



3 0318 00018 0323

# **Evaluation of Selected Potential Candidate Research Natural Areas**

as representative of

## **Ecological Landtype Associations**

on the

## **Superior National Forest, Minnesota**

Chel E. Anderson  
Minnesota County Biological Survey  
Section of Ecological Services, Division of Fish and Wildlife  
Minnesota Department of Natural Resources  
500 Lafayette Road, Box 25  
St. Paul, MN 55155

Biological Report No. 58

December 1997

4044 8621

**EVALUATION OF SELECTED POTENTIAL CANDIDATE RESEARCH NATURAL AREAS  
AS REPRESENTATIVE OF ECOLOGICAL LANDTYPE ASSOCIATIONS  
ON THE SUPERIOR NATIONAL FOREST, MINNESOTA**

Chel E. Anderson  
Minnesota County Biological Survey  
Section of Ecological Services, Division of Fish and Wildlife  
Minnesota Department of Natural Resources  
Box 25, 500 Lafayette Road  
St. Paul, Minnesota 55155

Biological Report No. 58

December 1997

LIBRARY  
Dept. of Natural Resources  
500 Lafayette Road  
St. Paul, MN 55155-4021

## CONTENTS

List of Appendices, Figures and Tables.....	2
Preface .....	3
Introduction .....	4
Background .....	4
Methods .....	5
Results .....	7
Discussion.....	7
Acknowledgments .....	18
Literature Cited .....	18

## LIST OF APPENDICES, FIGURES AND TABLES

Appendix 1. Supplemental information for 45 sites evaluated in 1997 as Potential Candidate Research Natural Areas on the Superior National Forest.

Appendix 2. Wall Map: *Superior National Forest Potential Candidate Research Natural Areas, 1997 Evaluation.*

Figure 1. Map: *Superior National Forest Potential Candidate Research Natural Areas, 1997 Evaluation.*

Table 1. Forty-five sites selected for evaluation in 1997 organized by Superior National Forest Ecological Units.

Table 2. Summary of evaluation of 45 sites as Potential Candidate Research Natural Areas, and index to information compiled in Appendix 1.

Table 3. List of 19 sites not considered for evaluation in 1997 but referred to in the discussion of Potential Candidate Research Natural Areas.

## PREFACE

The purpose of this project was to continue evaluations of potential candidate Research Natural Areas (RNAs) on the Superior National Forest (SNF) based on a selection of potential sites described in *Identification of potential natural areas, including representative ecosystems, on the Superior National Forest* (Vora 1997). These sites were selected as potential representatives of the highest-quality remaining examples of characteristic ecosystems in each ecological Landtype Association (LTA) found on the SNF. The scope of this project was limited by the amount of funding available and by the request that results be available in time to be considered in the preparation of revised Forest Land and Resource Management Plans for the Superior and Chippewa National Forests. Field work, data management and summaries of results of this project were completed between late June and December 1997. Because of its short duration relative to the total size of the area evaluated, this project could be described as a rapid assessment of selected sites as potential candidate research natural areas. Use of information contained in this report for other applications should be done in consideration of the cursory nature of this project.

While this project was underway, *The Notice of Intent (NOI) to Prepare an Environmental Impact Statement/Description of Proposal for Revising Forest Plans* was issued (August 1997) for the Superior (SNF) and Chippewa National Forests. The NOI includes a proposal to establish "special management complexes" (SMCs) on each forest. As of December 1997, the concept of SMCs was still being developed by Forest Service planning teams. Ongoing discussions included the clarification of the relationship of SMCs and RNAs. One possible relationship is that a portion of a potential candidate RNA site that contains the most representative features of an LTA would become an RNA, and the remainder would be managed to promote the ecological processes appropriate for the LTA, but would have fewer management restrictions than an RNA. Some sites within the SNF considered in this project, for which there is presently insufficient information for RNA designation, could become candidates for SMCs or other management units, with final criteria for such areas determined by the Forest planning process. In this report, references to SMCs in site specific evaluations indicates that there are important biological features in the area meriting consideration in the selection of SMCs or other managed areas by the SNF. The identification, evaluation and discussion of sites are an important information resource for use in Forest planning, but do not constitute a final recommendation of specific sites.

This cooperative project was funded by the US Forest Service (Washington Office Research Natural Area Grant), The Minnesota Department of Natural Resources (The Natural Heritage and Nongame Research Program [NHNRP] and the Minnesota County Biological Survey [MCBS]), and the Minnesota Field Office of The Nature Conservancy (TNC).

## INTRODUCTION

In order to both maintain healthy ecosystems and provide the public with commodities and recreation opportunities, land management agencies are now taking an ecosystem-based approach to managing federal lands. Designation of Research Natural Areas and other natural area classifications is one tool useful in this endeavor. RNAs are designated to be permanently protected for the purposes of maintaining biological diversity, conducting research and monitoring, and fostering education (USDA 1992). RNAs contain:

- Unique ecosystems or ecological features.
- Rare or sensitive species of plants, animals and their habitats.
- High-quality examples of widespread ecosystems.

The national network of RNAs contributes to the protection of biological diversity at all scales. Those that are representative of common ecosystems in natural condition serve as baseline or reference areas, essential to evaluating timber and other management prescriptions within the ecosystem management framework. Management of RNAs emphasizes maintaining natural features and processes. This makes RNAs excellent areas for studying ecosystems and monitoring succession and other long-term ecological changes, resulting in better understanding of complex natural systems necessary for ecosystem-based management.

## BACKGROUND

Initial identification of potential natural areas on the Superior National Forest began with Robin Vora's analysis under an FY96 Washington Office (WO) Research Natural Area grant. Details of this analysis are presented in a report of January 30, 1997, entitled *Identification of Potential Natural Areas, Including Representative Ecosystems, on the Superior National Forest*. Using existing information (field knowledge, maps, high-altitude aerial photography), the purpose of the analysis was to identify the "highest quality remaining examples of common ecosystems present within each ecological Landtype Association (LTA) found on the Forest" (Vora 1997). Descriptions of the LTA attributes are available from the Superior National Forest's Ecological Classification System (Leuelling et. al. 1992). Ninety-three areas were ultimately selected using a ranking and scoring process that considered the following site attributes: lack of disturbance, size of upland forest, integrity of watershed, size of wetlands, presence of lacustrine and riverine ecosystems, shape of site related to interior forest, the presence of rare communities, and landscape context.

In 1997, a second Washington Office grant was approved for further evaluation of potential natural areas with a greater emphasis on field evaluation. A meeting was held May 7, 1997 that included representatives of project cooperators to discuss methods for continued evaluation of potential candidate research natural areas under the constraints of limited time and funding. Given the potential for representation in state parks and the Boundary Waters Canoe Area Wilderness, a decision was made to give lower priority to 1997 work in LTAs in the Border

Lakes and North Shore Highlands Ecological Subsections. As the field season progressed, sites in LTAs in the North Shore Highlands were added to the evaluation at the request of SNF staff. Chel Anderson was employed by the Minnesota Department of Natural Resources (DNR) as the field plant ecologist for the project from June through November 1997.

While this project was in progress, revisions to the SNF's Ecological boundaries, including LTA boundaries were discussed and changes were proposed but not finalized. For the purposes of this project, the Ecological System boundaries used were those referenced in Vora's 1997 report.

## **METHODS**

The evaluation process began with the examination of information resources for up to five of the highest ranked sites in each of 19 LTAs according to Vora's analysis. The goal was to select two sites in each LTA as priority areas for 1997 field work. Project cooperators agreed that considerations for this selection should include the following (in no particular order): landscape context, historical context (disturbance history and comparison to the landscape at the time of the public land surveys), stand age, the presence of rare natural communities, suggestions from local experts, and access.

As part of the review process, SNF timber compartment records and old-growth maps were examined along with 1:40,000 color infrared photography (1990 National Aerial Photography Program, U.S.G.S., U.S. Department of Interior). Classified satellite imagery of cover types delivered to the DNR by the Natural Resources Research Institute (NRRI), University of Minnesota was not available at the beginning of the process but provided a valuable layer in final map production (Wolter 1997). Procedures used to generate the satellite classification are described in Wolter et. al. 1995. Also reviewed were records from the Public Land surveys (U.S. Surveyor General 1847-1908) that included information on ownership, exterior subdivision lines, general descriptions, and bearing trees (Almendinger 1996). Discussions with SNF District staff assisted with site selection.

In most instances the information that was reviewed reinforced or did not contradict Vora's original ranking. However, in a few cases lower-ranked sites were chosen for additional work because of recent disturbance to higher-ranked sites, or to achieve more complete representation of an LTA. In addition, some of the original boundaries proposed in Vora's 1997 report were modified due to new information or suggestions by SNF staff. In most cases two top-ranked sites in each LTA were selected as priorities for field work. With the later addition of sites in the North Shore Highlands, a total of 45 sites represented priority areas for evaluation in 1997. Additional comments in this report about the biological features of 19 other sites were possible as a result of the initial review process and discussions with the SNF staff.



The number and size of the sites limited field work on any individual site. Prior to field work, aerial photos and SNF compartment records were further examined to identify specific areas within sites for field work. Wherever possible, rare, old-growth or vegetation types for which forest inventory typing was too generalized were considered for field work emphasis. The field work that was completed was ultimately driven by accessibility and project time constraints.

Field surveys consisted of ground surveys and aerial surveys of 43 of the 45 sites. Forty-three days of ground surveys were possible due to good weather conditions in July, August and September, 1997. Observations and data from field visits were recorded using releve methods (Almendinger 1987) and site forms developed by the DNR's Minnesota County Biological Survey. The classification of natural communities used in the field evaluation of potential natural areas is described in *Minnesota's native vegetation: a key to natural communities* (Minnesota Natural Heritage Program 1993). Natural communities are classified and described on the basis of vegetation, hydrology, landforms, soil, and natural disturbance regimes and defined as "groups of native plants and animals that interact with each other and their abiotic environment in ways not greatly altered by modern human activity or by introduced organisms" (Minnesota County Biological Survey 1996). Three lakes were surveyed in August for aquatic plants.

*Potential Candidate RNA Evaluation* forms, developed by the project cooperators were completed for 25 of the 45 targeted sites. *RNA* forms were not completed for all 45 sites due to time limitations and the lower priority for documentation of sites located in the North Shore Highlands Subsection. Only two *RNA* forms were completed for sites in the North Shore Highlands. Information recorded on these forms was based primarily on field visits to those sites.

An effort to obtain an overall view of most sites was accomplished using three aerial reconnaissance flights (August 27th and September 8th and 22nd, 1997). These flights were useful in developing a sense of landscape context and the relationship and extent of cover types that was not possible from ground survey or from the review of older photos and compartment maps. Observations included the extent and distribution of supercanopy and canopy species within cover types, the extent and types of wetlands, recent disturbance, and the character of the surrounding landscape. On two of the flights, assistance was provided by SNF District staff and DNR personnel.

Data collected as part of this project were entered into the MCBS Site Database and the Releve Database of DNR's Natural Heritage Information System. Site boundaries were digitized in ARC/INFO by North Central Forest Experiment Station (NCFES) and MCBS staff from 1:24,000 base maps unless indicated otherwise on individual site maps. Map boundaries are approximate and do not represent a final recommendation of site delineation. The DNR produced site maps that display rare feature and releve locations as related to the classified Thematic Mapper cover type data provided by NRRI. (Appendix 1). The collection of rare species data was not the focus of this project. However, existing records from the Rare Features Database of the Natural Heritage Information System at these sites are included in Appendix 1. *Minnesota's List of Endangered, Threatened and Special Concern Species* (1996) is available from the DNR.

## RESULTS

Forty-five sites totaling 152,622 acres in 19 LTAs were selected for further aerial and field survey. Sites selected for evaluation are listed by the SNF ecological units in Table 1. Sites were visited in the field, by air, or both. Time constraints prevented completion of work in LTAs 16 and 19. Two of the sites in LTA 16 were flown, but no field work was accomplished. No sites in LTA 19 were evaluated. Twenty-four vegetation samples (relevés) were collected and entered into DNR's Releve Database. Aquatic plants observed in three lakes were recorded by Karen Myhre of MCBS. Evaluations from 30 sites were entered into DNR's MCBS Site Database. *Potential Candidate RNA Evaluation* forms were completed for 25 sites. In completing these forms, ownership percentages were approximated and size (National Forest Service acres) was recorded from the estimated figures given in Vora's analysis. Acreage figures found on printouts from the MCBS site database were derived from digitized site polygons using an ARC/INFO Geographic Information System. A summary of information compiled for each of the 45 sites is presented in Table 2, with supporting data in Appendix 1. These data include information that existed prior to this project as recorded in the Natural Heritage Information System. Some results are also presented on maps entitled *Superior National Forest Potential Candidate Research Natural Areas, 1997 Evaluation* (Figure 1 and Appendix 2)

## DISCUSSION

Of the 45 sites selected for field evaluation in 1997, the most complete information was compiled for 25 sites in LTAs found in the SNF mostly outside of the North Shore Highlands and the Border Lakes Subsections. Only two sites located in the North Shore Highlands have comparable information. These 25 sites are briefly described in the following discussion by Ecological Subsection, with supporting material presented in Appendix 1. For each site this supporting information includes: a map, a *Potential Candidate RNA Evaluation* form. Printouts from the site database, the releve database and the rare features database (DNR Natural Heritage Information System) are included where relevant. The abridged version of this report excludes printouts from the releve and rare features databases. For the remaining 20 sites, information in Appendix 1 is limited to a map and any existing data available from the Natural Heritage Information System. All 45 sites are represented on the maps in Figure 1 and Appendix 2.

The attention given to the 25 sites in this report does not imply that other sites identified in Vora's analysis for which *Potential Candidate RNA Evaluations* were not completed do not merit consideration as potential candidate RNAs. In addition to the 45 targeted sites, 19 other sites are referenced in this discussion based on interviews with SNF staff and the evaluation of aerial photos, compartment maps and other resources mentioned as the first part of the evaluation process. These sites are listed in Table 3. All except four of these sites are shown in maps on Figure 1 and Appendix 2. Maps were not available for *Johnson Lake South*, *Johnson Lake North*, *Pothole Lake* and *Elbow River* during the course of this project. References to Ecological Land Types (ELTs) in the discussion of sites is related to the original analysis of potential sites presented in Vora's 1997 report.



# Superior National Forest Potential Candidate Research Natural Areas, 1997 Evaluation.

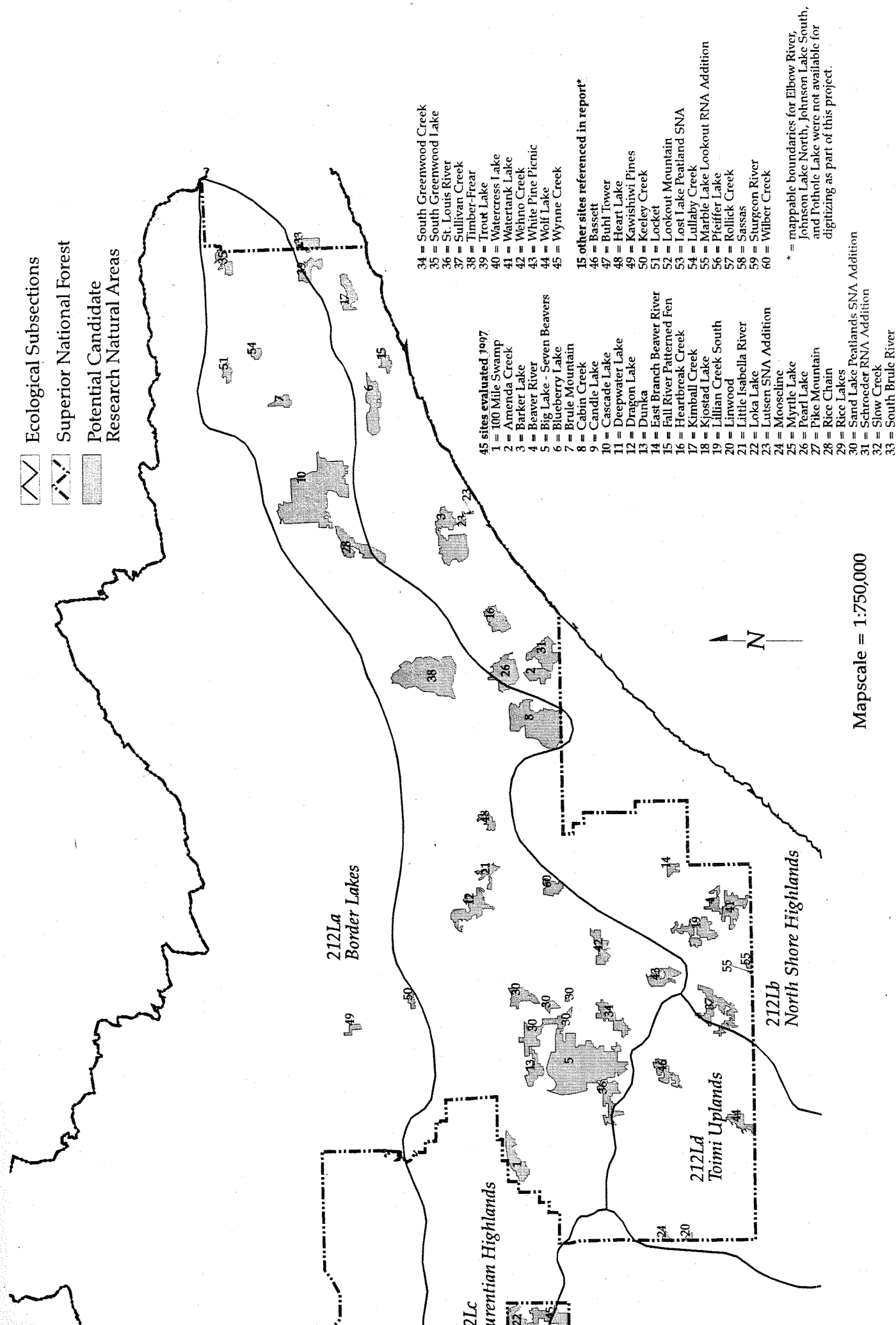
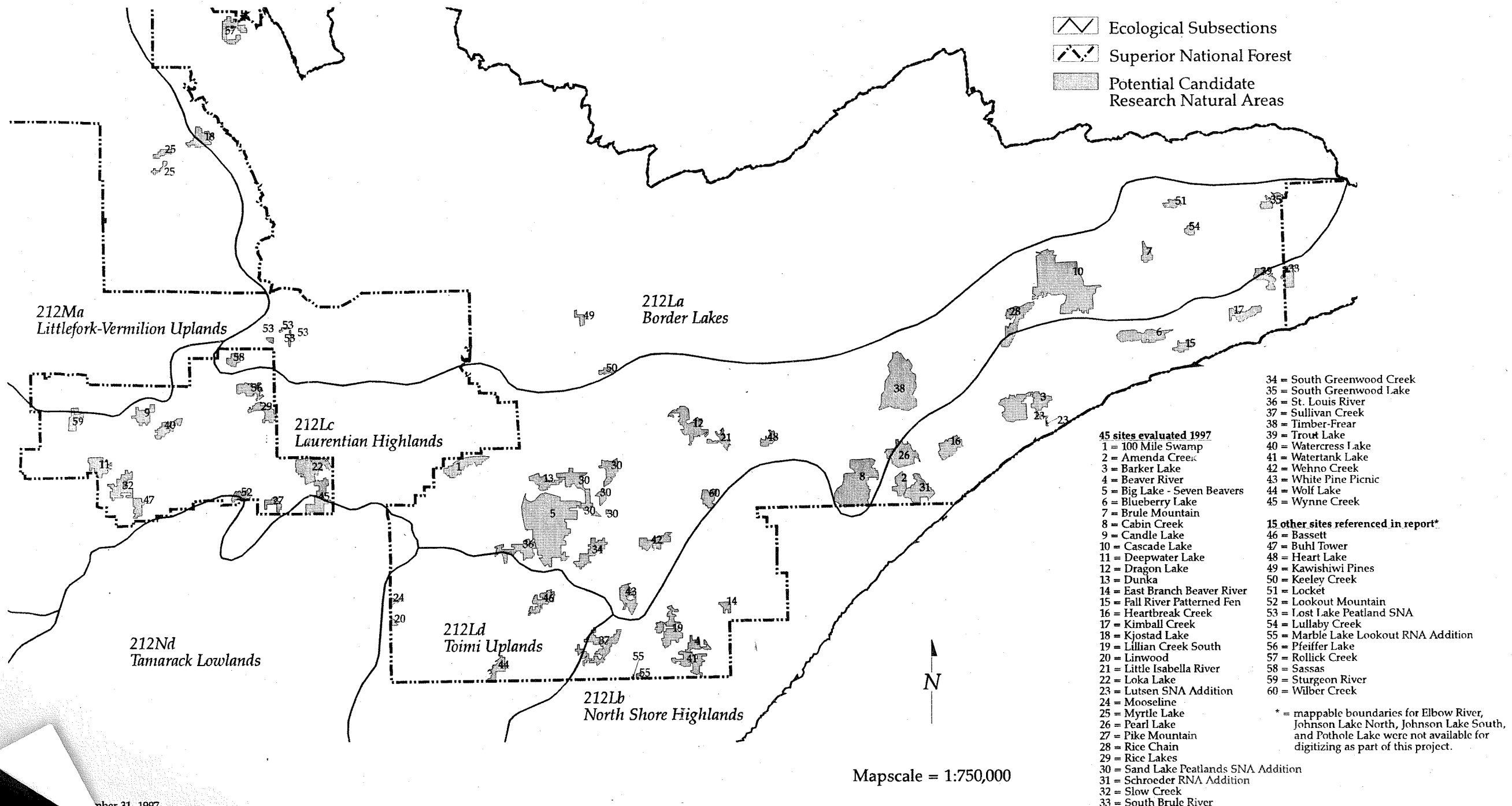


Figure 1. Superior National Forest Potential Candidate Research Natural Areas, 1997 Evaluation.



**Table 1. Forty-five sites selected for evaluation in 1997 organized by SNF Ecological Units.**

**212L NORTHERN SUPERIOR UPLANDS SECTION**

**212La Border Lakes Subsection**

No sites evaluated

**212Lb North Shore Highlands Subsection**

**LTA-3**

Amenda Creek

Barker Lake

Blueberry Lake

Heartbreak Creek

Kimball Creek

Pearl Lake

**LTA-11**

Fall River Patterned Fen

Lutsen SNA Addition

Schroeder RNA Addition

**LTA-12A**

Beaver River

Watertank Lake

**LTA-12B**

East Branch Beaver River

Lillian Creek South

**212Lc1 Laurentian Highlands Subsection**

**LTA-2**

Big Lake-Seven Beavers

Sand Lake Peatlands SNA Addition

St. Louis River

**LTA-8A**

100 Mile Swamp

Big Lake-Seven Beavers

Dunka

**LTA-8B**

Dragon Lake

Little Isabella River

**LTA-8C**

Cascade Lake

Rice Chain

**LTA-8D**

Cabin Creek

Timber-Frear

LTA-8E

Brule Mountain  
South Brule River  
South Greenwood Lake  
Trout Lake

LTA-9

South Greenwood Creek  
Wenho Creek  
White Pine Picnic

212Lc2 Nashwauk Uplands Subsection

LTA-1

Loka Lake  
Watercress Lake

LTA-5

Rice Lakes

LTA-18

Pike Mountain  
Wynne Creek

LTA-20

Deepwater Lake  
Slow Creek

212Ld Toimi Uplands Subsection

LTA-10

Sullivan Creek  
Wolf Lake

212M NORTHERN MINNESOTA AND ONTARIO SECTION

212Ma Little Fork-Vermilion Uplands Subsection

LTA-4

Candle Lake

LTA-16

Kjostad Lake  
Myrtle Lake

212N NORTHERN MINNESOTA DRIFT AND LAKE PLAIN SECTION

212Nd Tamarack Lowlands subsection (No further evaluation of sites was done in 1997).

LTA-19

Mooseline  
Linwood

**Table 2. Summary of evaluation of 45 sites as Potential Candidate Research Natural Areas and index to information compiled in Appendix 1. G=Ground survey; A=Aerial survey.**

Site Name	LTA	G	A	Acres mapped (GIS)	P.C. RNA Form	MCBS Site Record	Releve	Rare Features Records
100 Mile Swamp	8A		X	3,028				
Amenda Creek	3	X	X	1,649			X	X
Barker Lake	3	X	X	6,086		X	X	X
Beaver River	12		X	1,259				
Big Lake-Seven Beavers	8A/2	X	X	18,578	X	X		X
Blueberry Lake	3		X	3,736				
Brule Mountain	8E		X	1,051				
Cabin Creek	8D	X	X	9,719	X	X	X	
Candle Lake	4	X	X	1,872	X	X	X	X
Cascade Lake	8C	X	X	16,956	X	X	X	X
Deepwater Lake	20	X	X	2,209	X	X		
Dragon Lake	8B	X		3,778	X	X		
Dunka	8A	X	X	1,947	X	X	X	
E. Branch Beaver River	12B		X	630				
Fall River Patterned Fen	11		X	1,039		X		X
Heartbreak Creek	3	X	X	2,545		X	X	X
Kimball Creek	3		X	2,020				
Kjostad Lake	16		X	2,159				
Lillian Creek South	12	X	X	3,434	X	X		
Linwood	19			244				
Little Isabella River	8B	X		1,098	X	X		X
Loka Lake	1	X	X	4,079	X	X	X	X

**Table 2. Summary of evaluation of 45 sites as Potential Candidate Research Natural Areas and index to information compiled in Appendix 1. G=Ground survey; A=Aerial survey.**

Site Name	LTA	G	A	Acres mapped (GIS)	P.C. RNA Form	MCBS Site Record	Releve	Rare Features Records
100 Mile Swamp	8A		X	3,028				
Amenda Creek	3	X	X	1,649			X	X
Barker Lake	3	X	X	6,086		X	X	X
Beaver River	12		X	1,259				
Big Lake-Seven Beavers	8A/2	X	X	18,578	X	X		X
Blueberry Lake	3		X	3,736				
Brule Mountain	8E		X	1,051				
Cabin Creek	8D	X	X	9,719	X	X	X	
Candle Lake	4	X	X	1,872	X	X	X	X
Cascade Lake	8C	X	X	16,956	X	X	X	X
Deepwater Lake	20	X	X	2,209	X	X		
Dragon Lake	8B	X		3,778	X	X		
Dunka	8A	X	X	1,947	X	X	X	
E. Branch Beaver River	12B		X	630				
Fall River Patterned Fen	11		X	1,039		X		X
Heartbreak Creek	3	X	X	2,545		X	X	X
Kimball Creek	3		X	2,020				
Kjostad Lake	16		X	2,159				
Lillian Creek South	12	X	X	3,434	X	X		
Linwood	19			244				
Little Isabella River	8B	X		1,098	X	X		X
Loka Lake	1	X	X	4,079	X	X	X	X

Site Name	LTA	G	A	Acres mapped (GIS)	P.C. RNA Form	MCBS Site Record	Releve	Rare Features Records
Lutsen SNA Addition	11		X	286			X	X
Mooseline	19			304				
Myrtle Lake	16		X	1,133				
Pearl Lake	3	X	X	4,040		X	X	X
Pike Mountain	18	X	X	896	X	X	X	X
Rice Chain	8C	X		3,886	X	X	X	X
Rice Lakes	5	X	X	1,786	X	X	X	X
Sand Lake Peatlands SNA Addition	2		X	6,299	X	X		
Schroeder RNA Addition	11		X	3,495			X	X
Slow Creek	20	X	X	2,804		X	X	X
South Brule River	8E		X	1,573				
South Greenwood Creek	9	X	X	2,596	X	X	X	
South Greenwood Lake	8E	X	X	1,465	X	X	X	
St Louis River	2		X	3,044				
Sullivan Creek	10	X	X	4,032	X	X	X	X
Timber-Frear	8D	X	X	10,883	X	X		X
Trout Lake	8E	X	X	1,657	X	X	X	
Watercress Lake	1	X	X	1,684	X	X		X
Watertank Lake	12	X	X	2,709	X	X	X	
Wehno Creek	9	X	X	2,145	X	X		
White Pine Picnic	9	X		2,124	X	X	X	X
Wolf Lake	10	X	X	1,470	X	X	X	
Wynne Creek	18	X	X	3,195	X	X	X	X



**Table 3. List of 19 sites not considered for evaluation in 1997 but referred to in the discussion of Potential Candidate Research Natural Areas. (\*not mapped).**

---

Bassett  
Buhl Tower  
Elbow River\*  
Heart Lake  
Johnson Lake North\*  
Johnson Lake South\*  
Kawishiwi Pines  
Keeley Creek  
Locket  
Lost Lake Peatland SNA  
Lookout Mountain  
Lullaby Creek  
Marble Lake Lookout RNA Addition  
Pfeiffer Lake  
Pothole Lake\*  
Rollick Creek  
Sassas  
Sturgeon River  
Wilber Creek

---

**Laurentian Highlands Subsection**

LTA 2 Rainy Moraine Peatlands

Big Lake-Seven Beaver  
Sand Lake Peatlands SNA Addition

These sites comprise excellent representation of the LTA's physical and biological attributes, including all nine of the Ecological Land Types (ELTs) known from the LTA. The addition of the *St. Louis River* site would provide representation of additional uplands and a wide stream corridor.

LTA 8A Big Rice Outwash

Big Lake-Seven Beaver  
Dunka

These sites provide good representation of most of the LTA's biological and physical attributes. However, of the 12 ELTs within the LTA, one major ELT and four others with < 1% presence in the LTA are not represented. Inclusion of the *100 Mile Swamp* site would very likely complete representation of the prominent ELTs, and provide some additional upland diversity.

**Table 3. List of 19 sites not considered for evaluation in 1997 but referred to in the discussion of Potential Candidate Research Natural Areas. (\*not mapped).**

---

Bassett  
Buhl Tower  
Elbow River\*  
Heart Lake  
Johnson Lake North\*  
Johnson Lake South\*  
Kawishiwi Pines  
Keeley Creek  
Locket  
Lost Lake Peatland SNA  
Lookout Mountain  
Lullaby Creek  
Marble Lake Lookout RNA Addition  
Pfeiffer Lake  
Pothole Lake\*  
Rollick Creek  
Sassas  
Sturgeon River  
Wilber Creek

---

#### **Laurentian Highlands Subsection**

##### **LTA 2 Rainy Moraine Peatlands**

Big Lake-Seven Beaver  
Sand Lake Peatlands SNA Addition

These sites comprise excellent representation of the LTA's physical and biological attributes, including all nine of the Ecological Land Types (ELTs) known from the LTA. The addition of the *St. Louis River* site would provide representation of additional uplands and a wide stream corridor.

##### **LTA 8A Big Rice Outwash**

Big Lake-Seven Beaver  
Dunka

These sites provide good representation of most of the LTA's biological and physical attributes. However, of the 12 ELTs within the LTA, one major ELT and four others with < 1% presence in the LTA are not represented. Inclusion of the *100 Mile Swamp* site would very likely complete representation of the prominent ELTs, and provide some additional upland diversity.

#### LTA 8B Vermilion Moraines

Dragon Lake  
Little Isabella River

These sites provide excellent representation of most of the physical and biological attributes of the LTA. Five of fourteen ELTs, each with < 1% presence in the LTA are unrepresented. Forest communities dominated by white spruce and balsam fir may also be under-represented compared to the landscape in the 1800's.

#### LTA 8C Vermilion Outwash

Cascade Lake  
Rice Chain

These sites are highly representative of most of the physical and biological characteristics of the LTA. Two of 12 ELTs, both with < 1% presence in the LTA, are not represented. The white and red pine forest communities are also missing. White pine forest in particular is under-represented even within the current forest matrix. The addition of the *Heart Lake* site that contains white pine forests would significantly improve ecological representation of this LTA.

#### LTA 8D Duluth Complex Deep

Cabin Creek  
Timber-Frear

These sites provide good representation of the physical and biological attributes of the LTA. Among the natural communities, jack pine forest is not represented. Two of 12 ELTs, both with <1% presence in the LTA, are not represented. Presently, no other sites have been identified which could complete the representation.

#### LTA 8E Rove Slate Deep

South Greenwood Lake  
Trout Lake

These sites are fairly representative of the physical and biological characteristics of the LTA. Four of thirteen ELTs are not represented: two with <1% presence, two with 1%-9% presence in the LTA. Red pine, white pine, jack pine and spruce-fir dominated forest communities are not well-represented. The addition of the *South Brule River* site would incorporate a one mile section of the Brule River, the major watershed of this LTA, and improve the representation of conifer-dominated natural communities prevalent in the LTA. The addition of *Locket* and *Lullaby Creek* sites would provide for some representation of white pine forest.

#### LTA 9 Toimi Ground Moraine

South Greenwood Creek

Wehno Creek

White Pine Picnic

These three sites are fairly representative of the physical and biological attributes of the LTA. Some natural community types and species that are poorly represented have been scarce or absent since before 1900; others are no better represented elsewhere in the LTA (e.g. white pine). Six of 12 ELTs are unrepresented. One has a presence of 1%-9% in the LTA and five of < 1% in the LTA. The addition of the *Wilber Creek* site would contribute representation of two additional natural community types and a small shallow lake.

#### **Nashwauk Uplands Subsection**

##### LTA 1 Sandy River Outwash

Loka Lake

Watercress Lake

These two sites provide representation of most of the LTA's physical and biological attributes. Lacking are medium-sized lakes, and two of the 15 known ELTs of the LTA. Those missing each have a presence of 1%-9% in the LTA. Representation of current vegetation is good. However, red and white pine are present to a smaller degree than prior to European settlement. Additional sites in this LTA should focus on greater representation of these species and communities.

##### LTA 5 Big Rice Moraine

Rice Lakes

Rice Lakes encompasses many of the LTA's attributes, representing the lowland physical and biological attributes very well. Good representation of upland landforms and forest communities is lacking. Five of fifteen ELTs, three of which have <1% presence in the LTA, are also unrepresented. More complete representation might be achieved by including the *Pfeiffer Lake* site in this LTA.

##### LTA 18 Mesabi Iron Range, Vermillion Iron Range

Pike Mountain

Wynne Creek

These sites provide excellent representation of the natural communities of the LTA. Jack pine forest and black spruce swamp are the only communities without representation even though most of this LTA is outside the SNF. Two ELTs are not represented, both with <1% presence in the LTA. The addition of *Lookout Mountain* would likely complete the representation of natural communities in this LTA.

LTA 20 Nashwauk Uplands  
Deepwater Lake

This site includes good representation of the physical features, and most of the biological attributes of the LTA. White pine and maple-dominated communities are not represented. Six of 14 ELTs are not represented, all with < 1% presence in the LTA. The addition of the *Buhl Tower* site would possibly provide representation of the maple forest element and attributes of three other ELTs.

**Toimi Uplands Subsection**

LTA 10 Toimi Drumlin  
Sullivan Creek  
Wolf Lake

These sites are fairly representative of the physical and biological features of the LTA. The pine forest communities once common, are largely absent outside of plantations throughout the LTA. Black ash and tamarack are also not well-represented by these sites. Five of 11 ELTs are under represented. Three have a presence of < 1% and two of 1%-9% in the LTA. The addition of the *Bassett* site might contribute to a more complete natural community representation within the LTA and would add another stream corridor.

**Little Fork-Vermilion Uplands Subsection**

LTA 4 Lake Agassiz Outwash  
Candle Lake

This site compliments *Lost Lake Peatland Scientific and Natural Area* (Minnesota DNR) such that the two sites together represent the physical and biological attributes of the LTA fairly well. However, red, jack and white pine, once prominent in the uplands, are only minimally represented in these sites. Three of 17 ELTs are also unrepresented, each with < 1% presence in the LTA. Additional sites in this LTA should include pine forest communities and wide stream habitat (e.g., *Sassas* and *Sturgeon River*). The *Sturgeon River* site would likely provide this representation and also contains a rare silver maple-dominated riparian corridor.

#### LTA 16 Agassiz-Vermilion Granite Transition

No sites were evaluated in this LTA due to time constraints.

Two sites were assessed from the air :

Kjosted Lake

Myrtle Lake

The flight and inventory records suggest that they are largely representative of the LTA, including most of the natural community types, species and ELTs. After the field season, staff at the La Croix District recommended an old-growth site, *Elbow River* for consideration in this LTA.

#### **Tamarack Lowlands Subsection**

##### LTA 19 St. Louis Sublobe, Tamarack Lowlands

No sites were evaluated in this LTA due to time constraints.

Only two sites were identified in Vora's analysis:

Mooseline

Linwood

#### **North Shore Highlands and Border Lakes Subsections**

These two subsections received less documentation during the 1997 field season than other areas. Available information and recommendations on LTAs 3, 11, 12A and 12B of the North Shore Highlands Subsection, and additional recommendations are found below by LTA. Supporting data for these sites is found in Appendix 1.

#### **North Shore Highlands Subsection**

Some sites in the LTAs of the North Shore Highlands were visited. The project files of the Forest Service contain more detailed information than that presented here. Site boundary maps and database printouts are presented in Appendix 1 for those given closer examination. The following information, organized by LTA, is based on 1997 work and previous work done on some of the sites. This information is an additional resource for consideration in determining appropriate potential candidate RNA sites or other management units now or in the future.

##### LTA 3

A number of sites in this LTA were given some attention in the field and flights: *Pearl Lake*, *Barker Lake*, *Amenda Creek*, and *Heartbreak Creek*. Each of these sites offers significant natural community, old-growth and, in the case of *Pearl Lake* and *Barker Lake*, riparian features. Based on the information resources available and 1997 field work, the following areas provide some representation of the LTA: 1) The east portion of the *Barker Lake* site as a potential candidate

RNA; the west portion as another type of management unit. Part of this site has previously been nominated as an RNA. The additional area would enhance the natural community and old-growth diversity, and contribute to Poplar River watershed protection. 2) Additional field work may reveal that the *Pearl Lake* site is a potential candidate RNA because of its natural community diversity, old-growth, riparian and Cross River watershed protection features. The *Amenda Creek* and *Heartbreak Creek* sites also appear to merit consideration as natural area candidates, but require further evaluation.

#### LTA 11

The proposed creation of an RNA on federal lands adjacent to the *Lutsen SNA* would enhance natural community and old-growth diversity within the site, and establish a more ecologically driven boundary. The proposed addition is dominated by old and old-growth upland white cedar forest (mesic subtype) and mature northern hardwood forest (Rusterholz 1992).

The proposed addition to the *Schroeder RNA* would significantly improve representation of the natural community and species diversity distinctive of this LTA, establish a more ecologically meaningful and appropriate boundary and better reflect and sustain RNA and ecosystem values. The proposed addition is dominated by northern hardwood and white cedar forest communities, including old-growth areas.

The *Fall River Patterned Fen* was first studied and documented by Dr. Paul Glaser (1983) of the University of Minnesota Limnological Research Center. His research identified the site as a unique occurrence of patterned fen in northeastern Minnesota. This site is relatively isolated from other patterned peatlands in the state and occupies an unusual physiographic position in the North Shore Highlands.

#### LTA 12 (includes both LTA 12A and 12B)

*Potential Candidate RNA Evaluation Forms* can be found in Appendix 1 for two sites evaluated in this LTA: *Watertank Lake* and *Lillian Creek South*. The *Beaver River* site was observed from the air, but no field work was completed. Aerial views and compartment inventory information reveal that this 1200-acre area is dominated by minimally fragmented upland and lowland forest communities over 60 years of age, with some over 100 years. The site also contains a diversity of unforested wetland communities associated with more than a mile of the Beaver River and portions of two small streams. Together with the *Lillian Creek South* and *Watertank Lake* sites, this site links LTAs and large diverse blocks of old forest. They also encompass a significant portion of the upper Beaver River watershed. Federal ownership is contiguous, but the pattern of ownerships presents the possibility of some fragmentation depending on management outside the boundary. Given these circumstances, the *Beaver River* site should be given consideration as a potential candidate RNA in this LTA.

A proposed addition to the *Marble Lake Lookout RNA* is composed primarily of forested swamps of white cedar and mixed conifers, shrub swamp, and upland white-cedar forest. About one half mile of the Gooseberry River is also within the proposed addition. This addition would improve



RNA; the west portion as another type of management unit. Part of this site has previously been nominated as an RNA. The additional area would enhance the natural community and old-growth diversity, and contribute to Poplar River watershed protection. 2) Additional field work may reveal that the *Pearl Lake* site is a potential candidate RNA because of its natural community diversity, old-growth, riparian and Cross River watershed protection features. The *Amenda Creek* and *Heartbreak Creek* sites also appear to merit consideration as natural area candidates, but require further evaluation.

#### LTA 11

The proposed creation of an RNA on federal lands adjacent to the *Lutsen SNA* would enhance natural community and old-growth diversity within the site, and establish a more ecologically driven boundary. The proposed addition is dominated by old and old-growth upland white cedar forest (mesic subtype) and mature northern hardwood forest (Rusterholz 1992).

The proposed addition to the *Schroeder RNA* would significantly improve representation of the natural community and species diversity distinctive of this LTA, establish a more ecologically meaningful and appropriate boundary and better reflect and sustain RNA and ecosystem values. The proposed addition is dominated by northern hardwood and white cedar forest communities, including old-growth areas.

The *Fall River Patterned Fen* was first studied and documented by Dr. Paul Glaser (1983) of the University of Minnesota Limnological Research Center. His research identified the site as a unique occurrence of patterned fen in northeastern Minnesota. This site is relatively isolated from other patterned peatlands in the state and occupies an unusual physiographic position in the North Shore Highlands.

#### LTA 12 (includes both LTA 12A and 12B)

*Potential Candidate RNA Evaluation Forms* can be found in Appendix 1 for two sites evaluated in this LTA: *Watertank Lake* and *Lillian Creek South*. The *Beaver River* site was observed from the air, but no field work was completed. Aerial views and compartment inventory information reveal that this 1200-acre area is dominated by minimally fragmented upland and lowland forest communities over 60 years of age, with some over 100 years. The site also contains a diversity of unforested wetland communities associated with more than a mile of the Beaver River and portions of two small streams. Together with the *Lillian Creek South* and *Watertank Lake* sites, this site links LTAs and large diverse blocks of old forest. They also encompass a significant portion of the upper Beaver River watershed. Federal ownership is contiguous, but the pattern of ownerships presents the possibility of some fragmentation depending on management outside the boundary. Given these circumstances, the *Beaver River* site should be given consideration as a potential candidate RNA in this LTA.

A proposed addition to the *Marble Lake Lookout RNA* is composed primarily of forested swamps of white cedar and mixed conifers, shrub swamp, and upland white-cedar forest. About one half mile of the Gooseberry River is also within the proposed addition. This addition would improve

representation of the natural community and species diversity of the LTA, contribute to Gooseberry River watershed protection, establish a more ecologically meaningful boundary and better reflect and sustain ecological and RNA values.

### **Border Lakes Subsection**

Initial analysis by Vora (1997) identified three sites in the Border Lakes subsection: *Rollick Creek*, *Keeley Creek* and *Kawishiwi Pines*. During the course of this project, LaCroix District Forest Service personnel recommended additional sites for consideration: *Pothole Lake*, *Johnson Lake North*, and *Johnson Lake South*. Some information on each of these sites existed prior to this project. Some evaluation work has been done by the LaCroix District old-growth survey crew on the *Rollick Creek*, *Pothole Lake*, *Johnson Lake North* and *Johnson Lake South* sites.

### **ACKNOWLEDGMENTS**

A number of individuals in the Superior National Forest district offices provided assistance in a variety of ways with this project. Thanks are due to Wayne Russ, Dean Zeitz, Terry Gokee, Amy Wilfahrt, Robin Vora, Sherry Phillips, Mary Shedd, Ed Lindquist, and Don Potter. Thanks also to Steve Wilson of the DNR's Scientific and Natural Areas Program for help with aerial reconnaissance and Karen Myhre of the DNR's Minnesota County Biological Survey for her aquatic plant surveys of several lakes. Al Epp of the DNR's Natural Heritage and Nongame Research Program produced the maps found in this report. Mark Nelson and Stephanie Snyder of the North Central Forest Experiment Station assisted with digitizing and preliminary map production. Peter Wolter of the Natural Resources Research Institute, University of Minnesota provided classified satellite Thematic Mapper cover type data for final maps. Lucy Tyrrell of the Eastern Regional Office of the Forest Service, Kurt Rusterholz and Bon Eliason of the DNR's Natural Heritage and Nongame Program, Norm Aaseng of DNR's MCBS and Don Faber-Langendoen of the Midwest Regional Office of The Nature Conservancy contributed to the design of this project. Special thanks to Al Williamson of the Chippewa National Forest and Carmen Converse of the DNR's Minnesota County Biological Survey for helpful coordination and thoughtful consultation throughout the course of this project.

### **LITERATURE CITED**

- Almendinger, J.C. 1987. A handbook for collecting releve data in Minnesota. Unpublished report, Minnesota DNR, Section of Wildlife, St. Paul.
- Almendinger, J.C. 1996. Minnesota's bearing tree database. Minnesota DNR. Biological Report no. 56. 23p.
- Glaser, P.H. 1983. A patterned fen on the north shore of Lake Superior, Minnesota. *Canadian Field-Naturalist* 97(2): 194-199.

- Leuelling, B.; B. Kari; S. Phillips; R. Berrisford; S. Behling. 1992. Superior National Forest. Landtype Associations distinguishing characteristics. Unpublished report, USDA Forest Service, Superior National Forest, Duluth, Minnesota. 30p.
- Minnesota County Biological Survey. 1996. Natural communities and rare species of Winona County, Minnesota. [map] 1:75,000; 29x52 in; color. Minnesota County Biological Survey. Map Series No. 11.
- Minnesota Natural Heritage Program. 1993. Minnesota's native vegetation: a key to natural communities, version 1.5. Minnesota Department of Natural Resources, Division of Fish and Wildlife, Biological Report No. 2. 111p.
- Minnesota Natural Heritage Program. 1996. Minnesota's list of endangered, threatened and special concern species. Minnesota DNR, Section of Ecological Services, St. Paul, Minnesota. 16p.
- Rusterholz, K.A. 1992. Ecology of white cedar stands on the Superior National Forest. Unpublished report of a research project between the Natural Heritage Program, Minnesota Department of Natural Resources and the Superior National Forest. Minnesota DNR, Natural Heritage Program, St. Paul.
- Thom, D.; B. Luelling; T. Williams; S. Ludwig; D. Potter; M. Shedd. 1992. Old-Growth Resources on the Superior National Forest. Final report to the Superior National Forest Leadership Team. Unpublished report, USDA Forest Service, Superior National Forest Duluth, Minnesota.
- US Department of Agriculture Forest Service. 1992. Preparing for the Future: Forest Service Research Natural Areas. FS-503.
- US Surveyor General. 1847-1908. Field notes: township and exterior subdivision lines. Minnesota State Archives, Minnesota Historical Society, St. Paul.
- Vora, R.S. 1997. Identification of potential natural areas, including representative ecosystems, on the Superior National Forest. Unpublished report, USDA Forest Service, Superior National Forest, Duluth, Minnesota. 36p.
- Wolter, P. T. 1997. Classified TM data; Northeast Minnesota & Northwest Wisconsin. [Compact Disk]. Natural Resources Research Institute. University of Minnesota, Duluth, Minnesota.
- Wolter, P.T.; D.J. Mladenoff; G. E. Host; T. R. Crow. 1995. Improved forest classification in the Northern Lake States using multi-temporal Landsat imagery. PE&RS. 61(9):1129-1143.

Appendix 1. Supplemental information for 45 sites evaluated in 1997 as Potential Candidate Research Natural Areas on the Superior National Forest.

- |                              |                                      |
|------------------------------|--------------------------------------|
| 1. 100 Mile Swamp            | 25. Myrtle Lake                      |
| 2. Amenda Creek              | 26. Pearl Lake                       |
| 3. Barker Lake               | 27. Pike Mountain                    |
| 4. Beaver River              | 28. Rice Chain                       |
| 5. Big Lake-Seven Beavers    | 29. Rice Lakes                       |
| 6. Blueberry Lake            | 30. Sand Lake Peatlands SNA Addition |
| 7. Brule Mountain            | 31. Schroeder RNA Addition           |
| 8. Cabin Creek               | 32. Slow Creek                       |
| 9. Candle Lake               | 33. South Brule River                |
| 10. Cascade Lake             | 34. South Greenwood Creek            |
| 11. Deepwater Lake           | 35. South Greenwood Lake             |
| 12. Dragon Lake              | 36. St. Louis River                  |
| 13. Dunka                    | 37. Sullivan Creek                   |
| 14. East Branch Beaver River | 38. Timber-Frear                     |
| 15. Fall River Patterned Fen | 39. Trout Lake                       |
| 16. Heartbreak Creek         | 40. Watercress Lake                  |
| 17. Kimball Creek            | 41. Watertank Lake                   |
| 18. Kjostad Lake             | 42. Wehno Creek                      |
| 19. Lillian Creek South      | 43. White Pine Picnic                |
| 20. Linwood                  | 44. Wolf Lake                        |
| 21. Little Isabella River    | 45. Wynne Creek                      |
| 22. Loka Lake                |                                      |
| 23. Lutsen SNA Addition      |                                      |
| 24. Mooseline                |                                      |

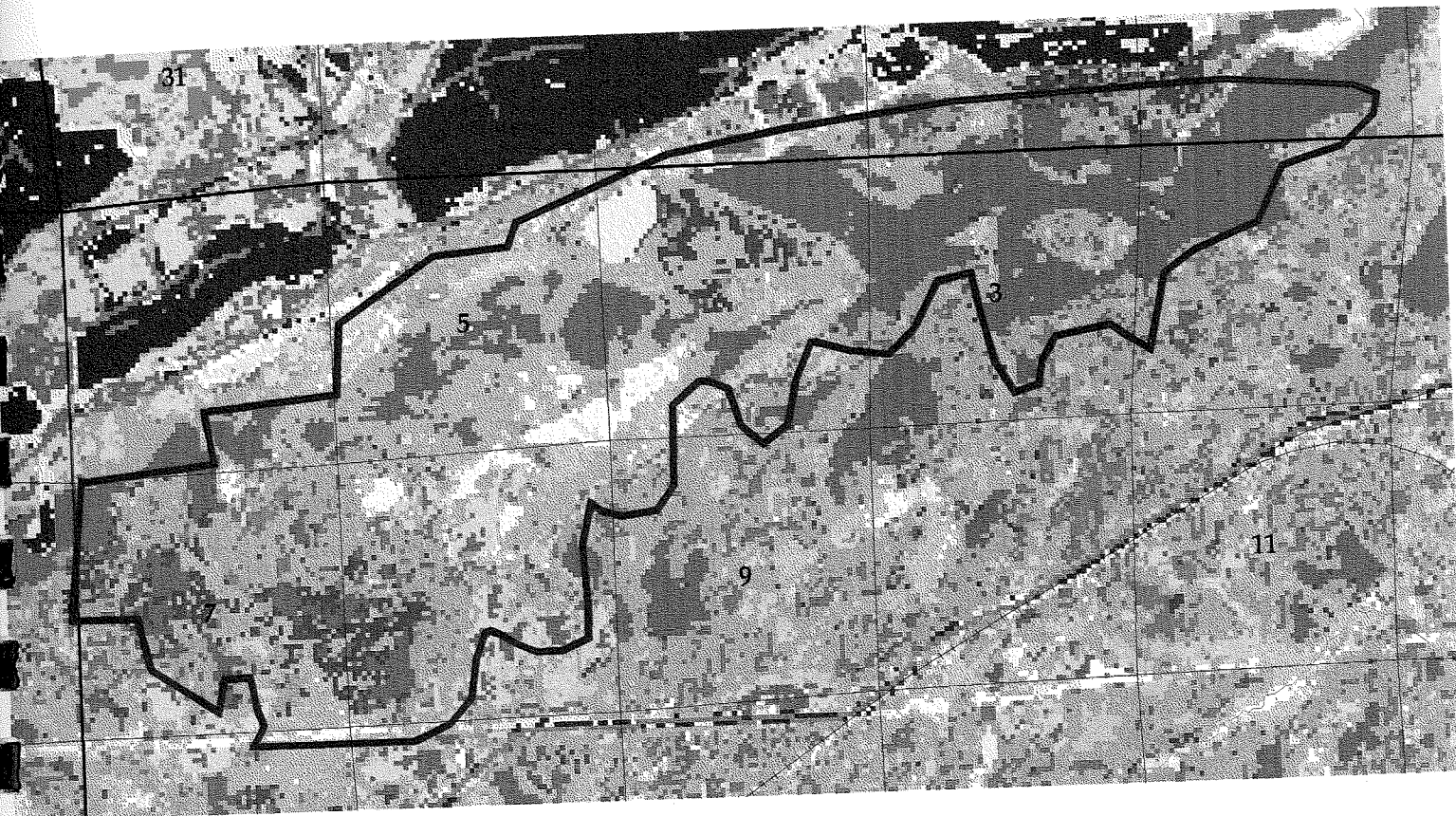
Codes for rare features occurring within and around Potential Candidate Research Natural Areas

Map Code	Element name (Common name)	Minnesota Status	Federal Status
<u>Rare Animals and Animal Aggregations</u>			
ACFU	<i>Acipenser fulvescens</i> (Lake sturgeon)	Special Concern	
BOLE	<i>Botaurus lentiginosus</i> (American bittern)		
CLIN	<i>Clemmys insculpta</i> (Wood turtle)	Threatened	
COWA	Colonial waterbird nesting site		
DECA	<i>Dendroica caerulescens</i> (Black-throated blue warbler)		
ERDI	<i>Erebia disa mancinus</i> (Disa alpine)	Special Concern	
HALE	<i>Haliaeetus leucocephalus</i> (Bald eagle)	Special Concern	Threatened
ICFO	<i>Ichthyomyzon fossor</i> (Northern brook lamprey)	Special Concern	
MICH	<i>Microtus chrotorrhinus</i> (Rock vole)		
<u>Rare Plants</u>			
ACPA	<i>Actaea pachypoda</i> (White baneberry)		
ADMO	<i>Adoxa moschatellina</i> (Moschatel)	Special Concern	
ARBU	<i>Arethusa bulbosa</i> (Dragon's-mouth)		
ASAL	<i>Astragalus alpinus</i> (Alpine milk vetch)	Endangered	
BOLA	<i>Botrychium lanceolatum</i> (Triangle moonwort)	Threatened	
BOMA	<i>Botrychium matricariifolium</i> (Matricary grapefern)		
BOMI	<i>Botrychium minganense</i> (Mingan moonwort)	Special Concern	
BOMO	<i>Botrychium mormo</i> (Goblin fern)	Special Concern	
BORU	<i>Botrychium rugulosum</i> (St. Lawrence grapefern)	Threatened	
CAEX	<i>Carex exilis</i> (Coastal sedge)	Special Concern	
CAFL	<i>Carex flava</i> (Yellow sedge)	Special Concern	
CAKA	<i>Carex katahdinensis</i> (Katahdin sedge)	Threatened	
CAME	<i>Carex media</i> (Intermediate sedge)		
CANA	<i>Caltha natans</i> (Floating marsh-marigold)	Endangered	
CAOR	<i>Carex ormostachya</i> (Necklace spike sedge)		
CLCA	<i>Claytonia caroliniana</i> (Carolina spring-beauty)	Special Concern	
GELI	<i>Geocaulon lividum</i> (Northern comandra)		
JUST	<i>Juncus stygius</i> var. <i>americanus</i> (Bog rush)	Special Concern	
LIAU	<i>Listera auriculata</i> (Auricled twayblade)	Endangered	
LIUN	<i>Littorella uniflora</i> (American shore-plantain)	Special Concern	
NYLE	<i>Nymphaea leibergii</i> (Small white water-lily)	Threatened	
OSBE	<i>Osmorhiza berteroi</i> (Chilean sweet cicely)	Endangered	
POOC	<i>Polemonium occidentale</i> ssp. <i>lacustre</i> (Western Jacob's ladder)	Endangered	
PYMI	<i>Pyrola minor</i> (Small shinleaf)	Special Concern	
RALA	<i>Ranunculus lapponicus</i> (Lapland buttercup)	Special Concern	
SCPE	<i>Scirpus pedicellatus</i> (Woolgrass)		
SPGL	<i>Sparganium glomeratum</i> (Clustered bur-reed)	Special Concern	
UTGI	<i>Utricularia gibba</i> (Humped bladderwort)		
WAFR	<i>Waldsteinia fragarioides</i> (Barren strawberry)	Special Concern	

# 100 Mile Swamp

Potential Candidate Research Natural Area, Superior National Forest

Townships: T60N R13W, T59N R13W, T59N R14W



Classified Thematic Mapper data from the Natural Resources Research Institute University of Minnesota.  
Relevés and rare species data from the Minnesota Natural Heritage Information System.

Potential candidate RNA boundary digitized from 1:126,720 scale map.

Scale = 1:42601



Miles

Kilometers

