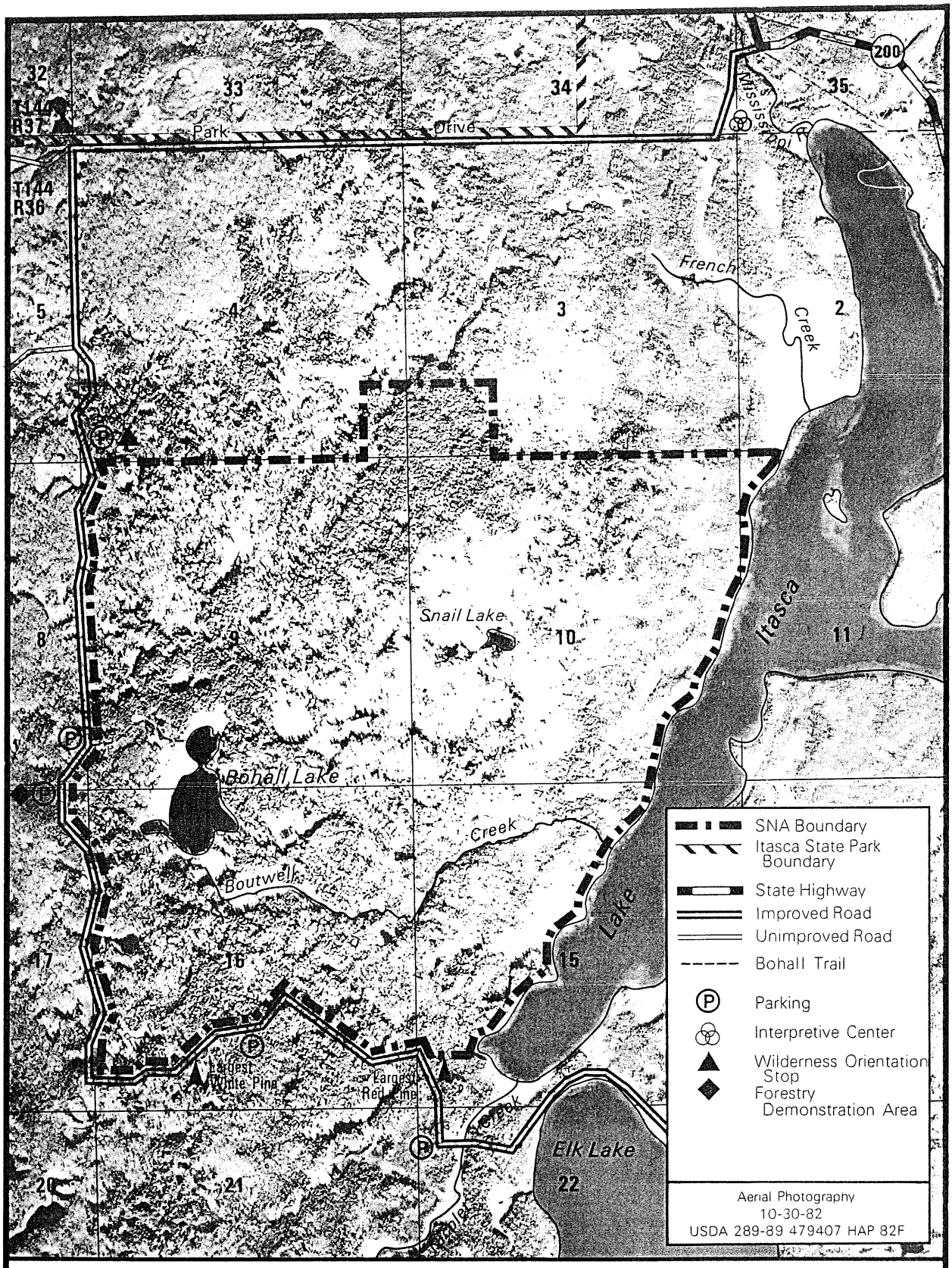
APPENDIX

ITASCA WILDERNESS SANCTUARY
SCIENTIFIC AND NATURAL AREA
RESOURCE INVENTORY

NOVEMBER 1985

Present Vegetation
Great Lakes Pine Forest -
Element Abstract
Flora
Element status sheets

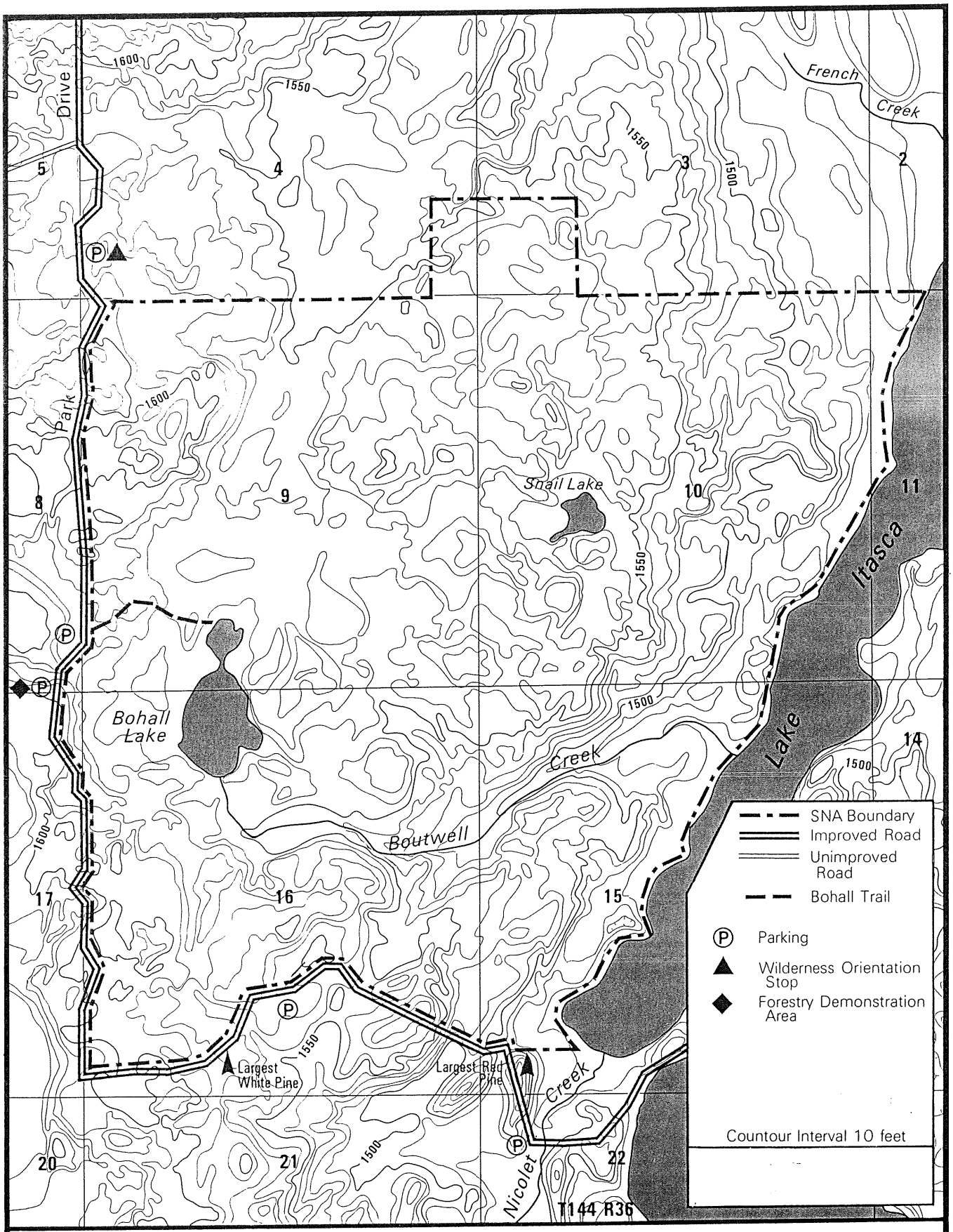


ITASCA WILDERNESS SANCTUARY SNA

0 ¼ ½ 1 MILES

0 ¼ ½ 1 KILOMETERS

VICINITY

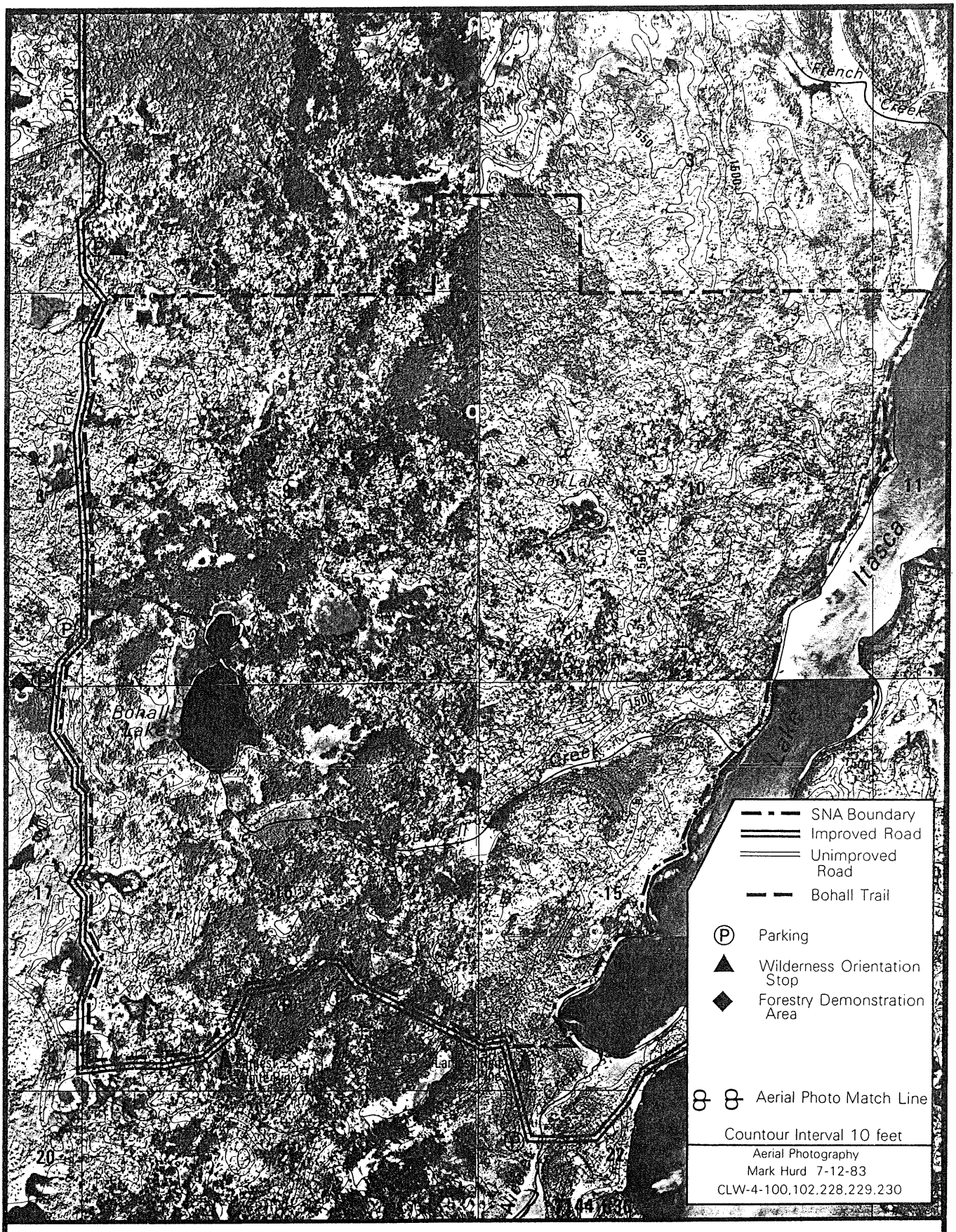


ITASCA WILDERNESS SANCTUARY SNA

0 ¼ ½ 1 MILES

0 ¼ ½ 1 KILOMETERS

SITE



ITASCA WILDERNESS SANCTUARY SNA

0 ¼ ½ 1 MILES

0 ¼ ½ 1 KILOMETERS

SITE

PRESENT VEGETATION

Introduction

The 32,000 acre Itasca State Park, in which the Itasca SNA is located, was established in 1891 to save a remnant of the "primeval pine forest" associated within the Mississippi headwaters. The park lies within the area of the Itasca Moraine - a prominent land form consisting of rolling to steeply irregular land, characterized by numerous depressions filled with lakes and small peat bogs. Sand outwash deposits are common throughout the moraine. This varied physiography combined with a long history of frequent fires has allowed the development of a heterogeneous mosaic of vegetation types. The upland forests within the park are dominated by aspen-birch forest and stands of red pine forest and white pine forest. Less common are boreal forest and transitional northern hardwood forests. Lowland sites are occupied by conifer and hardwood swamp, sedge meadow, and alder swamp.

The 2,000 acre Scientific and Natural Area within the park was established to recognize the significance of the virgin stands of red pine and white pine forest along with associated vegetation types representative of the Itasca Moraine in north central Minnesota. The SNA contains the finest example of Great Lakes pine forest (see detailed description) within north central Minnesota. As is the case with virtually all forests in the Great Lakes states, the Itasca SNA has been influenced by human activities. The most significant man-induced alteration within the SNA has been the artificial protection of the forest from natural fires. Frequent fires prior to 1918 maintained much of the entire park area in successional forest with pine largely dominating the uplands. Fire created conditions favorable for establishment and maintenance of these seral communities. Under a fire protection policy, uninterrupted succession is favoring an increase in more shade tolerant trees (red maple, sugar maple, red oak, balsam fir, etc.) at the expense of the pines. The most striking feature of the contemporary pine forests as noted by numerous researchers is the vigorous development of understory shrubs and hardwoods and the almost complete absence of successful pine reproduction.

In addition to altering or eliminating natural fire cycles, man has artifically increased deer populations which can have a major impact on natural vegetation development. The influence of excessive deer populations on the prevaling vegetation within the SNA is difficult to predict. However, exclosure studies suggest deer overutilization at various times has directly or indirectly caused the suppression or elimination of pine seedlings within Itasca Park.

Methods

The vegetation communities within the Itasca SNA are mapped and described in the following section. The vegetation for this site is grouped into 9 types--red pine forest, white pine forest, transitional northern hardwood forest, aspen-birch forest, boreal forest, jack pine forest, shrub swamp, hardwood swamp and conifer swamp. This classification is based on dominance of canopy layer species and overall floristic composition, and to some extent reproductive development. The boundaries of the vegetation types on the cover type map were identified with the use of aerial photographs, DNR

forest inventory data, and on-site field evaluations. Boundaries of vegetation types are always more definitive when mapped than they appear in the field. Discrete changes between vegetation types are rare; instead they grade on a continuum from one type to another. In the SNA, this continuum is especially significant in the upland vegetation types that are closely related through successional trends. Overlap of vegetation characteristics from one type to another is common. In the following descriptions, red pine forest and white pine forest are described in greater detail than other communities because of the ecological significance of these pine communities.

Community Descriptions

Red Pine Forest (RP)

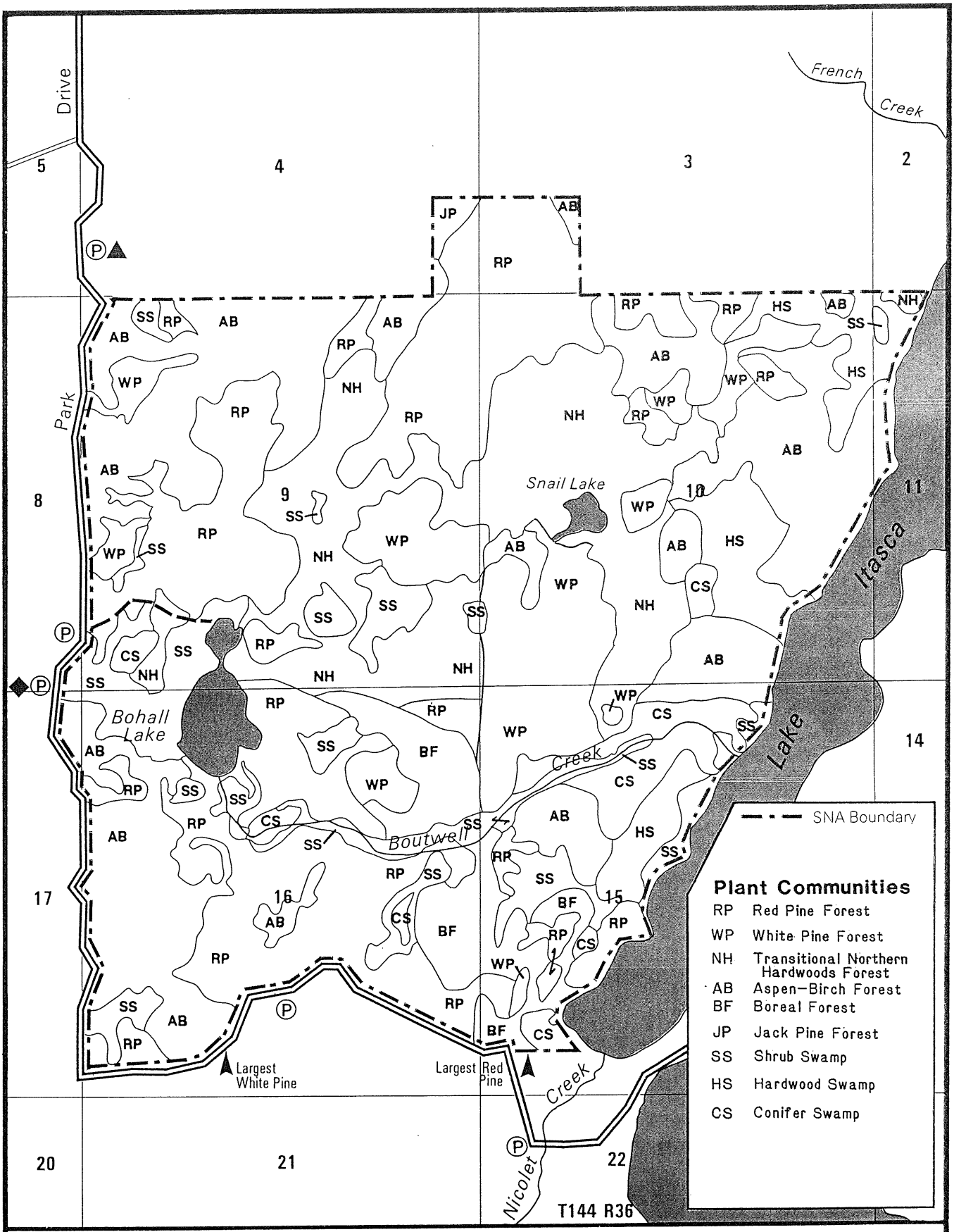
Red pine forests are a distinctive feature of the wilderness area. Most examples of this community are typically found on coarse-textured mineral soils. Stands are composed primarily of even-aged mature red pine (Pinus resinosa), or of red pine in combination with lesser amounts of white pine (P. strobus). The age of red pine stands is highly correlated to fires in the 1700's and 1800's.

The present understory vegetation reflects the supression of natural fires over the past 40 years. The absence of periodic surface fires has allowed the vigorous development of understory shrubs and hardwoods. Competition from shade tolerant species and lack of mineral seed beds are critical factors inhibiting successful pine reproduction. Regeneration under mature pine canopies is predominately species of the northern hardwoods, boreal forest, and/or aspen-birch communities. Highly developed understories of red maple (Acer rubrum), paper birch (Betula papyrifera), trembling aspen (Populus tremuloides) and red oak (Quercus rubra) are prevalent throughout the red pine stands. In some areas, balsam fir (Abies balsamifera) and lesser amounts of white spruce (Picea glauca) dominate the subcanopy, most typically on low-nutrient sites.

Hazelnut (Corylus cornuta) is the most dominate shrub, occurring in moderate to high densities depending on the amount of competition from regenerating hardwood species. Other shrubs, more frequently growing in small groups, include Acer spicatum, Cornus rugosa, Viburnum rafinesquianum, Dirca palustris and Vaccinium angustifolium.

Groundlayer species which are restricted to red pine forest and can be used to differentiate this community from other types have not been identified. The prevalent herbaceous species are also encountered in other vegetation types. These are Aster macrophyllus, Pteridium aquilinum, Maianthemum canadense, Dryopteris spinulosa, Steptopus roseus, Thalictrum dioicum, Aralia nudicaulis, and Lathyrus ochroleucus.

Seedlings of red maple, sugar maple (Acer saccharum), red oak and hackberry (Celtis occidentalis) are locally abundant depending on shrub competition and to some extent on animal browsing. Pine reproduction is unsuccessful in this community type. Researchers at Itasca State Park have identified a combination of reasons for this including intense competition from hardwood tree and shrub species, deer browse, white pine blister rust, variable seed production, and the lack of appropriate seedbeds.



ITASCA WILDERNESS SANCTUARY SNA

VEGETATION

White Pine Forest (WP)

This community is dominated by mature to old growth white pine, with specimens over 200 years old common in the central portion of the SNA. White pine forests characteristically occur on more mesic sites having finer textured soils than sites occupied by red pine forests. In addition, the understory of white pine forests usually includes more mesophytic species.

Closed canopy forests of pure white pine are rare in the SNA. Instead, white pine usually forms a more or less open overstory with different stages of northern hardwood development in the subcanopy. Where white pine is also found in admixture with red pine, it exceeds red pine in coverage and volume.

The understory typically has an abundance of shade tolerant mesophytic hardwood species, notably sugar maple, basswood (Tilia americana) and ironwood (Ostrya virginiana). Researchers attribute this highly developed hardwood understory to fire suppression since the early 1920's. Within the present white pine forest communities, white pine saplings and other intermediate size-age classes are almost absent. Studies in Itasca State Park have shown that white pine reproduction is most successful in jack pine forests where understory competition is minimal.

With the eventual loss of the old growth white pines to windthrow and other factors, the mesic hardwood species are likely to survive the loss of the pines and assume dominance in the upper canopy. In advanced stages of succession the white pine community resembles that of the transitional northern hardwoods community. Boundaries between these two types are somewhat artificial because of this overlap in vegetation characteristics.

Transitional Northern Hardwoods Forest (NH)

The transitional northern hardwood forests are found on the more mesic and finer-textured soil sites in the SNA. This community is represented by stands which are transitional in development, and contain a mix of seral and climax tree species.

In most cases the upper canopy is open and contains seral tree species - bur oak (Quercus macrocarpa), big-tooth aspen (Populus grandidentata), trembling aspen, red pine and/or white pine. These tree species occur singly or in combination. They are typically represented only by old growth trees. Seedlings and saplings of seral trees are uncommon in the understory.

In contrast, the northern hardwood species - sugar maple, red oak, basswood, ironwood, red maple and black ash, are represented in all age classes except the old growth class. They heavily dominate the mid canopy with few trees exceeding 100 years in age. Sugar maple and red maple are the most abundantly reproducing species. The shrub layer is typically sparse. Corylus cornuta and Acer spicatum are common components. The most common groundlayer herbs are Clintonia borealis, Aralia nudicaulis, Dryopteris spinulosa, Streptopus roseus, and Osmorhiza longifolia.

Before fire suppression, this community was probably restricted to mesic, fire-protected sites where fire frequency and intensity were low. Based on numerous studies within Itasca State Park, the transitional northern hardwood forests, under continued undisturbed succession, are expected to expand throughout the park at the expense of the seral oak and pine communities.

Aspen-birch Forest (AB)

This short-lived pioneer community is common on well-drained to moderately drained sites that have been subjected to fire or other catastrophic disturbances. Trembling aspen dominates most stands; paper birch is locally more abundant in some areas. The aspen-birch forest is typically 60-80 years in age with many stands becoming decadent with age or disease (especially hypoxylon canker and white trunk rot). Stands of aspen-birch forest with highly developed northern hardwood and/or conifer understories are found throughout the SNA. Red maple, balsam fir, red oak and white spruce are the prevalent species regenerating under aspen-birch forest. Other areas have limited understory tree development and are characterized by dense, near-continuous thickets of hazelnut, and lesser amounts of Viburnum rafinesquianum, Cornus spp., and Diervilla lonicera. Seedling or sucker regeneration of aspen and birch is common only in exposed areas. The prevalent herbaceous species in aspen-birch forests are Aster macrophyllus, Pteridium aquilinum, and Streptopus roseus. Aspen and birch are common components in other forest types throughout the SNA. Along with more tolerant hardwoods and conifers they often invade old growth pine forests following mortality of the canopy trees.

Boreal Forest (BF)

In the SNA, boreal forests are most often located on mesic to dry mesic areas near the Lake Itasca shoreline or on sites drained by Boutwell or Nicolet Creek. The most common species, balsam fir, occurs singly or in complex mixes with white spruce, birch and trembling aspen. Stands of boreal forest are predominately all-aged with balsam fir the most abundant reproducing species. Stand development appears to be young in most cases with the dominant trees less than 100 years. Occasionally scattered old growth red and/or white pine may be found in the overstory.

Jack Pine Forest (JP)

Mature jack pine stands are most prevalent on xeric sites of low fertility found near the north-central border of the SNA. Lesser amounts of balsam fir, aspen, birch and red pine are mixed in the canopy. Understory is composed of hazelnut and other shrubs in medium densities. Jack pine, red pine, and most often, white pine, are the most abundant reproducing trees typically found in openings in the forest. Balsam fir, shrub, and hardwood regeneration may limit success of pine regeneration in some areas.

Shrub Swamp (SS)

Shrub swamps, marshes and sedge meadows occur most frequently in poorly drained organic soils adjacent to streams or lakes. The largest areas are along or adjacent to Boutwell Creek, Nicolet Creek, the low shoreline of Lake Itasca, and west of Bohall Lake. Other areas include pitted outwash

depressions. Alder (Alnus rugosa) is common in thickets of moderate to dense cover. Other areas contain a significant willow (Salix bebbiana, S. gracilis) component. Open areas are typically dominated by cattails (Typha latifolia) or sedges (Carex spp.). These areas are often encircled by willows, alders, or hardwoods. Additional herbaceous species include Scirpus cyperinus and Phragmites australis.

Hardwood Swamp (HS)

Hardwood swamps occur in poorly drained lowlands near the outlets of French Creek and Boutwell Creek into Lake Itasca, and in other low areas near the Lake Itasca Shoreline. Dominant hardwood species include black ash, paper birch, balsam poplar (Populus balsamifera) and basswood. Associated tree species include yellow birch (Betula lutea), american elm, trembling aspen, balsam fir, and white spruce. Hazelnut and alder are common in the understory.

Conifer Swamp (CS)

Conifer swamps are most common on moderately wet sites along Boutwell Creek, Nicolet Creek and adjacent low areas. The largest conifer swamps are dominated either by black spruce (Picea mariana) or white cedar (Thuja occidentalis) and have tamarack (Larix laricina), balsam fir, and black ash associates. Smaller conifer swamps typically have nearly pure stands of tamarack or black spruce. Labrador tea (Ledum groenlandicum) and hazelnut (Corylus spp.) dominate the shrublayer.

GREAT LAKES PINE FOREST
(White Pine Forest, Red Pine Forest)
ELEMENT ABSTRACT

NATURAL COMMUNITY
ELEMENT NAME: Red Pine Forest, White Pine Forest

ELEMENT RANK: *Special Concern/Threatened in Minnesota

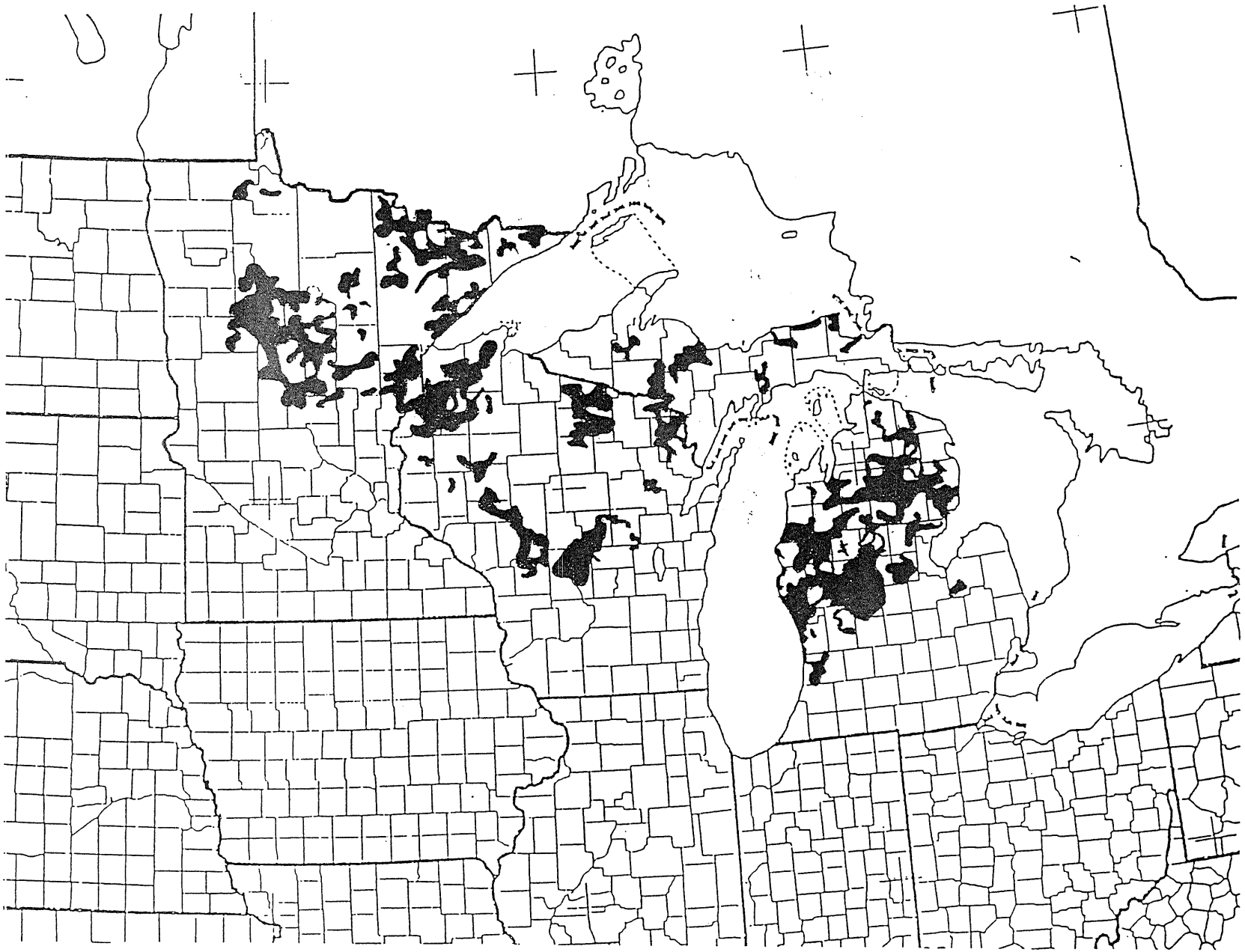
PLANT COMMUNITY
COVER TYPES: Pinus strobus, Pinus resinosa, Pinus resinosa - Pinus strobus, Pinus resinosa - Pinus banksiana

BASIS FOR CONCERN: Lumbering, beginning in the 1840's virtually eliminated the large blocks of original white pine and red pine forests from the landscape. Subsequent land clearing activities and slash fires destroyed chances for pine regeneration and resulted in their replacement with aspen, birch and other intolerant seral hardwoods and shrubs. Protected old growth pine stands are continuing to decline as the natural fires, necessary for their perpetuation, have been largely eliminated. Virgin pine stands are well represented in the Boundary Waters Canoe Area, less so in the Pine Moraine region (north central Minnesota), and very poorly represented in other landscape regions where they were once abundant.

REGIONAL DESCRIPTION AND DISTRIBUTION: The Great Lakes pine forest has been included under a number of classification systems including the Lake Forest Formation (Weaver and Clements 1938), the Minnesota Section of Hemlock-White Pine-Northern Hardwood Region (Braun 1950), and the Great Lakes Pine Forest according to Kuchler (1964). The Great Lakes pine forest occurs as a transition between the boreal forest and the eastern deciduous forest. It occurs in the upper Great Lakes region in Michigan, Wisconsin and Minnesota (Figure 1) and is defined by its characteristic trees, eastern white pine (Pinus strobus), red pine (Pinus resinosa) and jack pine (Pinus banksiana). Both red and white pine reach a peak of abundance in this region extending northward only to the southern fringe of the boreal forest region. Jack pine is essentially a tree of the boreal forest with most of its range lying in the boreal forest region of Canada. Characteristic hardwood associates within the Great Lakes pine forest include red oak (Quercus rubra), hills oak (Quercus ellipsoidalis), red maple (Acer rubrum), paper birch (Betula papyrifera), quaking aspen (Populus tremuloides), and big tooth aspen (Betula grandidentata). This forest type occurs most commonly on level or gently rolling sand plains, sandy glacial lake beds and thin glacial drift over bedrock.

* Element ranks for natural community types are program-defined and do not represent an official federal or state status (e.g., no legal status exists).

Figure 1. Presettlement extent of the Great Lakes pine forest (after Kuchler, 1964).



Throughout the Great Lakes pine forest, fire was the most important factor controlling the species composition and age structure of the vegetation as well as the overall vegetation patterns on the presettlement landscape. Paleoecological studies (Swain 1973, 1978; Cwynar 1978) show that white and red (or jack) pines have been associated with fire ever since their postglacial arrival within their present ranges some 1,000 to 9,000 years ago. Numerous contemporary studies have documented the dependence of pine forest communities on fire for both stand initiation and maintenance. Maissurow (1935, 1941) and Cary (1948) recognized the importance of fire in establishing white pine stands in Wisconsin, Michigan and New England. Detailed studies of fire cycles in Minnesota by Spurr (1954), Frissel (1971, 1973), and Heinselman (1973) have documented the relationship between forest fires and initiation of red, white, and jack pine stands.

In the absence of periodic fire, successional trends typically start with jack pine, pass through red pine and white pine and culminate in maple-basswood forest, or in the northern most portion of the area in spruce-fir forest. Uninterrupted, linear succession of this type - one vegetation complex replacing another on a given site in the absence of disturbance - probably rarely occurred in the presettlement Great Lakes pine forest. Fires, of varying frequency and intensity, commonly interrupted succession before any true climax vegetation was reached. Frequent fires produced a heterogeneous vegetation mosaic composed of the full spectrum of successional stages from early post-fire communities to mature, old growth communities. Heinselman (1978) succinctly summarizes the structure of the presettlement red pine - white pine forest under natural fire cycles.

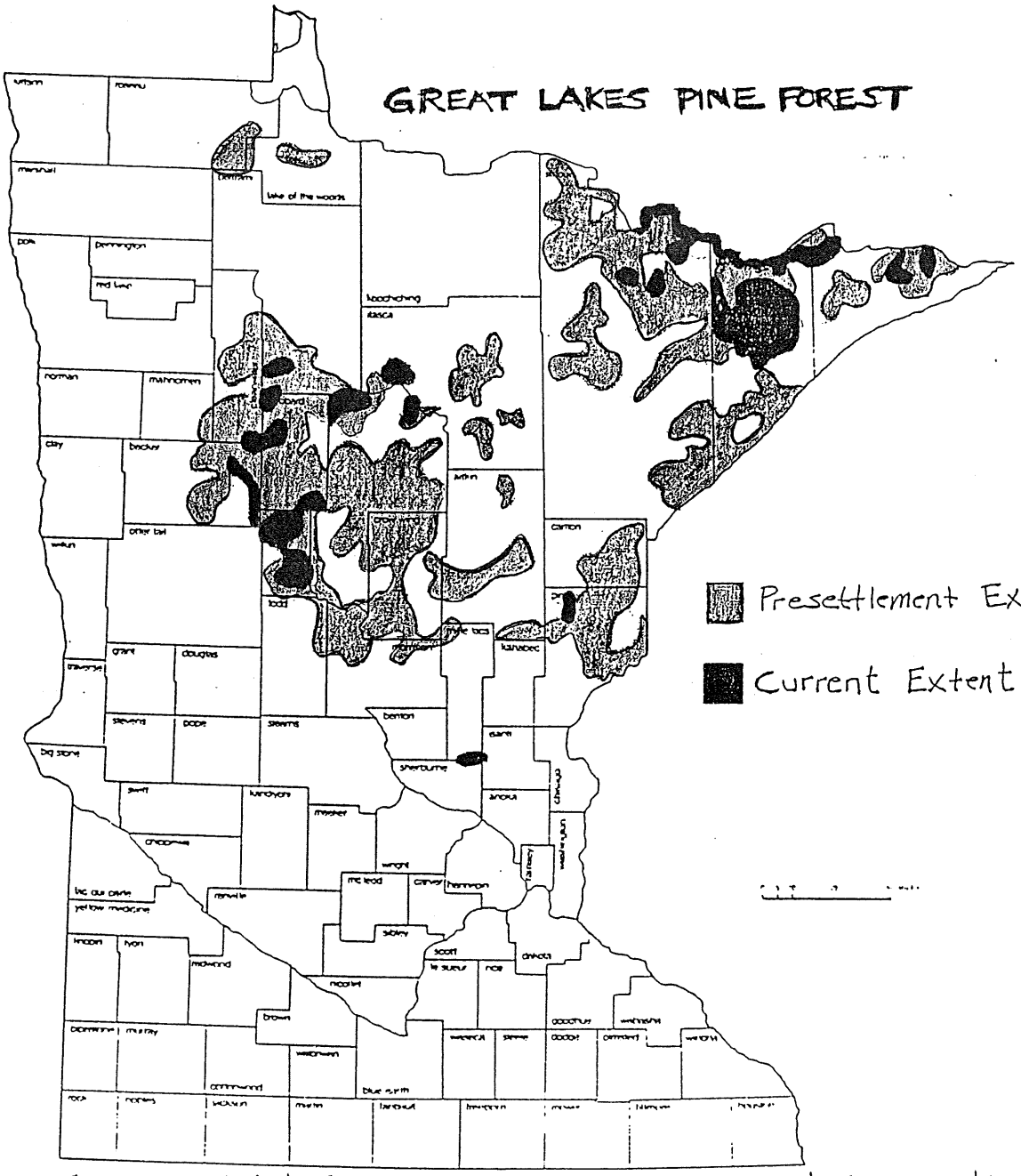
> "Throughout the region, from Maine to Minnesota, there were really two classes of pine forests from the standpoint of fire regimes: (1) The classic pure red pine-white pine groves, with little understory development, and almost no mixture with shade tolerant conifers or hardwoods. Such forests probably had a history of periodic light surface fires at 5 to 50 year intervals, in addition to severe fires at longer intervals that brought in whole new age classes of pine. These kinds of stands generally grew on the more xeric sites or in more fire-prone physiographic situations. (2) White pine forests (usually with less red pine in mixture) with significant stand components of shade-tolerant conifers or hardwoods--such as eastern hemlock, white or red spruce, balsam fir, northern white-cedar, sugar maple, beech, yellow birch, red maple or similar species. This class of stands occurred on more mesic sites, or perhaps also on sites better protected by their physiographic location from periodic surface fires. Such stands were probably more common from Michigan eastward due to heavier precipitation, while the first class was probably more common in the drier climates of Wisconsin, Minnesota, and western Ontario. The second class of stands apparently had a history of only one severe fire at very long intervals, which killed most of the previous generation and brought in a whole new forest. Fire cycles for forests of this type may have averaged 150 to 300 years."

GREAT LAKES PINE FOREST OF MINNESOTA: The Great Lakes pine forest occurred in Minnesota on a variety of landform types, principally on thin glacial till over bedrock and sandy outwash areas in the northeast (Border Lakes area) and the coarse-textured ground and end moraines, sand outwash plains, and gravelly till plains in the northcentral part of the state. Figure 2 shows the presettlement distribution of pine forest in the state. These forests were dominated by red pine or eastern white pine or a combination of the two species. Jack pine was often a component of red pine stands and also formed extensive pure stands. Forests of jack pine are considered under the boreal forest category since jack pine is a true boreal tree with the greatest percentage of its natural range found in the boreal forest region of Canada.

In general, the sequence of upland forest sites within the Great Lakes pine forest of Minnesota ranged from sterile, xeric sands dominated by jack pine, through intermediate red pine and aspen sites, to mesic, fertile loams dominated by white pine or sugar maple. The vegetation of local physiographic sites was strongly and variously affected by natural disturbances - fire, windstorms, insects, and disease. This interaction provided an unusual complexity in species composition and age structure of the major forest community types of the region. Contrary to popular belief, the Great Lakes pine forest of Minnesota was not a vast unbroken stand of old majestic red pine and white pine. The upland forest of the region was composed primarily of a mixture of aspen and birch with red, white, and jack pine stands of varying ages. In the absence of natural disturbances, on suitable soil types, spruce-fir forest and sugar maple-basswood forest were the climax forest types. Periodic natural disturbances, however, were an integral part of this ecosystem and maintained predominantly sub-climax forest types over much of the landscape. Fire was the most important disturbance feature and the dominant factor in determining the vegetation mosaic on the presettlement landscape, it is discussed in greater detail below.

Presettlement fire regimes in the Great Lakes pine forest

The Great Lakes pine forest region can not be fully understood without recognizing the crucial ecological role of fire. Fire controlled the vegetation mosaic on the landscape and also helped maintain the diversity, productivity, and long-term stability of the whole ecosystem (Heinselman 1973). The presettlement fire regimes for red pine-white pine forests have been detailed in studies conducted at Itasca State Park in north-central Minnesota and in the Boundary Waters Canoe Area (BWCA) in northeastern Minnesota. These studies have documented the significance of fire in the initiation and perpetuation of virgin pine forest in Minnesota.



Source: Modified from Marschner, 1930 and Minn. Land Management Information Center

Figure 2

Frissell (1973) worked out the fire history of Itasca State Park; he reports that "a major fire occurred in the park at an average interval of 10.3 years and that, on the average, any specific location in the park was affected by fire every 22 years." Virtually all pine components in the park were found to be of post-fire origin. Heinselman (1973) reported similar fire regimes for the BWCA. The red-white pine stands were characterized by infrequent, moderate surface fires with an average return interval of 36 years, punctuated at much longer intervals - perhaps 160 years - by severe surface fires or crown fires that killed portions of stands and brought in new age classes. Again, all significant red pine and white pine stands in the study area were of post-fire origin.

Thick insulating bark and long clear trunks make red pine and white pine well adapted to short cycle, light intensity surface fires. Fires also help create the mineral seed beds, and reduced shrub and hardwood competition necessary for pine tree reproduction (Ahlgren and Ahlgren 1960). Fire control over the last 60 years has greatly lengthened and modified the natural fire cycles which created the conditions necessary for maintenance of pine forest throughout the Great Lakes pine forest region. Fire suppression has allowed the development of dense understories of shade tolerant trees which create fuel ladders that can carry lethal crown fires into the overstory (Heinselman 1973). With continued fire protection, the understory fuel layer becomes capable of generating intense fires and restoration of presettlement fuels situation becomes increasingly difficult.

Long term fire exclusion may eventually force succession of red-white pine stands to more shade tolerant forest communities. This process is relatively slow as pine overstories are capable of persisting for 300 to 400 years without fire. Eventually, however, as the mortality rate of old pines becomes high due to windthrow and other causes they will likely be replaced by more shade tolerant species. Red pine seedlings and to a somewhat lesser extent white pine seedlings rarely succeed in competition with the more shade tolerant species which increase in the absence of fire. The studies within Itasca Park and the BWCA indicate pine will not regenerate under a forest canopy without the aid of disturbance, particularly fire. Succession on the uplands within the BWCA, without disturbance, leads to fir-birch forest and ultimately to the white cedar community type (Grigal and Ohmann, 1975). In Itasca State Park, uninterrupted succession on mesic sites leads to the sugar maple-basswood forest type, on nutrient-poor sites spruce-fir forest or transitional hardwoods may dominate (Buell and Martin 1961; Kurmis 1969; Ness 1971; Peet 1984).

Composition of red pine forest and white pine forest

In Minnesota, two natural community types are recognized within the Great Lakes pine forest-red pine forest and white pine forest. Both communities are closely related through successional trends. Variability within and between red pine forest and white pine forest is strongly related to the frequency and intensity of fire disturbance and only indirectly reflects the influence of local site factors. The general successional trend for both community types - in the

absence of disturbance - is for long-term development toward maple-basswood-oak forest. On dry, coarser-textured mineral soils subjected to relatively frequent fires, the early successional red pine forest type is easily distinguished from the more successionally advanced white pine forest found on mesic, finer textured soils generally exposed to less frequent and less intense fires. At intermediate successional stages the distinction between the two communities becomes blurred.

The red pine forest community was more abundant than the white pine community on the presettlement landscape, and commonly occurred on coarser-textured, drier sites, prone to more frequent and intense fires. Soils are typically well drained, loamy coarse sands to gravelly sandy loams. The community is dominated by red pine, typically of post fire origin, and is often associated with lesser amounts of white pine. On upper slopes and ridgetops of northeastern Minnesota, red pine occurs with scattered paper birch, red oak, and jack pine. On more mesic lower slopes, red pine is often associated with white pine, red maple, paper birch, and quaking aspen. White spruce and balsam fir may be present in some communities. One of the characteristic structural features of the red pine forest is the general openness beneath the canopy of large, old growth pines. Typically, the tall shrub layer is poorly developed. Juneberry (Amelanchier spp.), and beaked hazel (Corylus cornuta) are most common, with juniper (Juniperus communis) less common but modal to the community. Low shrubs include Rubus pubescens, Rubus idaeus, and Vaccinium angustifolium. In northeastern Minnesota, mosses and lichens are more prominent than the herbs. The common mosses and lichens are Dicranum rugosum, Calliergonella schreberi, and Cladonia rangiferina. The prevalent modal herbs, which differentiate the red pine community from the white pine community type are species indicative of open, dry conditions. These are cow-wheat (Melampyrum lineare), sweet fern (Myrica asplenifolia), bearberry (Arctostaphylos uva ursi), wintergreen (Gaultheria procumbens), pipsissewa (Chimaphila umbellata), and Dryopteris spinulosa. Associated prevalent species, which also occur commonly in the white pine forest community, include Canada mayflower (Maianthemum canadense), large-leaf aster (Aster macrophyllus), wild sarsaparilla (Aralia nudicaulis), bunchberry (Cornus canadensis) and bracken fern (Pteridium aquilinum). In the absence of fire, the accumulating litter layer restricts the reproduction of red pine. Under these conditions red maple followed by quaking aspen and red oak are the dominant reproducing trees. Balsam fir, white spruce and to a less extent white pine may also be found in the understory. With continued fire exclusion a well developed subcanopy of shade tolerant trees and shrubs replaces the previous open structure of the community.

The white pine forest community occurs on more favorable sites and on sites generally having a history of less intense fires than the drier red pine forest sites. The best developed white pine stands occur in northern Minnesota on mesic sites of lake margins and lower slopes; optimal growth occurs on moderately well drained deep loams and sandy loams. On all sites, white pine is strongly dominant, often forming relatively pure even-aged stands of post-fire origin. Associate trees are balsam fir, paper birch, white spruce, red maple, and sugar maple.

The understory layer of white pine forests have a moderately developed tall shrub layer which may include Diervilla lonicera, Corylus cornuta, Acer spicatum, Amelanchier spp., Viburnum rafinesquienum, Cornus rugosa, and Dirca palustris. The prevalent ground layer herbs and ferns include Aster macrophyllus, Maianthemum canadense, Aralia nudicaulis, Clematis virginiana, Fragaria virginiana, Mitella nuda, Lathyrus ochroleucus, Linnaea borealis, Cornus canadensis, Vaccinium myrtilloides, Clintonia borealis, Anemone quinquefolia, Trientalis borealis, Galium trifolium, Pteridium aquilinum, Athyrium Filix-femina, and Carex pensylvanica. The moss and lichen layer is less prominent than the herb layer and includes Pleurozium schreberi, Hylocomium splendens, Cladonia rangiferina, Hypnum cristacassrensis, and Dicranum rugosum. White pine may establish seedlings under its own canopy and advance to the sapling stage - at least where competition from fast growing or shade tolerant trees is not too severe. This community, similar to the red pine forest, however, is favored by periodic surface fires which eliminates competing understory trees and shrubs. In the absence of periodic fires sugar maple along with basswood, red oak ironwood, red maple, and ironwood are the most abundant reproducing species. In northeastern Minnesota (BWCA) balsam fir, white spruce and white cedar may dominate tree reproduction. With long-term fire protection, on fertile loams, the white pine community typically forms a two layered forest with a supercanopy of white pine (up to 400 years old) and a canopy of northern hardwoods or balsam fir/white cedar.

CURRENT STATUS AND THREATS: The red pine-white pine forests were one of the most thoroughly exploited natural resources in the Upper Midwest (Curtis 1959). The great economic demand for pine resulted in the removal of the large blocks of pine groves throughout their original range. A century of logging, slash burning, and land clearing activities had substantially reduced or eliminated most of the virgin pine forest as well as the seed sources for pine regeneration. Heinselman (1954) stated in Minnesota, Wisconsin, and Michigan alone, some 5 to 6 million acres of white and red pine forest were converted to essentially pure aspen and birch stands - almost totally devoid of pine seed trees.

In Minnesota, large, remnant stands of both red pine forest and white pine forest have been protected in the Border Lakes, and Pine Moraine landscape regions (Figure 3). In other regions, where pine forests were once abundant, they are poorly protected. Figure 2 shows the drastic reduction of pine forest since settlement in the mid 1800's.

The original pine forest vegetation and associated physiographic features of the Border Lakes landscape region are well represented within the Boundary Waters Canoe Area (BWCA) and Voyageurs National Park. Much of the BWCA region was little affected by the early logging era. Heinselman (1973) suggests that recurrent forest fires had maintained 75 percent of the region in commercially immature forests, hence only a small fraction of the BWCA was subjected to logging. Today, the BWCA contains 532,000 acres of virgin landscape with approximately 17,300 acres of unlogged red pine forest (Heinselman, 1973). White pine forest is less common in the BWCA; no acreage figures are available. Heinselman's study of the BWCA indicates that

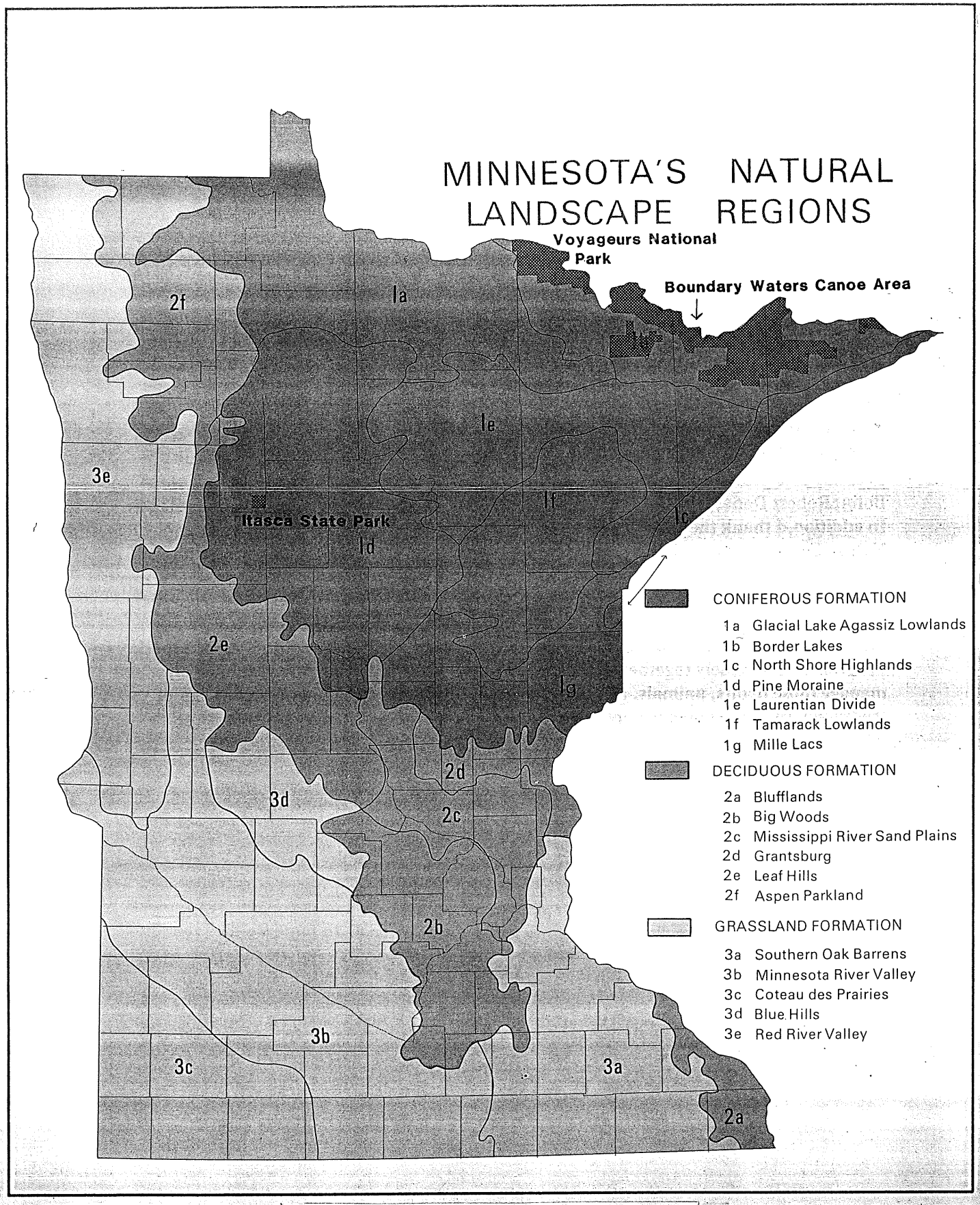

MINNESOTA'S NATURAL LANDSCAPE REGIONS
Voyageurs National Park
Boundary Waters Canoe Area
Itasca State Park
1a
1b
1c
1d
1e
1f
1g
2a
2b
2c
2d
2e
2f
3a
3b
3c
3d
3e
CONIFEROUS FORMATION
1a Glacial Lake Agassiz Lowlands
1b Border Lakes
1c North Shore Highlands
1d Pine Moraine
1e Laurentian Divide
1f Tamarack Lowlands
1g Mille Lacs
DECIDUOUS FORMATION
2a Blufflands
2b Big Woods
2c Mississippi River Sand Plains
2d Grantsburg
2e Leaf Hills
2f Aspen Parkland
GRASSLAND FORMATION
3a Southern Oak Barrens
3b Minnesota River Valley
3c Coteau des Prairies
3d Blue Hills
3e Red River Valley

Figure 3

essentially all the pine areas burned at sometime in the past 400 years and much of the present virgin forest is represented by post-fire successional communities 110 years or less in age. The oldest stand in the study area was a 360 year white pine stand. Deterioration of the old pines has resulted in advanced succession to a fir-spruce-cedar community. Virgin red-white pine stands are much rarer in Voyageurs National Park. They are restricted to scattered stands that would have been too young for logging in the early 1900's (Kurmis et al., 1980).

Itasca State Park in north central Minnesota was created in 1891 to save a remnant of the "primeval pine forest" associated within the Mississippi headwaters (Hansen et al., 1974). Although many former pine stands within the 32,000 acre park have been converted to aspen and other seral hardwoods, the park today contains some 5,000 acres of red pine forest and 1,200 acres of white pine forest (Kurmis et al. 1972). The pine forest is represented primarily by mature (90-150 years old) and old-growth (over 200 years old) stands of post-fire origin. Under existing conditions, establishment and growth of red pine seedlings, and to a somewhat lesser extent white pine seedlings, is severely restricted. Young pine stands are almost absent in the park. Fire protection, advance regeneration of shrubs and hardwoods, and excessive deer population prior to 1945 are the main factors preventing adequate pine regeneration (Kurmis 1969; Ness 1971; Frissell 1973).

Outside of the BWCA and Itasca State Park, old growth pine stands are rare and exist only as small, isolated remnants. Many of Minnesota's protected old growth pine stands are undergoing compositional change due to the elimination of natural fires and lack of active management. The most evident change has been a reduction in the pine component of these forests and a rapid increase in the more shade tolerant hardwoods. Other threats to the continuity of protected pine forests are the introduction of white pine blister rust, and predator control resulting in excessive populations of deer and other browsing animals. The influences of these dynamic factors on pine stands have been documented most thoroughly in Itasca State Park (Ross et al., 1970; Hansen et al., 1974; Peet 1984).

Presettlement forest diversity within the Great Lakes pine forest was closely tied to a variety of natural disturbance factors, notably fire and windthrow. Preserving examples of the original vegetation communities within this ecosystem suggests preserves be large enough to incorporate disturbance generated patches necessary for internal regeneration of the characteristic pines and other seral species. More active management approaches, in particular, prescribed burning and/or management of natural fires may be necessary to maintain the "naturalness" of virgin pine forests. The artificial protection of these forests from fire has greatly reduced the possibilities for perpetuating these fire-dependent, seral communities.

REPRESENTATIVE SITES: Lac La Croix RNA, BWCA (Border Lakes)
Cathedral Grove (North Shore Highlands)
Itasca State Park (Pine Moraine)
Pine Point RNA (Pine Moraine)

LITERATURE CITED:

Ahlgren, I. F. and C. E. Ahlgren. 1960. Ecological effects of forest fires. Bot. Rev. 26:483-533.

Braun, E. L. 1950. Deciduous forests of eastern North America. Blakiston. Philadelphia, PA. 596 p.

Buell, M. F. and E. W. Martin. 1961. Competition between maple-basswood and fir-spruce communities in Itasca Park, Minnesota. Ecology 42:428-429.

Cary, A. 1936. White pine and fire. J. of Forestry 34:62-65.

Curtis, J. T. 1959. The vegetation of Wisconsin, Univ. of Wis. Press, Madison. 657 p.

Cwynar, L. C. 1978. Recent history of fire and vegetation from laminated sediment of Greenleaf Lake, Algonquin Park, Ontario. Canadian J. of Botany 56:10-21.

Fowells, H. A. (editor) 1965. Silvics of forest trees of the United States. U.S. Dept. of Agric., Agric. Handbook No. 271. 762 p.

Frissell, S. S. 1971. An analysis of the maintenance of pre-settlement biotic communities as an objective of management in Itasca State Park, Minnesota. Ph.D. Thesis. Univ. Minnesota. 228 p.

Frissell, S. S. 1973. The importance of fire as a natural ecological factor in Itasca State Park, Minnesota. Quaternary Research 3:397-407.

Grigal, D. F. and Ohmann, L. F. 1975. Classification, description, and dynamics of upland plant communities within a Minnesota Wilderness Area. Ecological Monographs. 45:389-407.

Hansen, H. L., V. Kurmis, and D. D. Ness. 1974. The ecology of upland forest communities and implications for management in Itasca State Park, Minnesota. Univ. Minn. Agr. Exp. Sta. Tech. Publ. 298, For. Ser. 16. 43 p.

Heinselman, M. L. 1954. The extent of natural conversion to other species in the Lake States aspen-birch type. J. of Forestry 52:737-738.

Heinselman, M. L. 1973. Fire in the virgin forests of the Boundary Waters Canoe Area, Minnesota. Quaternary Research 3:329-382.

Heinselman, M. L. 1978. Fire intensity and frequency as factors in the distribution and structure of northern ecosystems. Unpublished manuscript. 60 p.

Kuchler, A. W. 1964. Potential natural vegetation of the conterminous United States. Spec. Publ. Amer. Geogr. Soc. 36, 116 p. and map.

Kurmis, V. 1969. Dynamics of advance reproduction in upland forest communities in Itasca State Park, Minnesota. Ph.D. Thesis. Univ. Minnesota. 166 p.

Kurmis, V. and H. L. Hansen. 1972. Pine reproduction in Itasca State Park: analysis in moisture-nutrient coordinates. J. Minn. Acad. Sci. 38:37-41.

Kurmis, V., L. C. Merriam, S. L. Webb, and N. E. Aaseng. 1980. Primary plant communities Voyageurs National Park, Minnesota. Part 3 - Final Report. College of Forestry, Univ. Minnesota. St. Paul, Minn. 93p.

Maissurow, D. K. 1935. Fire as a necessary factor in the perpetuation of white pine. J. of Forestry 33:373-378.

Maissurow, D. K. 1941. The role of fire in the perpetuation of virgin forests of northern Wisconsin. J. of Forestry 39:201-207.

Marschner, F. J. 1930. The original vegetation of Minnesota - Map. U.S. Dep. Agric. North Central For. Exp. Sta. St. Paul, Minnesota.

Minnesota Land Management Center. Major Forest Types - Minnesota 1977 Inventory. U.S. Dep. Agric. North Central For. Exp. Sta. St. Paul, Minnesota.

Ness, D. D. 1971. Comparative dynamics of upland forest communities in Itasca State Park, Minnesota. Ph.D. Thesis. Univ. Minnesota. 447 p.

Peet, R. K. 1984. Twenty-six years of change in a Pinus strobus, Acer saccharum forest, Lake Itasca, Minnesota. Bul. Torrey Bot. Club. 111:61-68.

Ross, A. B., J. R. Bray and W. H. Marshall. 1970. Effects of long-term deer exclusion on a Pinus resinosa forest in north-central Minnesota. Ecology 51:1088-1093.

Swain, A. M. 1973. A history of fire and vegetation in northeastern Minnesota as recorded in lake sediment. Quaternary Research 3:383-396.

Swain, A. M. 1978. Environmental changes during the past 2000 years in North Central Wisconsin: Analysis of pollen, charcoal, and seeds from varved lake sediment. Quaternary Research. 10:55-68.

Spurr, S. H. 1954. The forests of Itasca in the nineteenth century as related to fire. Ecology 35:21-25.

Weaver, J. W. and F. E. Clements. 1938. Plant ecology. McGraw-Hill, New York, NY. 601 p.

PREPARED BY: Keith Wendt, Plant Ecologist, Minnesota Natural Heritage Program, 2/85

FLORA

During 1984, Itasca Wilderness sanctuary SNA was inventoried for the occurrence of rare plant species. The inventory process began with a search of the Heritage Program data base, which revealed two records for the site. The most significant of the two is Malaxis paludosa (bog adder's-mouth), a state endangered species. The second species is Botrychium matricariaefolium (matricary grape-fern), a rare species in Minnesota, but one that is not officially listed as endangered, threatened or special concern.

An attempt was made during the summer of 1984 to relocate these two species in the SNA. An attempt was also made to determine if other rare species occur in the SNA that had not been previously reported. The two species previously collected on the SNA were not relocated, but one new rare species was discovered. The species is Malaxis brachypoda (white adder's-mouth), and is considered rare in Minnesota, but does not have official status. Descriptions of these species along with site specific comments are presented in accompanying status reports.

During the course of the rare plant search, a general species list for the SNA was initiated. It contains species which could be reliably identified in the field. Because of the history of over-collecting at this site, no voucher specimens were taken. The species list has been annotated with species reported by G. B. Ownbey to occur in the SNA (Ownbey, G.B. 1969. Annotated checklist of the reed plants, ferns and fern allies for Clearwater County and Itasca State Park Minnesota, Department of Botany, University of Minnesota).

Itasca Wilderness Area
Plant species List

Scientific name	Common name
Abies balsamea (L.) Mill.	Balsam Fir
Acer rubrum L.	Red Maple
Acer saccharum 1.	Hard Maple; Sugar Maple
Acer spicatum Lam.	Mountain Maple
Achillea lanulosa Nutt.	Wooly Yarrow
Acorus calamus L.	Sweet Flag
Actaea rubra (Ait.) Willd.	Red Baneberry
Agastache foeniculum (Pursh) Ktze.	Fragrant Giant Hyssop
Alnus rugosa (Du Roi) Spreng.	Speckled Alder
Amelanchier huronensis Weig.	A Species of Juneberry
Amphicarpa bracteata (L.) Fern.	Hog Pea-nut
Andromeda glaucophylla Link	Bog Rosemary
Anemone canadensis L.	Canada Anemone
Anemone quinquefolia L.	Wood Anemone
Antennaria neglecta Greene	A Species of Everlasting
Antennaria neodioica Greene	Smaller Everlasting
Aquilegia canadensis L.	Wild Columbine
Aralia nudicaulis L.	Wild Sarsaparilla
Aralia racemosa L.	American Spikenard
Arenaria lateriflora L.	Blunt-leaved Sandwort
Arisaema triphyllum (L.) Schott	Jack-in-the-Pulpit
Asarum canadense L.	Long-tipped Wild Ginger
Aster macrophyllus L.	Large-leaved Aster
Aster puniceus L.	Red-stalk Aster
Asclepias incarnata L.	Swamp Milkweed
Asclepias syriaca L.	Common Milkweed
Athyrium filix-femina (L.) Roth.	Lady Fern
Betula lutea Michx.	Yellow Birch
Betula papyrifera Marsh.	Paper Birch
Betula pumila L.	Bog Birch

Botrychium multifidum (Gmel.) rupr.	Leathery Grape Fern
Botrychium virginianum (L.) Sw.	Rattlesnake Fern
Calamagrostis canadensis (Michx.) Beauv.	Blue-joint Grass
Calopogon tuberosa	
Calla palustris L.	Wild Calla
Caltha palustris L.	Marsh Marigold
Calypso bulbosa (L.) Oakes	Calypso
Campanula aparinoides Pursh	Marsh Bellflower
Campanula rotundifolia L.	Harebell
Cardamine pennsylvanica Muhl.	Pennsylvanian Bitter Cress
Chamaedaphne calyculata (L.) Moench	Leather-leaf
Carex aurea Nutt.	Golden-fruited Sedge
Carex chordorrhiza L.	Creeping Sedge
Carex crawfordii Fern.	A Species of Sedge
Carex diandra Schrank.	Lesser Panicled Sedge
Carex disperma Dewey	A Species of Sedge
Carex granularis Muhl.	A Species of Sedge
Carex interior Bailey	A Species of Sedge
Carex intumescens Rudge	Bladder Sedge
Carex leptalea Wahl.	A Species of Sedge
Carex oligosperma Michx.	A Species of Sedge
Carex paupercula Michx.	Bog Sedge
Carex saximontana Mack.	A Species of Sedge
Carex tenuiflora Wahl.	A Species of Sedge
Carex tuckermani Dewey	A Species of Sedge
Cicuta bulbifera L.	Bulb-bearing Water Hemlock
Cicuta maculata L.	Water Hemlock
Cinna latifolia (Trin.) Griseb.	Slender Wood Reed Grass
Circaea alpina L.	Smaller Enchanter's Nightshade
Cirsium arvense (L.) Scop.	Canada Thistle
Cirsium muticum Michx.	Swamp Thistle
Cirsium vulgare (Savi) Tenore	Bull Thistle
Clintonia borealis (Ait.) Raf.	Yellow Clintonia
Commandra richardsiana Fern.	False Toad-flax
Coptis groenlandica (Oeder) Fern.	Goldthread
Corallorrhiza maculata Raf.	Spotted Coral Root

Corallorrhiza striata Lindl.	Striped Coral Root
Corallorrhiza trifida Chat.	Early Coral Root
Cornus canadensis L.	Bunchberry
Corylus cornuta Marsh.	Beaked Hazelnut
Cryptotaenia canadensis (L.) DC.	Honewort
Cynoglossum boreale Fern.	Northern Hound's-tongue
Cypripedium acaule Ait.	Pink Moccasin Flower
Cypripedium calceolus L. var. parviflorum (Salisb.) Fern.	Small Yellow Lady Slipper
Cypripedium calceolus L. var. pubescens (Willd.) Correll	Large Yellow Lady Slipper
Cypripedium reginae Walt.	Showy Lady Slipper
Cystopteris bulbifera (L.) Bernh.	Bulblet Bladder Fern
Danthonia spicata (L.) Beauv.	Common Wild Oat Grass
Diervilla longicera Mill.	Bush Honeysuckle
Drosera rotundifolia L.	Round-leaved Sundew
Dryopteris cristata (L.) Gray	Crested Shield Fern
Dryopteris spinulosa (Mueller) Watt	Spinulose Shield Fern
Dulichium arundinaceum (L.) Britt.	Dulichium
Eleocharis intermedia (Muhl.) Schultes	Matted Spike Rush
Eleocharis ovata (Roth) R. & S.	Ovoid Spike Rush
Equisteum arvense L.	Field Horestail
Equisteum fluviatile L.	Water Horsetail
Equisteum pratense Ehrh.	Meadow Horsetail
Equisteum scirpoides Michx.	Dwarf Scouring-rush
Erigeron philadelphicus L.	Philadelphia Fleabane
Erigeron strigosus Muhl.	Rough Fleabane
Eriophorum tenellum Nutt.	Delicate Cotton Grass
Eriophorum viridicarinatum (Engelm.) Fern.	Thin-leaved Cotton Grass
Eupatorium maculatum L.	Joe-Pye Weed
Eupatorium perfoliatum L.	Common Boneset
Fragaria vesca L.	American Wood Strawberry
Fragaria virginiana Duchesne	Virginia Strawberry
Fraxinus nigra Marsh.	Black Ash
Fraxinus pennsylvanica Marsh.	Ash
Galium boreale L.	Northern Bedstraw

Galium trifidum L.	Small Bedstraw
Galium triflorum Michx.	Sweet-scented Bedstraw
Gaultheria hispidula (L.) Bigel.	Creeping Snowberry
Gaultheria procumbens L.	Checkerberry
Gymnocarpium dryopteris (L.) Newm.	Oak Fern
Helenia deflexa (Smith) Griseb.	Spurred Gentian
Hepatica americana (DC.) Ker	Round-lobed Liverleaf
Heracleum lanatum Michx.	Masterwort
Hystrix patula Moench	Bottle-brush Grass
Impatiens capensis Meerb.	Spotted Touch-me-not
Iris versicolor L.	Blue Flag
Juncus dudleyi Wieg.	Dudley's Rush
Larix laricina (Du Roi) K. Koch	Tamarack
Lathyrus ochroleucus Hook.	Pale Vetchling
Lathyrus palustris L.	Marsh Vetchling
Lathyrus venosus Muhl.	Veiny Pea
Ledum groenlandicum Oeder	Labrador Tea
Lemna minor L.	Lesser Duckweed
Lemna trisulca L.	Ivy-leaved Duckweed
Linnaea borealis L.	Twin-flower
Liparis loeselii (L.) Rich.	Loesel's Twayblade
Listera cordata (L.) R. Br.	Heart-leaved Twayblade
Lobelia siphilitica L.	Great Lobelia
Lonicera canadensis Marsh.	American Fly-honeysuckle
Luzula acuminata Raf.	Hairy Wood Rush
Luzula multiflora (Retz.) Lejeune	Upright Wood Rush
Lychnis alba Mill.	White Campion
Lycopodium annotinum L.	Bristly Clubmoss
Lycopodium dendroideum Michx.	Round-branch Groundpine
Lycopus uniflorus Michx.	Northern Bugle Weed
Lysimachia thyrsiflora L.	Tufted Loosestrife
Malaxis brachypoda (Gray) Fern.	White Adder's Mouth
Malaxis paludosa (L.) Sw.	Bog Adder's Mouth
Malaxis unifolia Michx.	Green Adder's Mouth
Matteuccia struthiopteris (L.) Todaro	Ostrich Fern
Megalodonta beckii (Torr.) Greene	Water Marigold

Melampyrum lineare Desr.	Cow Wheat
Mentha arvensis L.	American Wild Mint
Menyanthes trifoliata L.	Buckbean
Mimulus ringens L.	Monkey Flower
Mitella nuda L.	Naked Bishop's Cap
Moneses uniflora (L.) Gray	One-flowered Pyrola
Monotropa hypopitys L.	Pinesap
Monotropa uniflora L.	Indian Pipe
Muhlenbergia glomerata (Willd.) Trin.	Wild Timothy
Nuphar variegatum Engelm.	Large Yellow Pond Lily
Nymphaea tuberosa Paine	Large Water Lily
Onoclea sensibilis L.	Sensitive Fern
Oryzopsis asperifolia Michx.	Rough-leaved Mountain-rice
Oryzopsis pungens (Torr.) Hitchc.	A Species of Mountain-rice
Osmorhiza claytoni (Michx.) Clarke	Wooly Sweet Cicely
Osmunda cinnamomea L.	Cinnamon Fern
Osmunda claytoniana L.	Interrupted Fern
Ostrya virginiana (Mill.) Koch	Hop Hornbeam
Panicum lanuginosum Ell. var. fasciculatum (Torr.) Fern	A Species of Panic Grass
Panicum perlongum Nash	Long-stalked Panic Grass
Parnassia palustris L.	Marsh Grass of Parnassus
Parthenocissus inserta (Kern.) Fritsch	Thicket Creeper
Petasites sagittatus (Pursh) A. Gray	Arrow-leaved Sweet Coltsfoot
Phragmites communis Trin.	Common Reed Grass
Picea glauca (Moench) Voss	White Spruce
Picea mariana (Mill.) B.S.P.	Black Spruce
Pilea fontana (Lunell) Rydb.	Black-fruited Clearweed
Pinus banksiana Lamb.	Jack Pine
Pinus resinosa Ait.	Norway Pine
Pinus strobus L.	Eastern White Pine
Platanthera hyperborea (L.) R. Br.	Tall Leafy Green Orchid
Platanthera obtusata (Pursh) Richards.	Blunt-leaved Orchid
Platanthera orbiculata (Pursh) Torr.	Large Round-leaved Orchid
Poa languida Hitch.	A Species of Blue Grass
Poa palustris L.	Fowl Meadow Grass

Polygonum amphibium L.	Floating Smartweed
Populus balsamifera L.	Balsam Poplar
Populus grandidentata Michx.	Large-toothed Aspen
Populus tremuloides Michx.	Quaking Aspen
Potamogeton foliosus Raf.	Leafy Pondweed
Potentilla palustris (L.) Scop.	Marsh Cinquefoil
Prenanthes alba L.	Rattlesnake-root
Prunus virginiana L.	Choke Cherry
Pteridium aquilinum (L.) Kuhn	Eastern Bracken
Pyrola asarifolia Michx.	Pink-flowered Pyrola
Pyrola elliptica Nutt.	Common Pyrola
Pyrola secunda L.	One-sided Pyrola
Pyrola virens Schweigg	Green-flowered Pyrola
Quercus macrocarpa Michx.	Bur Oak
Quercus rubra L.	Northern Red Oak
Ranunculus abortivus L.	Smooth-leaved Crowfoot
Ranunculus flabellaris Raf. f. riparius Fern.	Yellow Water Crowfoot
Ranunculus recurvatus Poir.	Hooked Crowfoot
Ranunculus reptans L.	A Species of Crowfoot
Rhamnus alnifolia L'Her.	Dwarf Alder
Rhus radicans L.	Poison Ivy
Ribes lacustre (Pers.) Poir.	Swamp Black Currant
Rubus pubescens Raf.	Swamp Blackberry
Sagittaria cuneata Sheld.	Arum-leaved Arrow-head
Sagittaria latifolia Willd.	Broad-leaved Arrow-head
Salix candida Fluegge	Hoary Willow
Salix pedicellaris Pursh	Bog Willow
Sambucus pubens Michx.	Red-berried Elder
Sanicula marilandica L.	Black Snakeroot
Sarracenia purpurea L.	Pitcher Plant
Scheuchzeria palustris L.	No Common Name
Schizachne purpurascens (Torr.) Swallen	False Melic Grass
Scirpus Smithii Gray	Smith's Club Rush
Scirpus validus Vahl	American Great Bulrush
Scutellaria epilobifolia Hamilt.	Marsh Skullcap
Scutellaria lateriflora L.	Mad-dog Skullcap

Sium suave Walt.	Hemlock Water Parsnip
Smilacina racemosa (L.) Desf.	False Solomon's Seal
Smilacina stellata (L.) Desf.	Star-flowered False Solomon's Seal
Smilacina trifolia (L.) Desf.	Three-leaved False Solomon's Seal
Solidago flexicaulis L.	Zig-zag Goldenrod
Solidago graminifolia (L.) Salisb.	Bushy Goldenrod
Solidago uliginosa Nutt.	A Species of Goldenrod
Sonchus arvensis L.	Corn Sow Thistle
Sparganium fluctuans (Morong) Robins.	Floating Bur-reed
Thuja occidentalis L.	White Cedar
Ulmus americana L.	American Elm
Utricularia vulgaris L.	Greater Bladderwort
Viburnum trilobum Marsh.	High-bush Cranberry
Vitis riparia Michx.	Frost Grape
Zizania aquatica L.	Wild Rice

Malaxis paludosa (L.) Sw.
Bog adder's-mouth

Orchidaceae

OFFICIAL STATUS: Endangered

BASIS FOR MINNESOTA STATUS: This diminutive orchid presents an interesting problem in plant distribution. It is generally regarded as frequent in northern Europe, but it is extremely rare in North America. In fact, it was unknown on the continent until 1904 when it was collected by H. L. Lyon at an unknown location near New York Mills, Minnesota (Otter Tail County). Since then it has been found at isolated locations in Canada and Alaska, but fewer than 30 collection sites have been reported, including six in Minnesota. For this reason, M. paludosa is often considered the rarest orchid in North America. Although it is unquestionably rare, it is also easily overlooked. This is because of its small stature (its flowers may be the smallest of any North American orchid) and its habit of growing on moss hummocks where its greenish color makes it difficult to see.

Of the six populations reported from Minnesota, three are known to still exist. The most interesting of these was discovered in 1927, but its forest habitat was soon clearcut (sometime prior to 1939). However, by 1984 the forest had regenerated itself, and M. paludosa was again well established there. It is not known if the original population survived the clearcutting, or if another population recolonized the site once the forest had returned. In any case, detailed case histories are needed before it will be possible to prescribe forestry techniques that are compatible with this species. Another population is known to still persist 50 years after its initial discovery. It has apparently existed at the same site since 1934, but in numbers as low as five or six plants.

Of the three unconfirmed populations, one was discovered in 1924 when a single individual was found. There were further reports of one or two plants there until 1934, but none since. Another unconfirmed population was first found in 1915 and likewise consisted of only a single plant. The last report at this site was in 1949, but no description was recorded then. Both these sites were extensively searched as recently as 1984, but no plants were found. The last unconfirmed population is at the original collection site near New York Mills. Unfortunately, the locational information is vague and ambiguous, and it may never be possible to relocate the exact site.

Comments. This species exhibits several interesting adaptations, including an unusual form of vegetative propagation. In some instances, small bulblet-like structures develop at the margins of the leaves. When the leaf is detached, these structures may develop into plantlets, and ultimately new individuals (ramets). This may explain why plants often appear in "clumps".

PREFERRED HABITAT IN MINNESOTA: All three known populations in Minnesota occur in conifer swamps characterized by Thuja occidentalis (white cedar), Picea mariana (black spruce) and Larix laricina (tamarack). Two of these sites may be better described as forested fens, because they occur on moderate slopes and receive their moisture from groundwater. Swamps and fens, as used in this context, are nearly neutral in pH with moderate levels of dissolved minerals. This habitat

type differs from typical bogs which receive their moisture entirely from precipitation and are therefore quite acidic and mineral poor. Some of the historical collection sites may have been in bog habitats, but that is not well documented.

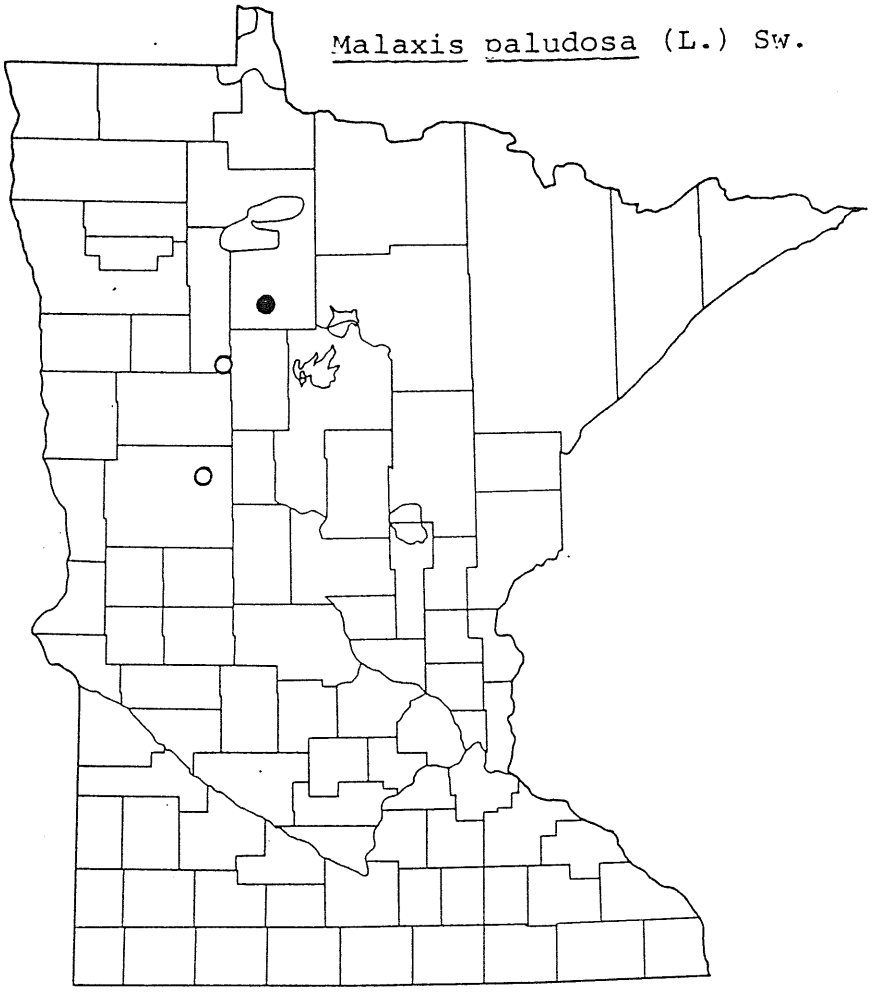
In their chosen habitat, M. paludosa generally occurs on hummocks of Sphagnum or Polytrichum moss. Individuals sometimes appear to be "perched" on the moss as if they were not actually rooted.

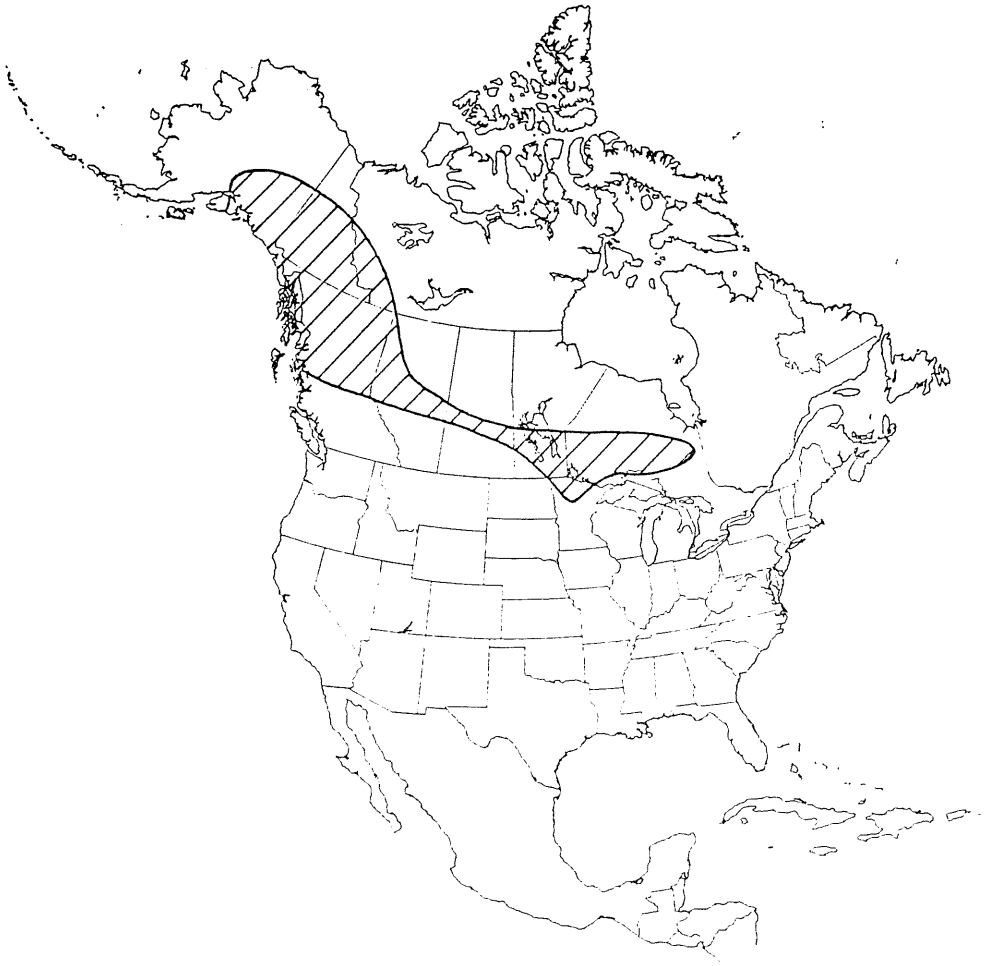
SITE SPECIFIC COMMENTS: Our knowledge of this species in the Itasca Wilderness sanctuary is based largely on a herbarium specimen in the University of Minnesota Herbarium (MIN), collected by S.C. Brayton on July 21, 1915. The site was described as a spruce-tamarack swamp behind Garrison Point at the southwest end of Lake Itasca. This site appears to be located in the NE 1/4 SW 1/4 sec 15. According to Brayton, a single plant was seen (and collected) on a Sphagnum hummock. Apparently Brayton returned the following year, but could not find any plants. There is a specimen of M. paludosa in the University of Wisconsin herbarium at Madison (MAD) collected by N.C. Fassett on August 23, 1949, which may also be from this site. The location is given only as "Garrison Point", Clearwater County. Nothing more is known about this collection.

The conifer swamp directly west of Garrison Point is believed the most likely source of these specimens. This area was searched in early and late July 1984 for the purpose of relocating this species. Although suitable habitat occurs at the site, no specimens of M. paludosa were found. The area is small and was searched intensively, but because of the small size of M. paludosa, it may have been overlooked.

SELECTED REFERENCES: Luer, C. A. 1975. The native orchid's of the United States and Canada. The New York Botanical Garden, New York. 361pp.

Malaxis paludosa (L.) Sw.





Malaxis brachypoda Gray
White adder's-mouth

OFFICIAL STATUS: None; unofficial watch list

BASIS FOR STATUS: This rare orchid has a broad trans-continental range, but with local and sporadic distribution. There are eight records from Minnesota, but only three are recent ones. There is currently too little information to determine if the species is declining or stable. It is apparent that the species has always been rare in Minnesota, and may be overlooked because of its small size.

SITE SPECIFIC COMMENTS: This species was not known to occur in the Itasca Wilderness sanctuary until July 1984, when a single specimen was discovered in the spruce-tamarack swamp southwest of Garrison Point. This site is located in the SW 1/4 SW 1/4 section 15. The search that discovered this population was moderately intensive, and yet only one individual was found. It is likely that more plants occur there, but were not observable at the time of the search.

Botrychium matricariaefolium A. Br. Ophioglossaceae
Matricary grape-fern

OFFICIAL STATUS: None; unofficial watch list

BASIS FOR STATUS: This unusual fern is quite rare in Minnesota, and may be suffering a decline linked to the loss of old-growth forests. There are nine records of this species from Minnesota, but only two of them are recent records. If further documentation becomes available which substantiates the apparent decline, the species will be proposed for protection status.

SITE SPECIFIC COMMENTS: The record of B. matricariaefolium in the Itasca Wilderness sanctuary dates from 1934. It was collected on that date by Dr. J.B. Moyle in a hardwood stand in the NW¼NW¼ Section 10. In July 1984, this area was searched in an attempt to relocate this population, but no plants were found. It is possible that this species still exists there, but was overlooked during the search.