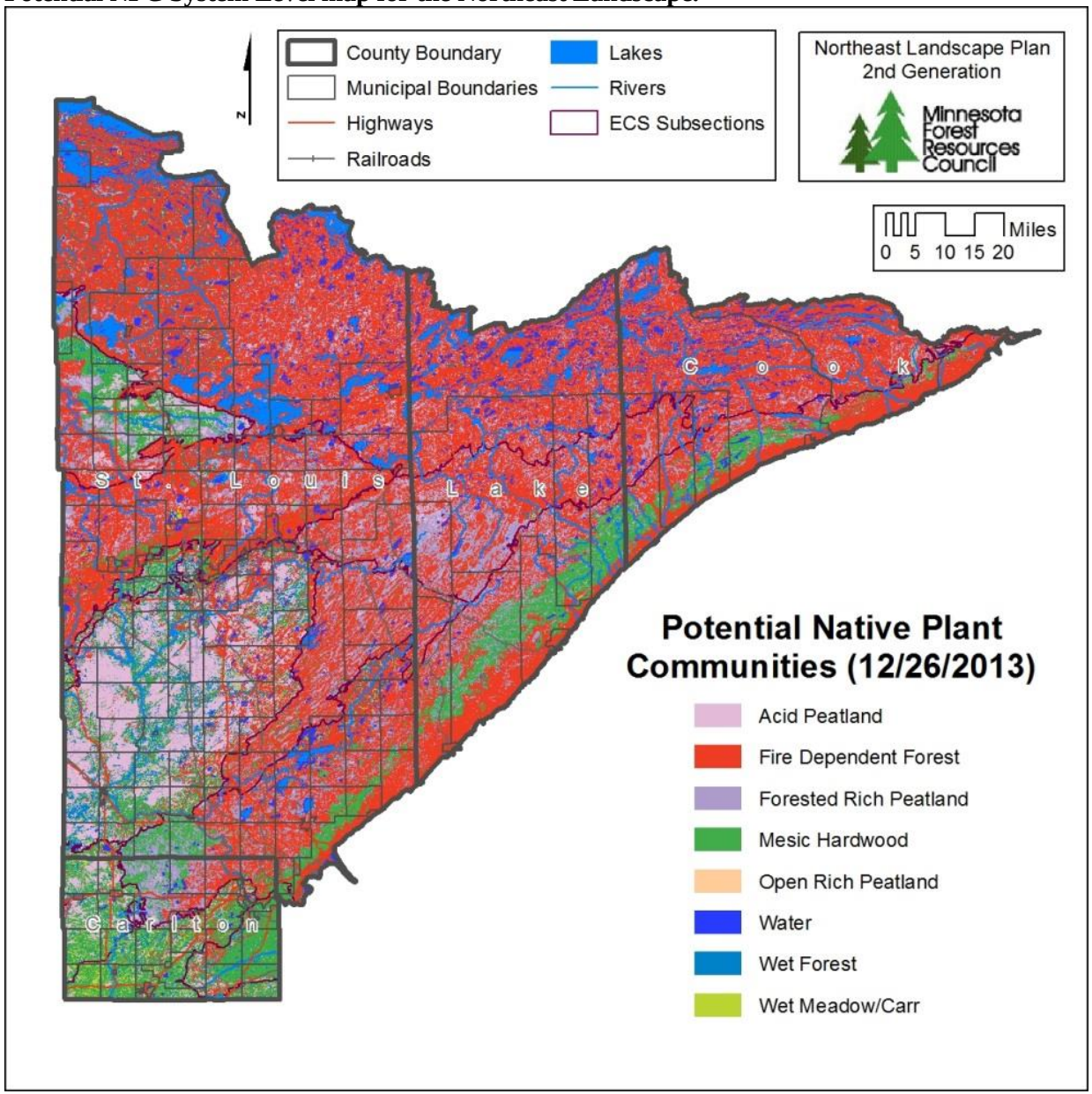
Classification Level	Dominant Factors	Example
System Group	Vegetation structure & geology	Upland Forest & Woodland Systems
Ecological System	Ecological processes	Fire-Dependent Forest/Woodland
Floristic Region	Climate & paleohistory	Central
NPC Class	Local environmental conditions	Central Dry Pine Woodland
NPC Type	Canopy dominants, substrate, or finer environmental conditions	Jack Pine-(Yarrow) Woodland
NPC Subtype	Finer distinctions in canopy dominants, substrate, or environmental conditions	Ericaceous Shrub

Source: Field Guide to the Native Plant Communities of Minnesota www.dnr.state.mn.us/npc/classification.html

B. Potential NPC Systems in the Northeast Landscape Map

The Northeast Landscape covers over 7.3 million acres. Within this region there are five forested NPC systems; three of which are generally represented in lowland areas and two systems that are in upland areas. The Natural Resources Research Institute integrated soil series, plant releveé, geomorphic, topographic, and other relevant geospatial data layers to create rough estimates of the extent and distribution of Native Plant Communities at the system and class level in the region.

Potential NPC System Level map for the Northeast Landscape.



Source: Map created by Jeff Reinhart (MFRC Staff) using data provided by George Host, Natural Resources Research Institute

C. Land Management Characteristics

In many cases land ownership and management or administration are the same; however there are several situations where this distinction can make a dramatic difference in understanding trends on the landscape. Therefore the tables below display NPC Systems and Classes by land management organizations. Private landowners the largest block of forests classified as mesic hardwood and the federal government is the largest owner of lands classified as fire dependent as well as the forested peatlands systems.

Potential NPC System Area Estimates by Land Management Category in the Northeast Landscape

Code	NPC Systems	Federal	State	County	Other Public	Tribal	Private	Total	% of NE Landscape
Upland Systems									
FD	Fire Dependent	1,622,825	435,534	485,989	10,036	42,332	1,159,621	3,756,337	51.0%
MH	Mesic Hardwoods	68,538	106,560	160,082	1,667	12,064	490,284	839,194	11.4%
	Subtotal	**1,691,363**	**542,094**	**646,071**	**11,702**	**54,396**	**1,649,904**	**4,595,531**	**62.4%**
Lowland Systems									
AP	Acid Peatland	62,284	145,358	210,340	532	1,084	169,158	588,757	8.0%
FP	Forested Peatland	365,008	211,596	195,841	2,816	16,317	319,718	1,111,295	15.1%
OP	Open Rich Peatland	318	339	129	2	0	324	1,113	0.0%
WF	Wet Forest	38,105	40,322	79,434	531	1,234	152,071	311,696	4.2%
WM	Wet Meadow	11,030	14,840	33,722	310	335	77,054	137,291	1.9%
W	Water	362,140	33,078	12,976	337	1,667	205,616	615,814	8.4%
	Subtotal	**838,885**	**445,534**	**532,441**	**4,527**	**20,637**	**923,941**	**2,765,966**	**37.6%**
	Total	**2,530,248**	**987,628**	**1,178,512**	**16,230**	**75,034**	**2,573,846**	**7,361,497**	**--**

Source: George Host, Natural Resources Research Institute; report available at www.frc.state.mn.us
Note: More information on NPC Classes can be found in the *'Field Guide to the Native Plant Communities of Minnesota'* or at: www.dnr.state.mn.us/npc/classification.html

Potential NPC Class Area Estimates by Land Management Category in the Northeast Landscape.

Code	NPC Class	Federal	State	County	Other Public	Tribal	Private	Total
FDc23	Central Dry Pine Woodland	0	1	0	0	0	133	134
FDc24	Central Rich Dry Pine Woodland	0	97	65	17	14	1,496	1,690
FDc34	Central Dry-Mesic Pine-Hardwood Forest	0	91	78	21	15	2,072	2,276
FDn12	Northern Dry-Sand Pine Woodland	0	282	1,180	14	0	6,351	7,827
FDn32	Northern Poor Dry-Mesic Mixed Woodland	837,355	107,571	33,980	1,627	143	125,910	1,106,586
FDn33	Northern Dry-Mesic Mixed Woodland	3,653	6,357	22,951	604	73	84,309	117,947
FDn43	Northern Mesic Mixed Forest	781,817	321,130	427,724	7,752	42,087	939,297	2,519,808
FD	Fire Dependent	0	5	12	0	0	53	70
MHc47	Central Wet-Mesic Hardwood Forest	0	13	93	0	0	437	543
MHn35	Northern Mesic Hardwood Forest	16,687	24,016	32,225	418	2,850	141,110	217,306
MHn44	No. Wet-Mesic Boreal Hdwd-Conifer Forest	6,226	45,754	75,254	835	2,221	256,984	387,275
MHn45	Northern Mesic Hardwood (Cedar) Forest	34,523	29,589	37,866	233	6,199	66,435	174,846
MHn46	Northern Wet-Mesic Hardwood Forest	6	1,421	603	26	251	7,073	9,380
MHn47	Northern Rich Mesic Hardwood Forest	0	25	60	5	0	676	766
MH	Mesic Hardwood	11,096	5,740	13,982	150	542	17,568	49,078
	Upland Total	**1,691,363**	**542,094**	**646,071**	**11,702**	**54,396**	**1,649,904**	**4,595,531**
APn80	Northern Spruce Bog	803	13,906	9,303	45	50	13,699	37,806
AP	Acid Peatland	61,481	131,452	201,037	487	1,034	155,459	550,951
FPn63	Northern Cedar Swamp	7	760	1,599	0	62	3,011	5,439
FPn71	Northern Rich Spruce Swamp (Water Track)	1,482	12,403	6,711	55	619	12,722	33,992
FPn81	No Rich Tamarack Swamp (Water Track)	90	14,695	3,220	0	3,830	1,635	23,470
FP	Forested Rich Peatland	363,428	183,738	184,310	2,761	11,806	302,350	1,048,393
OP	Open Rich Peatland	318	339	129	2	0	324	1,113
WFn53	Northern Wet Cedar Forest	0	78	122	0	109	67	376
WFn64	Northern Very Wet Ash Swamp	0	2,497	685	0	140	3,285	6,606
WF	Wet Forest	38,105	37,747	78,627	531	985	148,719	304,713
WM	Wet Meadow	11,030	14,840	33,722	310	335	77,054	137,291
W	Water	362,140	33,078	12,976	337	1,667	205,616	615,814
	Lowland Total	**838,885**	**445,534**	**532,441**	**4,527**	**20,637**	**923,941**	**2,765,966**
	Grand Total	**2,530,248**	**987,628**	**1,178,512**	**16,230**	**75,034**	**2,573,846**	**7,361,497**

Source: George Host, Natural Resources Research Institute; report available at www.frc.state.mn.us
Note: More information on NPC Classes can be found in the *'Field Guide to the Native Plant Communities of Minnesota'* or at: www.dnr.state.mn.us/npc/classification.html

D. Interpreting NPC System Descriptions and the Tree Suitability Table

Sections D through I provide summaries of the five NPC systems in the Northeast Landscape. A general overview is provided first along with a listing of the NPC classes and then followed by a silvicultural description. A map of the potential NPC systems is provided on page D-2.

For more information on NPC classes and the NPC classification methodologies, please refer to "*Field Guide to the Native Plant Communities of Minnesota: The Laurentian Mixed Forest Province*" at www.dnr.state.mn.us/npc/classification.html

Each native plant community summary includes a portion of the Minnesota DNR Tree Suitability Table (http://files.dnr.state.mn.us/forestry/ecssilviculture/treetables2.pdf). These tables were developed by the Minnesota Department of Natural Resources, Division of Forestry, Ecological Land Classification Program. Please use the following information to interpret these tables:

- Row shading: ability of tree species to compete with all vascular plants within NPC class (**GREEN** =excellent, **BLUE** =good, **YELLOW** =fair, **TAN**= poor, **WHITE**=not suitable)

- Column numbers: rank of tree species in order of competitive ability within each NPC class; 1=most suited; -- indicates trace presence

- Row shading and column numbers are based upon the importance value (IV) of a tree in each NPC Class, which is the product of percent presence and percent cover when present (IV=% presence x mean % cover when present). Row shading (not suited to excellent) is based upon the rank order of a tree's IV compared to the full range of IVs expressed by all plants - a rough estimate of absolute suitability. Column numbers (1,2,3, ...) are the rank order of a tree's IV compared to other trees - a rough estimate of relative suitability.

- Letters:
  w = tree species with a warmer synecological score than the community mean.
  d = tree species with a drier synecological score than the community mean.

E. Climate Change Considerations

To meet the challenges brought about by climate change, a team of federal and state land management agencies, private forest owners, conservation organizations, and others were convened by researchers with the USDA Forest Service Northern Institute of Applied Climate Science to develop the Northwood's Climate Change Response Framework (CCRF). The project's overall goals are to help land managers:
- Adapt ecosystems to changing climate,
- Mitigate carbon emissions,
- Respond to climate change impacts across ownership boundaries, and
- Rapidly incorporate science and monitoring information into management activities.

This effort has led to the development of two documents which were integrated into the Northeast Landscape Plan Revision.

- Forest Ecosystem Vulnerability Assessment and Synthesis (FEVAS)
- Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers (FAR).

Information from these documents provides baseline information on the potential impacts of climate change and strategies land managers can take to account for these potential changes. The Northeast Landscape Committee utilized this information to guide their goal and objective development process and excerpts of the CCRF work for each forested NPC System are summarized in the tables below and in the following NPC System summaries. Please refer to www.nrs.fs.fed.us/niacs/ for more information.

CCRF Vulnerability Determinations for Individual Forest Systems

Climate-induced shifts in drivers, stressors, and dominant tree species will result in different impacts to forested systems within the assessment area. Some communities may have a greater capacity to adapt to these changes than others, whereas some may be susceptible to relatively minor impacts. Therefore, it is helpful to consider these factors for individual forest systems in addition to describing general principles related to vulnerability and adaptive capacity. The table below presents a summary of major drivers and stressors for each forest community covered in the CCRF assessment.

Forest systems considered in the CCRF assessment, with a summary of current major drivers and stressors for each system.

Community Type	Major Drivers	Major Stressors
Fire-Dependent Forest	coarse-textured soils or shallow soils over bedrock, fire return intervals 20 to 150 yrs.	fire suppression, insect pests and diseases, understory hazel competition, deer herbivory
Mesic Hardwood Forest	mesic soils or deep impermeable layers, consistent moisture and nutrients, gap-phase disturbances with stand-replacing events every 400 to 2000 yrs.	exotic earthworms, invasive plants, insect pests, diseases, freeze-thaw cycles, drought, deer herbivory
Floodplain Forest	alluvial soils, annual or occasional floods, connectivity to river and water table	changes to flood regime, buckthorn and reed canarygrass, drought, deer herbivory
Wet Forest	wet-mesic soils, saturated in spring and dry in summer, periodic flooding	changes to soil moisture regime, ongoing ash decline, invasive species, insect pests, drought
Forested Rich Peatland	peat soils, saturated throughout growing season, moisture through precipitation and groundwater, pH greater than 5.5	changes to water table, roads and beaver dams, insect pests and diseases, winterburn, drought, deer herbivory
Acid Peatland	peat soils, saturated throughout growing season, moisture through only precipitation, pH less than 5.5, nutrient-poor environments	changes to water table, roads and beaver dams, insect pests and diseases, winterburn, drought
Managed Aspen	gradient of soil types and landforms, frequent disturbance, even-aged management on 35 to 60 yr. rotation	forest tent caterpillar and gypsy moth, drought, deer herbivory, hypoxylon canker, exotic earthworms

Managed Red Pine	sandy to mesic soils, limited by high summer temperatures, dependent on planting for regeneration, even-aged management on 60 to 120 yr. rotation	armillaria, red pine shoot blight, understory hazel competition, deer herbivory, bark beetles, drought stress in dense stands

The following vulnerability determinations draw on information presented other chapters of the FEVAS document, as well as an expert panel assembled from a variety of organizations and disciplines across the assessment area. The 23 panelists evaluated anticipated climate trends for the assessment area and ecosystem model projections (See Chapter 5 of FEVAS), in combination with their own expertise. For each forest system, panelists considered the potential impacts and adaptive capacity to assign a vulnerability determination and a level of confidence in that determination using the same confidence scale described above. For a complete description of the methods used to determine vulnerability, see FEVAS Appendix 5.

Overall vulnerability determinations ranged from low-moderate (Floodplain Forests) to high (Wet Forests, Forested Rich Peatlands, and Acid Peatlands). Panelists tended to rate the amount of evidence as medium (between limited and robust) for most forest systems. Incomplete knowledge of future wildfire regimes, interactions among stressors, and precipitation regimes were common factors limiting this component of overall confidence. The ratings of agreement among information also tended to be in the medium range. Contrasting information related to precipitation regimes under the high and low climate change scenarios was one factor that limited the level of agreement among information. In general, ratings were slightly higher for agreement than for evidence. This suggests that although evidence is not as robust as the experts would prefer, the information that is available leads them to reach a similar conclusion.

Vulnerability determination summaries for the forest systems considered in this assessment.

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

F. Fire-Dependent Forest/Woodland System (FD)

General Description

Fire-Dependent Forest/Woodland (FD) communities are common across the Laurentian Mixed Forest (LMF) Province, even after nearly 100 years of wildfire suppression. As the name implies, Fire-Dependent Forest/Woodland communities are strongly influenced by wildfires. Fires are the major source of species mortality and exert strong influence on patterns of plant reproduction by exposing mineral soil seedbeds, triggering dispersal of propagules, and increasing the amount of light reaching the ground or understory. Fires periodically remove much of the litter, duff, and other organic material from the community and can have a significant effect on nutrient cycling and nutrient availability. In the LMF Province, FD communities are characterized by prevalence of evergreen species, most visibly pines and other conifers. These species, like most of the species are adapted to survive repeated fires or to regenerate successfully following fire.

FD communities occur in the LMF Province on sites with coarse sandy or gravelly soils or with thin soils over bedrock. These sites are often drought prone, a condition that is enhanced by fire through the removal of organic material, such as litter and humus that retains soil moisture. Fires also can contribute to low nutrient availability in FD communities by releasing nutrients from plant material and making them susceptible to being leached below the plant rooting zone or carried away by runoff. In comparison with other communities, such as Mesic Hardwood Forests, in which nutrient availability changes predictably over each year and remains relatively stable from year-to-year, the random behavior of wildfires causes nutrient availability in FD communities to be episodic and unpredictable.

Northeast Landscape Area

- 3,756,000 acres
- 51 % of Northeast Landscape
- 82 % of the upland area in the Northeast Landscape

Disturbance Regime History:

- High to very high rates of fire disturbances historically with return interval from 40 years to 100 years.
- The frequency and intensity of fires in fire dependent communities show a strong geographic pattern correlating to the local climate.

Silvicultural Description

Jack pine, red pine, and white pine are the dominant species in these areas. These species are often successful due to their ability to adapt their physical conditions to these sites. Quaking aspen was also native to some of these sites but occurred naturally at lower abundance. In some areas catastrophic fires killed most canopy trees and created young forests with clear dates of origin. Other sites were abundant with young seedlings recovering from stand-regenerating fire. Often crown fires and severe surface fires left a rather clean, mineral-soil slate for tree establishment.

Silvicultural systems such as clear-cutting or clear-cutting with reserves best matches our impression of natural fires and skips. Quaking aspen, big-toothed aspen, and jack pine are the species with open regeneration strategies able to succeed following clear-cutting and variable seedbeds ranging from mineral (jack pine, big-toothed aspen) to rather undisturbed duff (quaking aspen).

Although fires were historically present in these areas, these silvicultural practices are often our only choice in mimicking this natural disturbance on a large-scale. When possible, however, controlled burns are a preferred option. While clear-cutting and clear-cutting with reserves mimics the light distribution in an area fairly well, components left by fires such as burned snags, tree scars and accelerated nutrient cycling are missing.

Detailed silvicultural prescriptions for Northern Dry-Sand Pine Woodland (FDn12), Central Rich Dry Pine Woodland (FDc24), Northern Poor Dry-Mesic Mixed Woodland (FDn32), Northern Dry-Mesic Mixed Woodland (FDn33), Central Dry-Mesic Pine-Hardwood Forest (FDc34), and Northern Mesic Mixed Forest (FDn43) are available on the MN DNR website. Please refer to:
http://www.dnr.state.mn.us/forestry/ecs_silv/interpretations.html

Suitability of tree species by Native Plant Community; Fire-Dependent

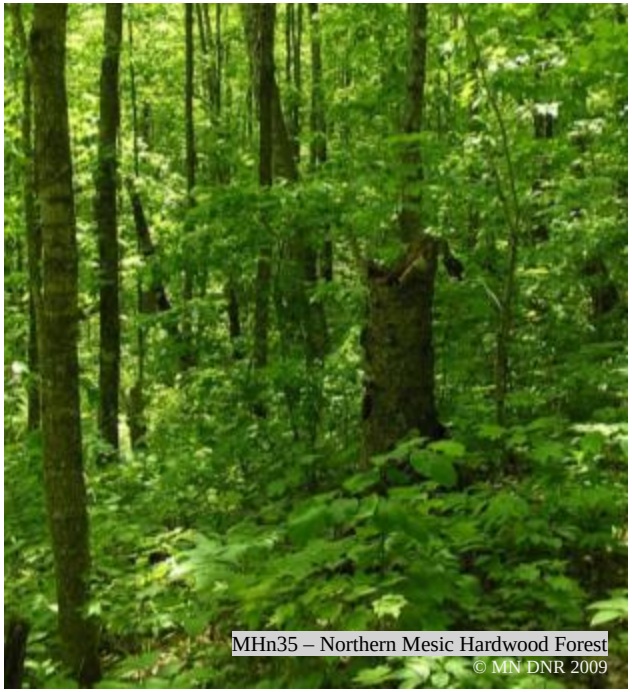
NPC Class	FDn12	FDn22	FDn32	FDn33	FDn43
	Northern Dry-Sand Pine Woodland	Northern Dry-Bedrock Pine Woodland	Northern Poor Dry-Mesic Mixed Woodland	Northern Dry-Mesic Mixed Woodland	Northern Mesic Mixed Forest
Area Estimate (acres)*	7,827	--	1,106,586	117,947	2,519,808
Jack pine	**1**	**2**	**1d**	**5d**	**10d**
Red pine	**2d**	**1d**	**3d**	**1d**	**4d**
Quaking aspen	**3w**	-	**4wd**	**4d**	**3wd**
White spruce	**4**		-	**10**	**7**
Balsam fir	**5**		**7**	**6**	**6**
White pine	-	**3**	**5wd**	**3d**	**2wd**
Paper birch	-	**4**	**6wd**	**2d**	**1wd**
Black spruce	-		**2**	**9**	**9**
Big-toothed aspen		**5wd**	**5wd**	**7wd**	**7**
Red maple		**6w**	-	**8wd**	**8wd**
Northern red oak		**7w**		**11wd**	
White cedar					**5**

Source: Minnesota Department of Natural Resources, Division of Forestry, Ecological Land Classification Program; Version 2.2, 2013.
Table interpretation information is available above on page D-6.
* Estimate from George Host, Natural Resources Research Institute; report available at www.frc.state.mn.us

Climate Change Projections

- Moderate Vulnerability. (medium evidence, medium agreement) Changes to the fire regime for northern Minnesota are particularly threatening for this system, in addition to the loss of suitable habitat for many key species and the potential for greater pest and disease activity. A high tolerance for disturbance increases the adaptive capacity of this system.
- Moderate-High Adaptive Capacity. Fire-Dependent Forests are generally tolerant of drought and disturbances and can contain a diversity of species, which lends these forests greater adaptive capacity to climate change. Additionally, these forests can persist on poor soils, so the possibility exists that Fire-Dependent Forests could "retreat" to favorable locations on the landscape even if overall conditions change. Southern portions of the assessment area may be more prone to shift to Mesic Hardwoods because fragmentation and broadleaf species will likely limit fire activity.
- Potential Impacts
  - Drivers. Fire-Dependent Forests are generally found on coarse-textured or shallow soils, and may be able to tolerate the projected shift toward drier soils during the summer months. Evidence indicates that wildfires may burn larger areas in northern Minnesota under climate change, and that the fire season may shift later into the growing season. Blowdown-causing wind events could also provide more fuel buildup for large fire events. Greater wildfire activity could be a positive impact for these forest types, but it is possible that too much change to the fire regime would hamper regeneration.
  - Stressors. Climate change is expected to intensify several key stressors for Fire-Dependent Forests. Insect pests and diseases may become more virulent and damaging under a warmer climate, and the possibility exists for new pests such as western bark beetles to arrive in the assessment area. The continued shift toward mesic species within Fire Dependent Forests may be encouraged by climate change if fire suppression activities continue and broadleaf species like red maple continue to spread. White-tailed deer populations are also anticipated to increase with warmer winters, so herbivory on preferred species may continue to hinder regeneration.
  - Dominant Species. Considering the range of possible climate futures, the majority of dominant species that make up Fire-Dependent Forests are expected to decline in suitable habitat and across the assessment area according to model projections (jack pine, quaking aspen, paper birch, balsam fir, and black spruce). The same modeling studies suggest red pine and white pine will remain relatively constant or experience slight increases across the assessment area, and that minor components of Fire Dependent Forests like northern red oak, bur oak, and red maple will also increase across the assessment area.

G. Mesic Hardwood Forest System (MH)


MHn35 – Northern Mesic Hardwood Forest
© MN DNR 2009

General Description

Mesic Hardwood Forest (MH) communities are present in the Laurentian Mixed Forest (LMF) Province on upland sites with moist soils, usually in settings protected from fire. They are characterized by continuous, often dense, canopies of deciduous trees, including sugar maple, basswood, paper birch, and northern red oak, and understories with shade-adapted shrubs and herbs.

Plants in MH communities have access to predictable supplies of water and nutrients, but they are often limited by light because of the dense forest canopy. Typical sites are buffered from seasonal drought by fine-textured, moisture-retaining soils or dense subsoil layers that perch snowmelt and rainfall. At the same time, soils are well drained and do not experience water logging or saturation except after spring snowmelt or heavy rains. Consequently, plants in MH communities rarely experience diminished respiration due to soil anoxia. Essential nutrients, especially nitrogen, are mineralized from decaying organic matter at twice the rate of that in either Fire-Dependent Forest/Woodland (FD) or Wet Forest (WF) communities. As a result, nutrients in dead plant material quickly become available again for uptake by plants.

Nutrient availability in MH communities follows an annual or seasonal pattern that is more predictable than in FD forests, where nutrients are released mainly following episodic fires. Tree mortality in MH communities is also rather constant, with stand-regenerating disturbances such as wildfires and windthrow uncommon. The death of established trees most often involves individual canopy trees or small patches that are affected by minor windthrow, disease, or other fine-scale disturbances.

Northeast Landscape Area

- 839,000 acres
- 11 % of Northeast Landscape
- 18 % of the upland area in the Northeast Landscape

Disturbance Regime History:

- Low to very low rates of stand-replacing fire or wind disturbances historically with return intervals in excess of 400 years and often greater than 1,000 years.
- Moderate disturbances from light fires and patchy windthrow were frequent to occasional with return intervals ranging from 40 to 300 years.
- Many NPCs in this system, especially MHn45-47 have a very fine-grained disturbance pattern with few large patches of regenerating forest with small disturbance patches being the norm.

Silvicultural Description

Quaking aspen, paper birch, balsam fir, and white spruce were the dominant native trees that occupied this area historically. White pine, red maple, black ash, balsam poplar, white cedar, bur oak, and red oak are likewise native to some sites but occurred naturally at lower abundance. The consequence of fire suppression, commercial logging, and settlement in the past century has been to promote more balsam fir than usual at the expense of white spruce. Otherwise, most stands are similar to their historic counterparts, and management interpretations are not complicated by the ingress of atypical species.

Historically, senescence of the initial-cohort trees created regeneration opportunities for trees, ranging from single-tree gaps to large gaps up to an acre in size. Several silvicultural systems could be used to approximate the natural loss of initial-cohort trees and regeneration typical of transitioning forests. Selective harvesting matches best the small-gap mortality pattern, and would favor white spruce and balsam fir. Shelterwood variants or group selection would create the large-to-small openings that favor recruitment of white spruce, balsam fir, red maple, and black ash. Paper birch, red oak, bur oak, white cedar, white pine, and basswood should all do well in the larger gaps created by patch cutting or variants of seed-tree harvests.

Given that only minimal stands in the area were described as having been burned or windthrown, it is clear that destructive agents other than these obvious catastrophes were involved to create so much young, small diameter forests. We suspect chronic disease and possibly surface fire. What seems clear from the historic records is that young, re-initiated stands were patchy and offered a mixture of situations where seeding, sprouting, and release of advance regeneration worked together to initiate the next forest. It is highly unlikely that re-initiated forests resembled something as uniform as a clear-cut. Clear-cutting with reserves, patch cutting, and variants of seed-tree cutting could all approximate the natural pattern of disturbances that created young forests. Clear-cutting with reserves would favor quaking aspen and balsam poplar, which are primarily open regeneration strategists on sites. Patch cutting or variants of seed-tree harvests are silvicultural strategies that should work to re-initiate stands and favor trees that do well in the open or in large gaps such as paper birch, white cedar, and white pine.

Detailed silvicultural prescriptions for Northern Mesic Hardwood Forest (MHn35), Northern Wet-Mesic Boreal Hardwood-Conifer Forest (MHn44), Northern Mesic Hardwood (Cedar) Forest (MHn45), and Northern Rich Mesic Hardwood Forest (MHn47) are available on the MN DNR website. Please refer to: http://www.dnr.state.mn.us/forestry/ecs_silv/interpretations.html

Suitability of tree species by Native Plant Community; Mesic Hardwood

NPC Class	MHn35 Northern Mesic Hardwood Forest	MHn44 No. Wet-Mesic Boreal Hardwood-Conifer Forest	MHn45 Northern Mesic Hardwood (Cedar) Forest	MHn46 Northern Wet-Mesic Hardwood Forest	MHn47 Northern Rich Mesic Hardwood Forest
Area Estimate (acres)*	217,306	387,275	174,846	9,380	766
Sugar maple	**1wd**	**13**	**1wd**	**6wd**	**1wd**
Basswood	**2wd**	**5wd**	**5wd**	**2wd**	**2wd**
Northern red oak	**3wd**	**11wd**		**9wd**	**5wd**
Paper birch	**4d**	**4d**	**3d**	**7d**	**4d**
Quaking aspen	**5d**	**1d**	**9d**	**3d**	**11d**
Red maple	**6wd**	**3wd**	**8wd**	**5wd**	**9d**
Big-toothed aspen	**7wd**			**15wd**	**15**
Ironwood	**8wd**				**7wd**
White pine	**9d**	**8d**	**10d**		
Bur oak	**10wd**	**12wd**		**4wd**	
Yellow birch	**11w**		**2w**	**13w**	**3**
Balsam fir	**12**	**2**	**7**	**12**	-
White spruce	-	**6**	**6**	**14**	
White cedar		**7**	**4**	**11**	**8**
Black ash		**9w**	-	**1w**	**6**
Balsam poplar		**10**		**10**	
Green ash		**14**		**8w**	**10w**
Red pine		**15**			
American elm		-		**16**	

Source: Minnesota Department of Natural Resources, Division of Forestry, Ecological Land Classification Program; Version 2.2, 2013.
Table interpretation information is available above on page D-6.
* Estimate from George Host, Natural Resources Research Institute; report available at www.frc.state.mn.us

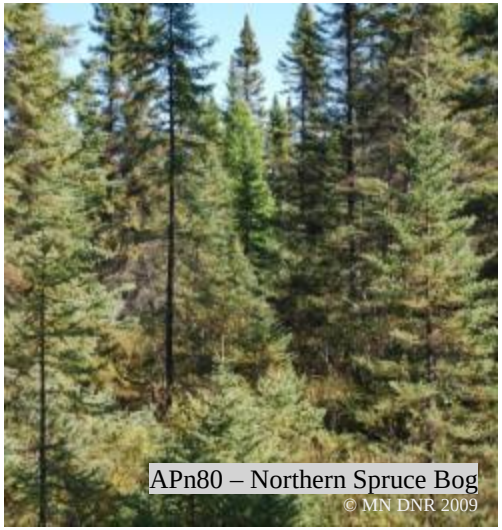
Climate Change Projections

- Moderate Vulnerability. (medium evidence, medium agreement) Climate change may intensify several major stressors for this forest system, such as drought and forest pests. High species diversity may increase resilience to future change, and uncertainty regarding future moisture regimes and potential interactions between stressors limit the confidence in this determination.
- Moderate-High Adaptive Capacity. Mesic Hardwood Forests generally contain a large number of species, which leads to a high response diversity. These forests could also gain territory lost by other forest types under wetter or drier future conditions. This system contains several species at their northern range limits, such as sugar maple and northern red oak, which may benefit from gene flow between

southern populations. Increased CO_2 concentrations may also increase the water-use efficiency of some species, reducing the risk of moisture stress. Stands with few species and reduced structural diversity may have lower adaptive capacity.

- Potential Impacts
  - Drivers. Mesic Hardwood Forests depend on relatively moist, nutrient-rich soils and a lack of wildfire disturbance. The potential for climate change to increase the frequency of extended droughts poses a threat to these forests for multiple reasons, including increased moisture stress, wildfire occurrence, and susceptibility to other stress agents. Hardwood forests occurring on moist, rich soils may be buffered from short-term droughts or seasonal moisture stress. Warming temperatures may also allow this system to expand into previously unsuitable areas.
  - Stressors. Climate change could amplify several major stressors to Mesic Hardwood Forests. Forest tent caterpillar and other pests may cause more frequent and severe damage in climate-stressed forests, and new pests such as gypsy moth and Asian longhorn beetle present unknown risks. White-tailed deer populations may also increase with warmer winters, which may hinder hardwood regeneration as well as the northward expansion of this system. The potential also exists for synergistic negative interactions between current stressors in this system, such as earthworms, herbivory, drought, and invasive species.
  - Dominant Species. Model projections indicate that the majority of dominant species that make up Mesic Hardwood Forests are expected to gain in suitable habitat and biomass across the assessment area (American basswood, sugar maple, red maple, green ash, bur oak). Deciduous forest types are also projected to have large potential productivity increases. Paper birch and quaking aspen are two key species anticipated to decline across the assessment area, and modeling results are mixed for northern oak and yellow birch. Several minority species in this system may also increase in biomass and suitable habitat across the assessment area (e.g., eastern white pine, ironwood, American elm, white oak, bitternut hickory). NPC Class MHn44 may be particularly vulnerable because this class contains boreal species such as quaking aspen, balsam fir, and paper birch.

H. Acid Peatland System (AP)


APn80 – Northern Spruce Bog
© MN DNR 2009

General Description

The Acid Peatland (AP) System is characterized by conifer, low-shrub, or graminoid-dominated communities that develop in association with peat-forming Sphagnum. AP communities are acidic (pH < 5.5), extremely low in nutrients, and have hydrological inputs dominated by precipitation rather than groundwater. These communities are floristically depauperate, with the flora composed primarily of a small subset of species characteristic of rich peatland systems that are able to survive in the harsh, low-nutrient environments typical in AP communities. The floristic differences between forested and open AP communities are subtle because of low species diversity in the AP System as a whole and because trees, when present, are usually sparse, making the boundary between forested and open AP communities diffuse. Therefore, this classification places all acid peatland communities into one System, unlike the rich peatland communities, which are divided into forested and open systems.

AP communities are widespread in the Laurentian Mixed Forest (LMF) Province because of cool climate, abundant precipitation, numerous poorly drained basins, and extensive poorly drained glacial lake plains, which produce favorable conditions for peat development across much of the Province. AP communities tend to be prevalent in basins in areas with non-calcareous soils and on lake plains underlain by impermeable clayey and loamy soils, which minimize movement of groundwater through the overlying peat.

Northeast Landscape Area

- 589,000 acres
- 8 % of Northeast Landscape
- 21 % of the upland area in the Northeast Landscape

Disturbance Regime History:

- Return interval of stand-replacing fires (rare) – over 1,000 years.
- Return interval of superficial or light fires – approximately 120 years.
- Return interval of catastrophic windthrows – over 700 years.

Silvicultural Description

The canopies of forests in the AP System are typically dominated by black spruce. Trees are usually stunted (<30 ft or 10m tall) with 25-75% cover. Some sites have scattered tamarack in addition to black spruce. The vegetation in the area is composed only of bog species, with very low species diversity. This environment occurs where a buildup of peat causes the peat surface to become isolated from mineral-rich runoff or subsurface flow so that all mineral inputs come from precipitation.

Although fires can occur in spruce bogs, they are not very common. Records indicate that the historic rotation of catastrophic fires in these areas was in excess of 1,000 years. Superficial fires appear to have been more common, occurring about every 120 years. Such fires can kill

black spruce trees and favor nearly continuous cover of leatherleaf. Following lighter fires, some of the characteristic shade-tolerant understory species usually remain at the site. Severe, catastrophic fires can result in conversion of the peatland to an open bog community dominated by bog wire grass. If sufficient nutrients are released into surface waters by burning of peat and vegetation, the bog may be converted to a poor fen. Recovery to forested conditions may take decades in these peatlands. The ability of black spruce to send up new stems, or layer, from branches buried by peat has been interpreted as an adaptive trait for surviving windthrow. There is, however, little direct evidence that windthrow has a significant impact on spruce bogs. Records suggest the historic rotation of catastrophic windthrow in these areas was about 700 years. These trees are somewhat susceptible to windthrow because of structurally weak peat soils and shallow root systems, but this seems to be offset by short height (<30ft or 10m), sparse crowns, rootgrafting, and branch-layering.

There are several management options that are suggested to help support the conservation of particular species, and general diversity, in the area. The first is to use natural disturbance patterns to help guide rotation periods. Landscape disturbance patterns can also be mimicked by timber harvesting practices to help maintain the natural succession of these lowland species and environments. If timber is harvested in this area, regulation and monitoring of damage to the area, such as rutting and other negative impacts on the soils, vegetation and hydrology of the area need to be addressed. One advisable action is to harvest only in frozen-soil conditions to keep the impact on the environment at a minimum. Options such as harvesting spruce tops and boughs may produce extra revenue from the area.

Methods to mimic the natural disturbance of the area could be provided by several management options. The first is to leave reserve trees in the area after harvesting. While these trees leave some potential for seed dispersal they also act as future snag trees, and attempts to mimic the stratified vertical pattern natural to the landscape. Leaving downed logs in the area may also mimic the disturbance of windthrow. Regenerating the area may cause a problem due to a lack of knowledge on how to regenerate species in lowland bog areas. Some options include aerial seeding, which may only be possible if pathogens such as dwarf mistletoe aren't present in the area.

A detailed silvicultural prescription for the Northern Poor Conifer Swamp (APn81) is available on the MN DNR website. Please refer to: http://www.dnr.state.mn.us/forestry/ecs_silv/interpretations.html

Suitability of tree species by Native Plant Community; Acid Peatland

NPC Class	APn80	APn81
	Northern Spruce Bog	Northern Poor Conifer Swamp
Area Estimate (acres)*	37,806	--
Black spruce	**1d**	**1d**
Tamarack	**2**	**2**
White pine		**3wd**
Paper birch		-

Source: Minnesota Department of Natural Resources, Division of Forestry, Ecological Land Classification Program; Version 2.2, 2013.
Table interpretation information is available above on page D-6.
* Estimate from George Host, Natural Resources Research Institute; report available at www.frc.state.mn.us

Climate Change Projections

- High Vulnerability. (medium evidence, medium-high agreement) Acid Peatlands are not resilient to changes in water tables and are not buffered by groundwater inputs. The dominant species in these forests are expected to decline under a range of climate futures. Future precipitation trends are the primary uncertainty for this system.
- Low Adaptive Capacity. Acid Peatlands receive water inputs through precipitation only, so these systems may be particularly susceptible to shifts in precipitation patterns and droughts. Increased winter and spring precipitation could possibly be retained in low-lying areas on the landscape and compensate for summer droughts. Acid Peatlands are more widely distributed across the assessment area than Forested Rich Peatlands, but are typically smaller and more confined to particular hydrologic regimes. These systems are slower to recover from disturbances like fires and blowdown events than Forested Rich Peatlands. Because of their acid conditions, however, these forests may face less competition from other forest types.
- Potential Impacts
    - Drivers: Acid Peatlands typically occur on perched water tables without connection to groundwater. Therefore, these systems are likely even more vulnerable to water level changes than Forested Rich Peatlands. Higher water levels could result in a transition to open peatland systems and lower water levels could cause greater drought stress and mortality in shallow-rooted forests.
    - Stressors: Roads, beaver dams, drainage ditches, or other watershed modifications that change flood regimes or water tables are already a negative impact in some parts of the assessment areas. These modifications may be intensified by climate change. Additionally, higher growing season temperatures may increase evapotranspiration rates and reduce the rate of peat accumulation in these systems as a result of increasing decomposition rates. Warmer winters may also increase the occurrence of winterburn in Acid Peatlands, and allow for more frequent outbreaks of pests like tamarack sawfly.
    - Dominant Species: The dominant tree species in Acid Peatlands, black spruce and tamarack, are projected to experience significant declines in suitable habitat and biomass across the landscape according to ecosystem models. Declines may be most severe for black spruce. These species are at the southern edge of their ranges in Minnesota, and therefore may not tolerate warmer conditions. The assessment area is also the southern range limit for sphagnum moss. Acid peatlands also contain a suite of rare and endemic plant species that are adapted to acidic, nutrient-poor conditions. These associated species are also presumably vulnerable to changes in water table level and the peat substrate.

I. Forested Rich Peatland System (FP)


FPn63 – Northern Cedar Swamp
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General Description

Forested Rich Peatland (FP) communities are conifer- or tall shrub-dominated wetlands on deep (>15in [40 cm]), actively forming peat. They are characterized by mossy ground layers, often with abundant shrubs and forbs. FP communities are widespread in the Laurentian Mixed Forest (LMF) Province. The cool climate of the region, abundant precipitation, and presence of poorly drained basins and glacial lake plains result in extensive peat development relative to other parts of Minnesota. These communities are particularly prominent in the Northern Minnesota and Ontario Peatlands and the Minnesota Drift and Lake Plains sections within Minnesota.

Northeast Landscape Area

- 1,111,000 acres
- 15 % of Northeast Landscape
- 40 % of the upland area in the Northeast Landscape

Disturbance Regime History:

- Return interval of stand-replacing fires (very rare) – 400 to 1,000 years.
- Return interval of catastrophic windthrows – over 600 years.
- Return interval of patchy windthrows – approximately 80 years.

Silvicultural Description

This area's understory is comprised mostly of white cedar, balsam fir, black spruce, tamarack and paper birch, with a few elm and black ash. The canopy is made up by the same species composition with a variable 25-100% canopy cover.

This area very rarely experiences catastrophic fire disturbance, with an estimated rotation of about 400 years in some areas and up to almost 1,000 years in other areas. The areas that are more susceptible to fire disturbance are those with more poorly drained landscapes paralleled with extreme draught.

Because of structurally weak peaty soils and shallow root systems, trees in this area are susceptible to windthrow, resulting in somewhat shorter rotations for both stand-regenerating catastrophic windthrow (about 600 years) and windthrow of small patches of canopy trees (about 380 years). Smaller disturbances resulting in partial mortality of the canopy were somewhat common, with a rotation of about 80 years, and are presumed to have involved both patchy windthrow and surface fires. Hummocks of soil and peat are also somewhat common due to the presence of tip-up-mounds found from fallen and wind-thrown trees. Recommended silvicultural methods in this area are similar to the Acid Peatland system, with a high presence of downed woody debris as well as snags.

A detailed silvicultural prescription for the Northern Rich Tamarack Swamp (Western Basin) (FPn82) is available on the MN DNR website. Please refer to: http://www.dnr.state.mn.us/forestry/ecs_silv/interpretations.html

Suitability of tree species by Native Plant Community; Forested Rich Peatland

NPC Class	FPn62	FPn63	FPn71	FPn72	FPn81	FPn82
	Northern Rich Spruce Swamp	Northern Cedar Swamp	Northern Rich Spruce Swamp (Water Track)	Northern Rich Tamarack Swamp (Eastern Basin)	Northern Rich Tamarack Swamp (Water Track)	Northern Rich Tamarack Swamp (Western Basin)
Area Estimate (acres)*	--	5,439	33,992	--	23,470	--
Black spruce	**1**	**2**	**1d**	**2**	**2d**	**2d**
Tamarack	**2**	**4**	**2**	**1**	**1**	**1**
Paper birch	**3wd**	**5wd**		**3wd**		
White cedar	**4**	**1**	**3d**			**3d**
Balsam fir	**5d**	**3d**				
White pine	-			-		-
White spruce	-			-		
American elm				-		
Black ash				-		

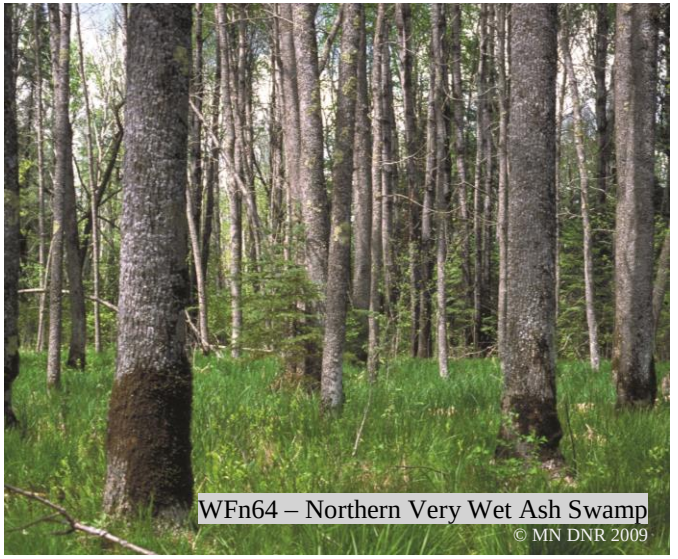
Source: Minnesota Department of Natural Resources, Division of Forestry, Ecological Land Classification Program; Version 2.2, 2013.
Table interpretation information is available above on page D-6.
* Estimate from George Host, Natural Resources Research Institute; report available at www.frc.state.mn.us

Climate Change Projections

- High Vulnerability. (medium evidence, medium-high agreement) Forests in peat systems have limited tolerance to changes in water tables. Additionally, the dominant species in these forests are expected to decline under a range of climate futures. Low agreement on future precipitation trends is the primary uncertainty for this system.
- Low Adaptive Capacity. Forested Rich Peatlands typically receive water inputs through groundwater as well as precipitation, so these forests may be somewhat buffered from seasonal or short-term moisture deficits. Increased winter and spring precipitation could also be retained in low-lying areas on the landscape and compensate for summer droughts. Forested Rich Peatlands are widely distributed across the assessment area, but are confined to particular hydrologic regimes, soil types, and landscape positions. Therefore, they are unlikely to expand to new territory within the assessment area or out-compete other forest types. In some locations Forested Rich Peatlands occur within a matrix of Fire-Dependent Forests like jack pine systems, so they may be exposed to more frequent wildfire if climate change results in extended droughts and more active wildfire regimes in the assessment area.
- Potential Impacts

- Drivers. Climate change has the potential to alter the water tables in low-lying areas across the assessment area. Forested Rich Peatlands function in a relatively narrow window of water table conditions, because higher water levels could result in a transition to open peatland systems and lower water levels allow other forest types to invade as peat layers dry and decompose.
- Stressors. Roads, beaver dams, drainage ditches, or other watershed modifications that change flood regimes or water tables are already a negative impact in some parts of the assessment areas. These effects may be intensified by climate change. Additionally, higher growing season temperatures may increase evapotranspiration rates and reduce the rate of peat accumulation in these systems as a result of increasing decomposition rates. Warmer winters and reduced snowpack may also increase the occurrence of winterburn in these systems, and allow for more frequent outbreaks of pests such as tamarack sawfly and eastern larch beetle.
- Dominant Species. Most species in this system are at the southern edge of their ranges in Minnesota, and therefore may not tolerate warmer conditions. The dominant species in Forested Rich Peatlands, tamarack and black spruce, are projected to experience declines in suitable habitat and biomass across the landscape. Declines may be most severe for black spruce. Other minor species like balsam fir and paper birch are also expected to decline under the hotter, drier climate scenario. The assessment area is also the southern range limit for sphagnum moss. Red maple, white pine, and speckled alder may become larger components of this system in the future, but it is unclear if Forested Rich Peatlands will maintain their inherent identity if that shift occurs.

J. Wet Forest Systems (WF)


WFn64 – Northern Very Wet Ash Swamp

General Description

Wet Forest (WF) communities occur commonly in narrow zones along the margins of lakes, rivers, and peatlands; they also occur in shallow depressions or other settings where the groundwater table is almost always within reach of plant roots but does not remain above the mineral soil surface for long periods during the growing season. Because of a cool climate characterized by regular precipitation and slow rates of evaporation, WF communities are common across the Laurentian Mixed Forest (LMF) Province. They are dominated most often by black ash or white cedar, with understories characterized by patches of shrubs such as speckled alder or mountain maple, mosses and upland forest herbs on raised hummocks, and sedges and wetland forbs in wet or mucky hollows.

WF communities are strongly shaped by steady fluxes of water and nutrients supplied to deep soil layers by moving groundwater. In basins or depressions connected to annually recharged shallow aquifers, the supply of groundwater peaks early in the growing season but persists at some level through much of the summer. In settings connected to deeper aquifers that discharge groundwater throughout the year, the supply of water and nutrients is steady through the growing season. The groundwater moves laterally below the surface but often upwells to create springs, seeps, or spring runs within and adjacent to WF communities. Varied micro-topography and variation in groundwater supply on sites fed by shallow aquifers result in the alternating presence of water-logged and dry conditions in upper soil layers. This variability in soil moisture in both space and time is a hallmark of the WF System and controls the availability of the oxygen needed for roots to respire, for decomposition of organic litter, and for release of nutrients in forms usable by plants.

Northeast Landscape Area

- 312,000 acres
- 4 % of Northeast Landscape
- 11 % of the upland area in the Northeast Landscape

Disturbance Regime History:

- Return interval of catastrophic fires – 800 to >1,000 years.

Silvicultural Description

Species present in the sub-canopy of this area include white cedar, balsam fir, black ash, basswood, red maple, yellow birch quaking aspen, paper birch sugar maple and green ash. The canopy is composed mostly of the same species with a small component of black spruce, white spruce and tamarack.

In the past, catastrophic disturbances were infrequent in WFn53. An analysis of Public Land Survey records indicates that the rotation of catastrophic fires was more than 800 years, and the rotation of catastrophic windthrow was more than 300 years. Events that result in partial loss of trees, such as patchy windthrow or light surface fires, were also rare, with a rotation of about 340 years.

Succession is evident in this system, with various species growing at varying times under the canopy. Different sites differ by species located within the canopy and sub-canopy at any point in time. In order to preserve the species diversity in the area and mimic natural selection, harvesting while leaving reserves and underplanting other species at certain time intervals would best replicate the natural growth and establishment in the area.

Detailed silvicultural prescriptions for Northern Wet Cedar (WFn53) and Northern Very Wet Ash Swamp (WFn64) are available on the MN DNR website. Please refer to: http://www.dnr.state.mn.us/forestry/ecs_silv/interpretations.html

Suitability of tree species by Native Plant Community; Wet Forests.

NPC Class	WFn53	WFn55	WFn64
	Northern Wet Cedar Forest	Northern Wet Ash Swamp	Northern Very Wet Ash Swamp
Area Estimate (acres)*	376	--	6,606
White cedar	**1**	**4**	**4**
Black ash	**2w**	**1w**	**1w**
Paper birch	**3d**	**8d**	**7d**
Balsam fir	**4d**	**9d**	**9d**
Black spruce	**5**	**13**	
White spruce	**6d**	**15d**	**-**
Balsam poplar	**7d**	**7d**	
Yellow birch	**8wd**	**3wd**	**5wd**
Quaking aspen	**9d**	**2d**	**3d**
Tamarack	**-**	**-**	**2**
Green ash		**5wd**	
Red maple		**6wd**	**6wd**
Basswood		**10wd**	
American elm		**11wd**	**8wd**
White pine		**12d**	
Bur oak		**14wd**	
Sugar maple		**-**	
Red elm			**10wd**

Source: Minnesota Department of Natural Resources, Division of Forestry, Ecological Land Classification Program; Version 2.2, 2013.
Table interpretation information is available above on page D-6.
* Estimate from George Host, Natural Resources Research Institute; report available at www.frc.state.mn.us

Climate Change Projections

- High Vulnerability. (limited-medium evidence, medium agreement) On-going ash decline and emerald ash borer present serious existing threats to this system. These stressors may be exacerbated by climate change impacts to the precipitation regime. Limited research and management history and uncertainty for future precipitation reduce confidence in this determination.
- Low Adaptive Capacity. There is a lack of knowledge and management history in these forests compared to other forest systems in the assessment area, so we know less about how they function and respond to disturbance. Many species that exist in Wet Forests can tolerate intermittent wet and dry conditions, so this system might be adaptable to short-term floods and droughts. Extended droughts would likely cause significant damage to these shallow-rooted forests. Increased winter and spring precipitation could buffer summer moisture stress if excess water is retained in low-lying areas on the landscape. Additionally, Wet Forests often exist as large complexes of a single species or few species, so they have low response diversity. These forests also exist as isolated pockets on the landscape in some areas, so they may be disconnected in terms of migration and gene flow.
- Potential Impacts.
    - Drivers. Wet Forests depend on wet-mesic soils with saturated conditions in the spring and dry conditions in the summer months. Climate change has the potential to alter precipitation patterns across the assessment area, particularly during the growing season. The regeneration requirements of several species within this system are also linked to the timing of these wet and dry periods. Shifts in the timing or amount of precipitation could disrupt the function of these forests.
    - Stressors. The ongoing decline in black ash in the assessment area already presents problems for the health of Wet Forests. Invasive species such as reed canarygrass and European buckthorn are existing threats to these forests, and invasive species have the potential to increase in abundance in the assessment area under climate change. White-tailed deer populations are expected to increase with warmer winters, which may hinder regeneration of northern white-cedar in particular. Dutch elm disease will also likely limit the potential increase in American elm.
    - Dominant Species. The potential for emerald ash borer to spread throughout the assessment area presents a serious risk to black ash and green ash in Wet Forests. Considering the range of possible climate futures, the majority of dominant species that make up Wet Forests are expected to decline in suitable habitat and biomass across the assessment area, particularly under the GFDL A1FI scenario (black ash, northern white-cedar, balsam fir, balsam poplar, and black spruce). Model projections indicate that red maple may become a larger component of this system, and that minor species within Wet Forests like American elm and American basswood will also increase across the assessment area. Elm/ash/cottonwood forests could experience large potential productivity gains under a range of climate futures.

Appendix E
Native Plant Community Class Growth Stage and Composition

This appendix contains a series of tables that were used by the Planning Committee, in addition to other sources of information, to determine if the 100 year goals and strategies from the 2003 Plan should be maintained, amended, or eliminated. The revised goals appear in Section 7 of the Northeast Landscape Forest Resources Plan. These tables were adapted from the Tree Suitability and NPC Silviculture Interpretation work developed by the MN DNR Division of Forestry, Ecological Land Classification Program. Readers should note that the MN DNR has not created these tables for all NPC Classes. This appendix contains data on NPC Classes for which: 1) the data was available; and 2) were modeled to appear in great enough abundance in the Northeast Landscape to be relevant to the Planning Committee.

Table Interpretation

The following text provides information on interpreting the information displayed in this section of the plan; however, users of this plan are strongly encouraged to review the original documents and utilize the wealth of information within them.

Tree Suitability Tables (Left Side of NPC-Class Tables)

Each native plant community table includes a portion of the Minnesota DNR Tree Suitability Table – Version 2.2, 2013 (http://files.dnr.state.mn.us/forestry/ecssilviculture/treetables2.pdf). These tables were developed by the Minnesota Department of Natural Resources, Division of Forestry, Ecological Land Classification Program. Please use the following information to interpret these tables:

- Numbers: rank in order of competitive ability; 1=most suited; -- indicates trace presence; blank cells are for species not include in the Suitability Table.
- Color: Ability to compete with all vascular plants within NPC class (**GREEN** = excellent, **BLUE** = good, **YELLOW** = fair, **TAN** = poor, **WHITE** = not suitable)
- Letters:
  - w = tree species with a warmer synecological score than the community mean.
  - d = tree species with a drier synecological score than the community mean.

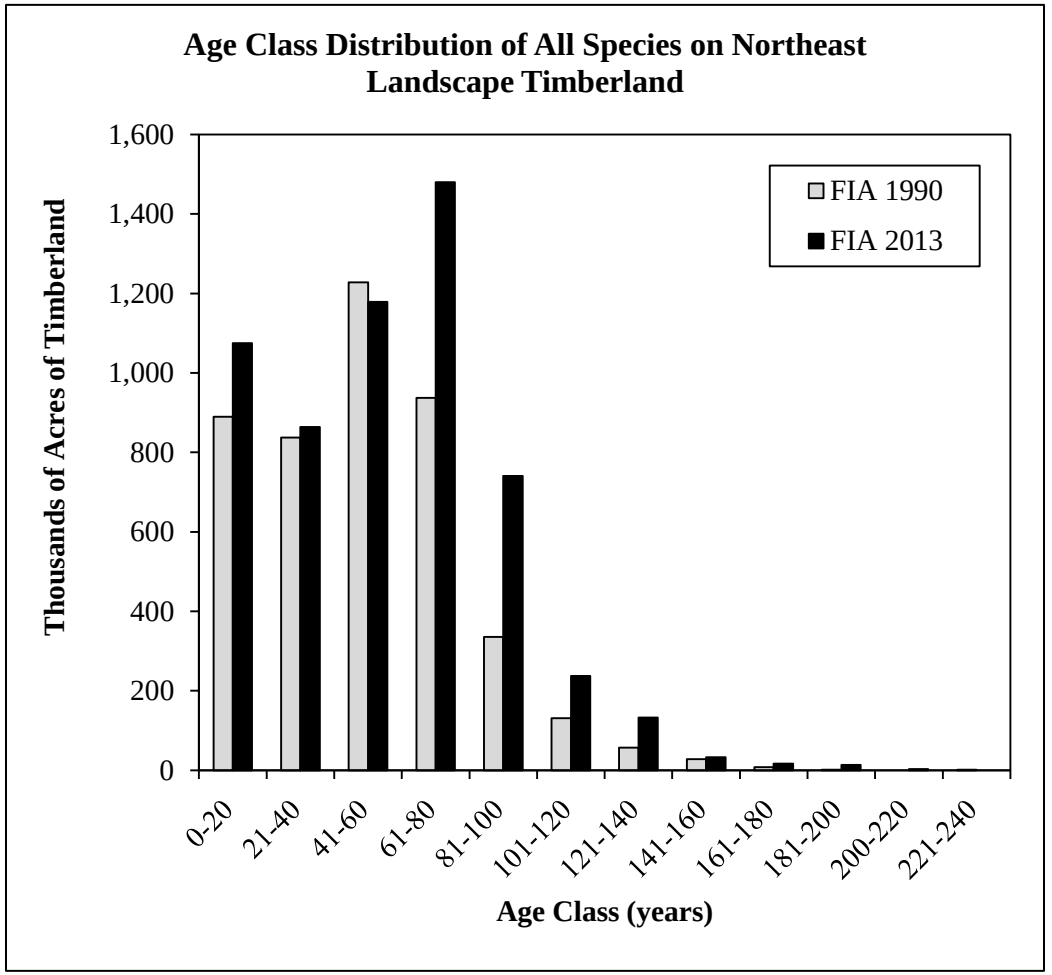
Public Land Survey vs Forest Inventory and Analysis Growth-stage Tables (Right Side of NPC-Class Tables)

The MN DNR Division of Forestry, Ecological Land Classification Program has developed Silviculture Interpretations for a number of NPC Classes (www.dnr.state.mn.us/forestry/ecs_silv/interpretations.html). In the development of these Silviculture Interpretations the MN DNR created tables comparing Public Land Survey (PLS; *ca.* 1846-1908 AD) and Forest Inventory and Analysis (FIA; *ca.* 1990 AD) growth-stage data. The 1990 FIA data is the most modern dataset that has been analyzed in this manner due to changes in how FIA collects its data. Changes have occurred in the region's forests between the FIA 1990 data and the development of this plan including a general shift to more mature age classes (see figure below). Please acknowledge these potential shortcomings when interpreting the following tables and realize these are the best estimates the Planning Committee had to work with when amending the 2003 Northeast Landscape goals and strategies.

Please use the following information to interpret these tables:

- Table values are relative abundance (%) of trees at PLS corners (orange shading) and FIA subplots (blue shading) modeled to represent the NPC community and estimated to fall within the young, mature, and old growth-stages.
- Arrows indicate increase or decrease between growth-stages for common tree species.
- The bottom row allows for a comparison of the percent balance of growth-stages across the 'pre-settlement landscape' and the 'modern landscape.'

Note: This information is meant to give a rough idea of the change in species and growth stage over time and should be used to establish general context, and not targets that should or even could be achieved.



FDn32: Northern Poor Dry-Mesic Mixed Woodland

FDn32: Northern Poor Dry-Mesic Mixed Woodland							
Tree Suitability	**Tree Species**	**Young (0-35)**		**Transition (35-55)**		**Mature (55-95)**	
		PLS[1]	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**
1d	Jack Pine	40%	1%	↓↓	↓	10%	0%
2	Black Spruce	1%	1%	↑↑	↑	31%	10%
3d	Red Pine	3%	--	↑		5%	--
4wd	Quaking Aspen	24%	74%	↓↓	↑↑	7%	43%
5wd	White Pine	5%	--	↑	↑	10%	2%
6wd	Paper Birch	19%	8%	↓	↑	17%	16%
7	Balsam Fir	6%	15%	↑	↑	13%	27%
	Miscellaneous	2%	1%			7%	2%
-	White Spruce						
-	Red Maple						
Adapted from work done by MN DNR, Division of Forestry, Ecological Land Classification Program.							
For Table Interpretation: See p. 7-2 and 7-3							
[1] 6,156 Public Land Survey records for section and quarter-section corners (*ca.* 1846-1908 AD).							
[2] 1,708 FIA (1990 AD) subplots that were modeled to be FDn32 sites.							
Percent of NPC Class in Growth Stage		**57%**	**56%**	**25%**	**39%**	**18%**	**5%**

FDn33: Northern Dry-Mesic Mixed Woodland

FDn33: Northern Dry-Mesic Mixed Woodland											
Tree Suitability	**Tree Species**	**Young (0-35)**		**Transition (35-55)**		**Mature (55-125)**		**~125**		**Old (> 125)**	
		PLS[1]	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**
1d	Red Pine	17%	1%	↑	-	27%	1%	↓↓	-	16%	1%
2d	Paper Birch	16%	5%	↑	↑	19%	26%	↓	↓	14%	18%
3d	White Pine	--	0%	↑↑	↑	19%	1%	↑	↑↑	30%	19%
4d (7wd)	Quaking Aspen (Big-toothed)[3]	40%	79%	↓↓	↓↓	9%	48%	↓	↓	7%	37%
5d	Jack Pine	15%	--	↓		7%	--	↓		2%	--
6	Balsam Fir	1%	7%	↑	↑	4%	11%	↑	↑	5%	15%
8wd	Red Maple	--	4%		↑	1%	9%		↓	2%	0%
10 (9)	White Spruce (Black)[3]	--	1%	↑	-	5%	1%	↑	-	13%	1%
	White Cedar	--	0%			2%	1%		↑	2%	8%
	Miscellaneous	11%	3%			7%	2%			9%	1%
11wd	Northern Red Oak										
Adapted from work done by MN DNR, Division of Forestry, Ecological Land Classification Program. For Table Interpretation: See p. 7-2 and 7-3 [1] 6,807 Public Land Survey records for section and quarter-section corners (*ca.* 1846-1908 AD). [2] 2,615FIA (1990 AD) subplots that were modeled to be FDn33 sites. [3] Species could not be separated in the PLS data.											
Percent of NPC Class in Growth Stage		**14%**	**30%**	**27%**	**30%**	**44%**	**39%**			**15%**	**1%**

FDn43: Northern Mesic Mixed Forest

FDn43: Northern Mesic Mixed Forest											
Tree Suitability	**Tree Species**	**Young (0-35)**		**Transition (35-55)**		**Mature (55-95)**		**Transition (95-115)**		**Old (> 115)**	
		PLS[1]	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**
1wd	Paper Birch	15%	5%	↑	↑	31%	20%	↓	↓	18%	18%
2wd	White Pine	2%	0%	↑↑	↑	24%	1%	↑	↑	28%	3%
3wd	Quaking Aspen	60%	76%	↓↓	↓	12%	52%	↓	↓	5%	23%
4d	Red Pine	3%	0%	↑	↑	9%	1%	↓	-	5%	1%
5	White Cedar	–	0%	↑	-	3%	0%	↓	↑	2%	14%
6	Balsam Fir	1%	7%	↑	↑	10%	13%	↑	↑	13%	25%
7	White Spruce	–	1%	↑	↑	4%	2%	↑↑	-	28%	2%
8wd	Red Maple	–	3%	↑	↑	1%	4%	↓	↓	–	1%
9	Black Spruce	0%	0%	-	↑	0%	1%	-	↑	0%	6%
10	Jack Pine	19%	0%	↓	-	3%	0%	-	-	3%	0%
	Balsam Poplar	–	4%		↓	–	2%		-	–	2%
	Miscellaneous	0%	4%			3%	4%			0%	5%
Adapted from work done by MN DNR, Division of Forestry, Ecological Land Classification Program. For Table Interpretation: See p. 7-2 and 7-3 [1] 11,725 Public Land Survey records for section and quarter-section corners (*ca.* 1846-1908 AD). [2] 10,785 FIA (1990 AD) subplots that were modeled to be FDn43 sites.											
Percent of NPC Class in Growth Stage		**17%**	**20%**	**30%**	**26%**	**31%**	**48%**	**6%**	**3%**	**16%**	**2%**

MHn35: Northern Mesic Hardwoods

MHn35: Northern Mesic Hardwoods											
Tree Suitability	**Tree Species**	**Young (0-55)**		**Transition (55-95)**		**Mature (95-205)**		**Transition (205-295)**		**Old (> 295)[3]**	
		PLS[1]	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**
1wd	Sugar Maple	11%	24%	↑	↑	14%	32%	↑↑	↑	29%	50%?
2wd	Basswood	6%	9%	↑	↑	9%	19%	↓	↓	6%	0%
3wd	Red Oak	10%	6%	↓	↑	5%	11%	↓	↓	1%	0%
4d	Paper Birch	38%	9%	↓↓	↓	28%	7%	↓↓	↓	12%	0%
5d	Quaking Aspen	20%	22%	↓↓	↑	6%	4%	↓	↓	4%	0%
6wd	Red Maple	--	9%		↓	--	4%		↓	0%	0%
8wd	Ironwood	1%	7%		-	1%	7%	-	↓	1%	0%
9d	White Pine	1%	0%	↑	↑	7%	1%	↑↑	↓	31%	0%
10wd	Bur Oak	1%	1%		↑	2%	3%		↑↑	0%	50%?
12	Balsam Fir	5%	4%	↓	↓	3%	2%	↓	↓	1%	0%
-	White Spruce[4]	1%	1%	↑↑	↓	13%	0%	↓	↓	--	0%
	American Elm	3%	2%	↓	↑	2%	3%	↓	↓	0%	0%
	Miscellaneous	3%	6%			10%	7%			15%	0%
7wd	Big-toothed Aspen										
11w	Yellow Birch										

Adapted from work done by MN DNR, Division of Forestry, Ecological Land Classification Program.

For Table Interpretation: See p. 7-2 and 7-3

[1] 5,887 Public Land Survey records for section and quarter-section corners (*ca.* 1846-1908 AD).

[2] 3,470 FIA (1990 AD) subplots that were modeled to be MHn35 sites.

[3] Just 4 FIA trees contributed to the old growth-stage and the results are unreliable.

[4] Important historically, white spruce is no longer a significant component of MHn35 forests and is not covered in the accounts of potential crop species.

Percent of NPC Class in Growth Stage	**39%**	**29%**	**51%**	**52%**	**8%**	**18%**	**1%**	**1%**	**1%**	**0%**

MHn45: Northern Mesic Hardwoods (Cedar)

MHn45: Northern Mesic Hardwoods (Cedar)											
Tree Suitability	**Tree Species**	**Young (0-75)**		**Transition (75-95)**		**Mature (95-155)**		**Transition (155-195)**		**Very Old (> 195)**	
		PLS[1]	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**
1wd	Sugar Maple	33%	17%	↓↓	↑	12%	34%	↓	↑	11%	38%
2w	Yellow Birch	22%	0%	↓	↑	11%	1%	↑	↓	15%	0%
3d	Paper Birch	13%	21%	↓	↓	6%	14%	↓	↓	–	13%
4	White Cedar	6%	0%	↑↑	↑	25%	5%	↓↓	↑↑	8%	25%
5wd	Basswood	2%	4%		↑	2%	6%		↓	1%	0%
6	White Spruce	6%	3%	↑↑	↓	37%	2%	↑↑	↑	54%	13%
7	Balsam Fir	11%	29%	↓	↓	4%	17%	↓	↓	2%	0%
8wd	Red Maple[3]	--	3%		↑	--	5%		↓	--	0%
9d	Quaking Aspen	2%	19%		↓	--	7%		↓	0%	0%
	Black Spruce[3]	--	0%		↑	--	3%		↓	--	0%
	Miscellaneous	5%	4%			3%	6%			9%	11%
10d	White Pine										
-	Black Ash										

Adapted from work done by MN DNR, Division of Forestry, Ecological Land Classification Program.

For Table Interpretation: See p. 7-2 and 7-3

[1] 4,074 Public Land Survey records for section and quarter-section corners (*ca.* 1846-1908 AD).

[2] 10,595 FIA (1990 AD) subplots that were modeled to be MHn45 sites.

[3] Red maple and black spruce could not be separated in the PLS notes and were included with sugar maple and white spruce respectively in the PLS percentages.

Percent of NPC Class in Growth Stage	**29%**	**64%**	**16%**	**20%**	**38%**	**15%**	**3%**	**0%**	**14%**	**0%**

MHn44: Northern Wet-Mesic Boreal Hardwood-Conifer Forest

MHn44: Northern Wet-Mesic Boreal Hardwood-Conifer Forest											
Tree Suitability	**Tree Species**	**Young (0-35)**		**Transition (35-95)**		**Mature (95-195)**		**~195**		**Old (> 195)**	
		PLS[1]	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**
1d	Quaking Aspen	86%	78%	↓↓	↓↓	24%	40%	↑	↑	28%	43%
2	Balsam Fir	3%	5%	↑	↑	10%	17%	-	↓	10%	16%
3wd	Red Maple	1%	3%	-	↓	1%	2%		↓	1%	0%
4d	Paper Birch	5%	3%	↑	↑	18%	14%	↓	-	12%	14%
5wd	Basswood	--	1%		-	1%	1%		↓	1%	0%
6	White Spruce	1%	0%	↑↑	↑	34%	1%	↓	↓	33%	0%
7	White Cedar	--	0%		↑	1%	4%		↑	1%	18%
8d	White Pine	--	0%	↑	↑	1%	4%	↑	↓	4%	2%
9w	Black Ash	1%	2%	-	-	1%	2%		↑	--	5%
10	Balsam Poplar	1%	6%		↓	--	3%		↓	1%	2%
11wd	Red Oak	--	0%		↑	--	1%		↓	1%	0%
12wd	Bur Oak	1%	1%	-	↑	1%	2%		↓	2%	0%
	Miscellaneous	2%	2%			9%	12%			9%	0%
13wd	Sugar Maple										
14w	Green Ash										
15d	Red Pine										
-	American Elm										
Adapted from work done by MN DNR, Division of Forestry, Ecological Land Classification Program. For Table Interpretation: See p. 7-2 and 7-3 [1] 4,074 Public Land Survey records for section and quarter-section corners (*ca.* 1846-1908 AD). [2] 10,595 FIA (1990 AD) subplots that were modeled to be MHn44 sites.											
Percent of NPC Class in Growth Stage		**24%**	**21%**	**60%**	**75%**	**14%**	**4%**			**2%**	**0%**

APn80: Northern Spruce Bog

APn80: Northern Spruce Bog						
Tree Suitability	**Tree Species**	**Young**			**Mature**	
		PLS	**FIA**		**PLS**	**FIA**
1d	Black Spruce	No Growth Stage Data Available				
2	Tamarack					
Source: MN DNR, Division of Forestry, Ecological Land Classification Program.						

APn8: Northern Poor Conifer Swamp

APn81: Northern Poor Conifer Swamp							
Tree Suitability	**Tree Species**	**Young (0-55)**		**~55**		**Mature (>55)**	
		PLS[1]	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**
1d	Black Spruce	21%	59%	↑	↑	27%	66%
2	Tamarack	77%	29%	↓	↓	67%	24%
	Balsam Fir	--	5%		↓	1%	3%
	White Cedar	--	2%		↑	2%	3%
	Miscellaneous	2%	5%			3%	4%
3wd	White Pine						
-	Paper Birch						
Adapted from work done by MN DNR, Division of Forestry, Ecological Land Classification Program. For Table Interpretation: See p. 7-2 and 7-3 [1] 3,818 Public Land Survey records for section and quarter-section corners (*ca.* 1846-1908 AD). [2] 4,961FIA (1990 AD) subplots that were modeled to be APn81sites.							
Percent of NPC Class in Growth Stage		**35%**	**41%**			**65%**	**59%**

FPn82: Northern Rich Tamarack Swamp

FPn82: Northern Rich Tamarack Swamp							
Tree Suitability	**Tree Species**	**Young (0-55)**		**~55**		**Mature (>55)**	
		PLS[1]	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**
1	Tamarack	80%	39%	↓↓	↑↑	66%	57%
2	Black Spruce	12%	56%	↑↑	↓↓	20%	38%
3d	White Cedar	2%	2%	↑	↑	7%	3%
	Miscellaneous	6%	3%			7%	2%
-	White Pine						
Adapted from work done by MN DNR, Division of Forestry, Ecological Land Classification Program. For Table Interpretation: See p. 7-2 and 7-3 [1] 2,840 Public Land Survey records for section and quarter-section corners (*ca.* 1846-1908 AD). [2] 1,542 FIA (1990 AD) subplots that were modeled to be FPn82 sites.							
Percent of NPC Class in Growth Stage		**23%**	**60%**			**77%**	**40%**

Other Forested Rich Peatland Communities

FPn62 - Northern Rich Spruce Swamp	**FPn63** - Northern Cedar Swamp	**FPn71** - Northern Rich Spruce Swamp	**FPn72** - Northern Rich Tamarack Swamp	**FPn81** - Northern Rich Tamarack Swamp	**Tree Species**	**Young**			**Mature**	
Tree Suitability						**PLS**	**FIA**		**PLS**	**FIA**
1	**2**	**1d**	**2**	**2d**	Black Spruce	No Growth Stage Data is Available for these NPC Classes				
2	**4**	**2**	**1**	**1**	Tamarack					
3wd	**5wd**		**3wd**		Paper Birch					
4	**1**	**3d**			White Cedar					
5d	**3d**				Balsam Fir					
-			-		White Pine					
-			-		White Spruce					
			-		American Elm					
			-		Black Ash					

Source: MN DNR, Division of Forestry, Ecological Land Classification Program.

WFn64: Northern Very Wet Ash Swamp

WFn64: Northern Very Wet Ash Swamp											
Tree Suitability	**Tree Species**	**Young (0-75)**		**~75**		**Mature (75-135)**		**~135**		**Old (> 135)**	
		PLS[1]	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**
1w	Black Ash	72%	55%	↓	↑	71%	56%	↓	↓	56%	36%
2	Tamarack	1%	0%	↑	-	2%	0%	↑	-	12%	0%
3d	Quaking Aspen	2%	6%	↓	↓	1%	4%	↓	↓	--	3%
4	White Cedar	1%	1%	↑	↑	8%	7%	↓	↑↑	4%	31%
5wd	Yellow Birch	1%	0%	-	↑	1%	1%	↓	↑	--	3%
6wd	Red Maple	1%	1%	-		1%	--	-		1%	0%
7d	Paper Birch	4%	4%	↓	↑	3%	5%	-	↓	3%	4%
8wd	American Elm	6%	6%	↓	↑	5%	7%	↑	↓	6%	4%
9d	Balsam Fir	6%	16%	↓	↓	1%	12%	↑	↑	2%	16%
-	White Spruce	1%	1%	↑	-	5%	1%	↑	-	13%	1%
	Balsam Poplar	1%	8%		↓	--	4%		↓	0%	1%
	Miscellaneous	6%	3%			4%	4%			4%	4%
10wd	Red Elm										
Adapted from work done by MN DNR, Division of Forestry, Ecological Land Classification Program.											
For Table Interpretation: See p. 7-2 and 7-3											
[1] 1,113 Public Land Survey records for section and quarter-section corners (*ca.* 1846-1908 AD).											
[2] 1,831 FIA (1990 AD) subplots that were modeled to be WFn64sites.											
Percent of NPC Class in Growth Stage		**55%**	**51%**			**35%**	**40%**			**10%**	**9%**

WFn53: Northern Wet Cedar Forest

WFn53: Northern Wet Cedar Forest											
Tree Suitability	**Tree Species**	**Young (0-55)**		**Transition (55-75)**		**Mature (75-105)**		**Transition (105-155)**		**Old (> 155)**	
		PLS[1]	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**	**PLS[1]**	**FIA[2]**
1	White Cedar	18%	11%	↑↑	↑↑	67%	46%	↓↓	↑	26%	55%
2w	Black Ash	7%	45%	↓	↓↓	4%	20%	↓	↓	3%	12%
3d	Paper Birch	8%	7%	-	↓	8%	5%	↓	↑	5%	6%
4d	Balsam Fir	52%	24%	↓↓	↓	7%	17%	↑↑	↑	21%	18%
6d (5)	White Spruce (incl. Black)[3]	3%	2%	↑	↑	7%	4%	↑↑	↓	23%	2%
7d	Balsam Poplar	3%	9%		↓	2%	4%		↓	2%	3%
-	Tamarack	2%	0%	↓	↑	11%	2%	↑↑	↓	11%	0%
	Miscellaneous	5%	2%			4%	0%			9%	4%
8wd	Yellow Birch										
9d	Quaking Aspen										
Adapted from work done by MN DNR, Division of Forestry, Ecological Land Classification Program.											
For Table Interpretation: See p. 7-2 and 7-3											
[1] 1,505 Public Land Survey records for section and quarter-section corners (*ca.* 1846-1908 AD).											
[2] 2,746FIA (1990 AD) subplots that were modeled to be WFn53sites.											
[3] Species could not be separated in the PLS data.											
Percent of NPC Class in Growth Stage		**7%**	**22%**	**10%**	**15%**	**34%**	**23%**	**15%**	**26%**	**9%**	**14%**

WFn55: Northern Wet Ash Swamp

WFn55: Northern Wet Ash Swamp						
Tree Suitability	Tree Species	Young			Mature	
		PLS	FIA		PLS	FIA
1w	Black ash	No Growth Stage Data is Available for this NPC Class				
2d	Quaking aspen					
3wd	Yellow birch					
4	White cedar					
5wd	Green ash					
6wd	Red maple					
7d	Balsam poplar					
8d	Paper birch					
9d	Balsam fir					
10wd	Basswood					
11wd	American elm					
12d	White pine					
13	Black spruce					
14wd	Bur oak					
15d	White spruce					
-	Tamarack					
-	Sugar maple					

Appendix F
Coordination Committee Documents

This section provides a list of support documents that the Planning Committee created during the development of the Plan that they thought would aid in the coordination of plan implementation. These documents will be further reviewed and refined by to the Northeast Coordination Committee following the approval of the Plan. These documents should be viewed as a first pass at collecting ideas and refined by the Coordination Committee. To obtain copies of the Coordination Committee documents listed above, please contact the MFRC staff.

- Operations Guide
- 10 Year Project List
- Monitoring Question Table
- Adult Education Model
- List of Potential Action Items

Appendix G
Spatial Planning Categories

This appendix reports the number of acres by organizational planning category for several of the major public land owners in the Northeast Landscape. These acre estimates are from the organization's Land Management Plan.

A. MFRC Landscape Program – 2003 Northeast Landscape Plan

Ecological Plant Community	Percent of Northern Superior Uplands Section	Acres Northern Superior Uplands Section	Percent of EPC by Land Management Type in Northern Superior Uplands Section			
			Private	County	State	Federal
Mesic White-Red Pine	12%	671,000	38%	28%	9%	20%
Mesic Aspen-Birch	20%	875,000	34%	11%	19%	36%
Dry-Mesic White-Red Pine	11%	641,000	36%	15%	18%	31%
Jack Pine – Black Spruce	21%	1,069,900	10%	2%	6%	*26% **56%
Northern Hardwoods	10%	246,000	35%	23%	18%	24%
Total		**3,503,000**				

* Outside BWCA, ** BWCA
Adapted from 2003 Northeast Landscape Plan (www.mn.gov/frc/initiatives_llm_committees_northeast.html)

B. US Forest Service: Superior National Forest – Land & Resource Management Plan

Landscape Ecosystems	Acres	Percent of SNF
Jack Pine/Black Spruce	888,000	41%
Dry-Mesic Red and White Pine	254,400	12%
Mesic Red and White Pine	166,500	8%
Mesic Birch/Aspen/Spruce/-Fir	387,100	18%
Sugar Maple	64,000	3%
Lowland Conifer	477,000	22%
Total	**2,179,300**	**100%**

Adapted from 2004 US Forest Service: Superior National Forest – Land & Resource Management Plan
(www.fs.usda.gov/main/superior/landmanagement/planning)

C. Fond du Lac Band of Lake Superior Chippewa – Integrated Resource Management Plan

Cover Types	Acres	Percent of Fond du Lac
Aspen	16,148	57%
Northern Hardwood	3,683	13%
Paper Birch	1,416	5%
White Cedar	283	1%
Natural Pines – Red/White/Jack	283	1%
Pine Spruce Plantation	1,133	4%
Fir and Spruce	567	2%
Swamp Hardwoods	1,983	7%
Swamp Conifer	2,833	10%
Total	**28,329**	**100%**

Adapted from 2008 Fond du Lac Band of Lake Superior Chippewa Integrated Resource Management Plan (www.fdlrez.com/newnr/main.htm)

D. Bois Forte Forestry Department – Integrated Resource Management Plan

Data not made available.

E. Grand Portage Forestry Department – Integrated Resource Management Plan

Data not made available.

F. Minnesota DNR Forestry – Border Lakes SFRMP – 2001

Border Lakes Subsection Forest Cover Type Composition on State Lands (outside BWCAW)	Acres	Percent of DNR Lands
Aspen/Birch/Balm of Gilead	130,318	49%
White/Red Pine	20,645	8%
Jack Pine/Black Spruce Upland	24,216	9%
White Spruce/Balsam Fir/Upland Cedar	19,384	7%
Black Spruce Lowland/Tamarack/ Stagnant Conifers	47,160	18%
Ash/Lowland Hardwoods/Lowland Cedar	19,339	7%
Northern Hardwoods	757	0%
Upland Brush	2,459	1%
Subsection Total	**264,278**	**100%**
www.dnr.state.mn.us/forestry/subsection/borderlakes		

G. Minnesota DNR Forestry – Mille Lacs SFRMP

DNR Managed Land Area by Cover Type	Acres	Percent of DNR Lands
Ash/Lowland Hardwoods	19,455	8%
Aspen/BAM	105,123	44%
Birch	8,210	3%
Northern & Cent Hdwds	38,735	16%
Oak	28,970	12%
White Pine	671	0%
Norway Pine	7,508	3%
Jack Pine	1,354	1%
White Spruce	2,653	1%
Balsam Fir	2,625	1%
Black Spruce	11,540	5%
Tamarack	11,324	5%
Total	**238,166**	**100%**
2011 (www.dnr.state.mn.us/forestry/subsection/millelacs/index.html)		

H. Minnesota DNR Forestry – North Shore Area SFRMP

	Acres	Percent of DNR Lands
Ash	6,914	3.2%
Lowland Hardwoods	667	0.3%
Aspen	69,216	31.7%
Balm of Gilead	1,157	0.5%
Birch	29,930	13.7%
Northern Hardwoods	14,343	6.6%
Oak	155	0.1%
White Pine	2,178	1.0%
Red Pine	8,526	3.9%
Jack Pine	5,227	2.4%
Scotch Pine	6	0.0%
Balsam Fir	12,224	5.6%
White Spruce	12,574	5.8%
Norway Spruce	5	0.0%
Tamarack	5,519	2.5%
Larch, Upland	11	0.0%
Black Spruce Upland	3,207	1.5%
Black Spruce Lowland	29,054	13.3%
White Cedar	16,724	7.7%
Cutover Area	560	0.3%
Total	**218,197**	**100.0%**
Adapted from North Shore Area SFRMP Assessment		

I. Minnesota DNR Forestry – North Four SFRMP

Cover Type	Acres	Percent of DNR Lands
Ash/Lowland Hardwoods	52,343	7.2%
Aspen/Balm of Gilead	261,008	35.8%
Birch	10,064	1.4%
Northern Hardwoods/Oak	27,781	3.8%
Jack Pine/ Upland Black Spruce	15,006	2.1%
White Spruce(Planted)	9,525	1.3%
White Spruce(Natural)	1,169	0.2%
Balsam Fir	16,033	2.2%
Tamarack- High SI	24,556	3.4%
Tamarack- Low SI	49,452	6.8%
Black Spruce Lowland- High SI	29,008	4.0%
Black Spruce Lowland – Med SI	94,678	13.0%
Black Spruce Lowland – Low SI	55,788	7.7%
Red Pine	36,343	5.0%
White Pine	2,176	0.3%
White Cedar	43,510	6.0%
Totals	728,440	100.0%
Adapted From: www.dnr.state.mn.us/forestry/subsections/north4/finalplan.html		

J. Carlton County Land Department – Management Plan for Tax Forfeited Lands

Native Plant Community	Acres	Percent of Carlton County Tax Forfeit Lands
Dry Mesic Poor Mixed Woodland (FDn32)	429	0.6%
Dry Mesic Mixed Woodland (FDn33)	2,908	4.0%
Mesic Hardwood Forest (MHn35)	2,684	3.7%
Mesic Mixed Forest (FDn43)	16,226	22.5%
Mesic Rich Northern Hardwood (MHn47)	25	0.0%
Wet Mesic Boreal Hardwood -Conifer Forest (MHn44)	12,864	31.9%
Wet/Dry Boreal hardwood-conifer forest (MHn44b)	4,480	6.2%
Wet Ash Swamp (WFn55)	754	1.0%
Wet Cedar Forest (WFn53)	18,774	26.0%
Wet Northern Alder Swamp (FPn73)	2,514	3.5%
Wet Spruce Bog (APn80)	10,510	14.6%
Source: www.co.carlton.mn.us/Departments/Land/		

Cover Type	Acres	Percent of Carlton County Tax Forfeit Lands
Ash	4,055	5.6%
Aspen	24,044	33.2%
Balm of Gilead	557	0.8%
Balsam Fir	1,304	1.8%
Birch	1,862	2.6%
Black Spruce, Lowland	3,086	4.3%
Lowland Hardwoods	144	0.2%
Northern Hardwood	3,310	4.6%
Jack Pine	22	0.0%
Red Pine	1,399	1.9%
White Pine	78	0.1%
Oak	244	0.3%
Tamarack	2,059	2.8%
White Cedar	626	0.9%
White Spruce	1,124	1.6%
Stagnant Cedar? Spruce / Tamarack	3,404	4.7%
Upland Grass / Brush	372	0.5%
Lowland Grass / Brush	10,376	14.3%

Marsh / Muskeg	12,004	16.6%
Permenent Water	405	0.6%
Non-permenent Water	663	0.9%
Developed / Roads / Agricultural / Other	1,269	1.8%
Total	**72,407**	**100.0%**
Source: www.co.carlton.mn.us/Departments/Land/		

K. Lake County Land Department – Forest Management Plan

	Acres	Percent of Tax Forfeit Lands in Lake County
Aspen	Data not available in Lake County Management Plan	
Birch		
Northern Hardwoods		
Spruce		
Balsam Fir		
Cedar		
Pine		
Total		

L. St. Louis County Land Department – Long-Term Resource Management Plan

Cover Type	Acres	Percent of Tax Forfeit Lands in St Louis County
Ash/Lowland Hdwds	38,524	4.4%
Aspen/BG	304,216	34.8%
Birch	44,725	5.1%
Northern Hdwds	14,956	1.7%
Oak	988	0.1%
White Pine	5,959	0.7%
Red Pine	19,895	2.3%
Jack Pine	8,994	1.0%
Black Spruce, up	1,652	0.2%
White Spruce	7,470	0.9%
Balsam Fir	22,156	2.5%
Cedar/Tamarack/BS	12,925	1.5%
White Cedar	20,897	2.4%
Tamarack	31,658	3.6%
Black Spruce, low	40,285	4.6%
Stagnant C/T/BS	104,703	12.0%
Harvest Area	24,462	2.8%
Low Brush/Grass	82,984	9.5%
Up Brush/Grass	4,872	0.6%
Water/Marsh/Etc.	66,191	7.6%
Dev/Rds/Other	15,286	1.7%
Total	**873,798**	**100.0%**
Adapted from: St. Louis County Land Department Long-Term Resource Management Plan		