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Lee Frelich has calculated that as of 1992, Wisconsin had 23,039 ha (56,906 acres) of primary forest. The breakdown by type was as follows: Northern White-cedar, 18,211 ha; Black Spruce-Tamarack, 2428 ha; Jack Pine, Red-White Pine, spruce-fir, oak-hickory, riverbottom, and northern hardwood each more than 400 ha. The percentage of primary forest that is old growth by the definition that Minnesota and Frelich use, that is, composed of long-lived species that are more than 120 years in age, is not known. Frelich calculated that presettlement forest in Wisconsin covered 8,987,000 ha (22,197,890 acres). Thus, in Wisconsin current primary forest is 0.25% of the presettlement forest (Frelich 1995).

The most extensive old-growth site in Wisconsin today is a privately owned tract, 3-4 miles across, that cannot be discussed because its future is under negotiation. Leaving this tract out of consideration, a majority of the old growth is now or, was within the past fifty years, in the hands of the Board of Commissioners of Public Lands. When Wisconsin became a state, the federal government gave to the state, land to distribute to settlers. At one time the Board of Commissioners controlled 10 million acres, approximately one-third of the land base of the state. The Board still holds almost 80,000 acres of what are known as State Trust Lands. Approximately 45,000 acres are swamp (Black Spruce, Tamarack, Northern White-cedar, alder, muskeg, and sedge meadow); the balance is upland. The Trust Lands today are mostly in small patches—40, 80, 120 acres. Roughly 80% of the current acreage of Trust Land is in the northern counties of Vilas, Oneida, Forest, Florence, Price, and Iron.

A higher percentage of the State Trust Lands than of other public lands is composed of remnant forests. Since these remaining Trust Lands were never distributed, many of them were never cleared or burned. They are not untouched, however. The Board of Commissioners conducts a logging program, consisting for the most part of selective logging of hardwoods. Although occasional fires occur through natural causes, at least half of the 80,000 acres is what may be called “older forest,” and a significant acreage is old growth. Most of the old growth within the boundary of Nicolet National Forest is on current or former State Trust Land, for example.

The Board of Commissioners has the right to sell and to trade land. It usually sells to public entities. The board has sold to private parties including The Nature Conservancy. Selling lands to private parties, however, was discontinued in 1986. The money that it obtains from the sale of land and of timber is held for the benefit of schools, universities, and certain other institutions. The Board has amassed some half a billion dollars. With the interest on its funds (not with the income from logging), it makes low-interest loans to communities and school districts. Unfortunately the Board is not authorized to purchase land. The Wisconsin legislature would have to consent to the granting of such authorization. Meanwhile, the half billion dollars cannot be used for land purchases to benefit the environment, no matter how urgent the need.

The Board and its staff manage the 80,000 acres without a legally based public planning process. Wisconsin residents are less aware of the State Trust Lands than they are of other public ownerships. Unlike, the US Forest Service (USFS), the Board does not have to go through a planning process with public input. The Board chooses not to log lowland Northern White-Cedar, Tamarack, or Black Spruce. In addition, it defers from logging some of the sites that have been identified through a recent biotic inventory as having natural area quality of state significance. Other natural area quality sites--including existing old growth--continue to be managed for timber production. The board only owns 5000 acres of hardwoods. The balance of the uplands are in other timber types.

Our site descriptions of State Trust Lands are only a sampling, as the sites are too numerous to present in their entirety here. Many of the Trust Land sites are part of larger complexes. The summary of the Draft Biotic Inventory 2003, on which we drew for our information on the Trust Lands, provides the acreage of the Trust Lands but not that of other lands in the complexes (Krause 2002, Board 2003).

USFS released a joint Proposed Land and Resource Management Plan and a joint Draft Environmental Impact Statement for the Chequamegon and Nicolet National Forests in the spring of 2003. The degree of protection that the proposed plan affords to identified old growth varies by alternative. The preferred alternative, Alternative 5, would set aside 86,100 acres as Old Growth and Natural Features Complexes (Management Area 8G). Alternatives 4, 7, and 9 would protect 93,2000 acres in such complexes. Old Growth and Natural Features Complexes “are characterized by ecosystem complexes and scattered individual stands which feature existing or developing old growth forest, as well as other exemplary natural communities.” The proposed plan would also protect certain old-growth stands in Special Management Areas (MA 8F) and in Research Natural Areas (RNAs), a total of 99,100 acres in the proposed plan. Currently the Forest Service has a policy of not logging wet forests (Epstein 2002), and various specific areas were deferred from logging pending adoption of the revised management plan (Parker 2002).

We give only a sampling of the old-growth areas in the National Forests, drawn from data sheets provided by Linda Parker, Forest Ecologist, reflecting the results of biological surveys of the forests. The data sheets describe numerous complexes at some length, but, as a general rule, do not indicate the acreage of old growth. Therefore we are often unable to give old-growth acreage in our site descriptions. Parker estimated in 1998 that there were probably a few thousand acres of current old growth in each National Forest, much of it in small isolated pieces. At that time, the Forest Service was still delimiting old-growth areas (Parker 1998).

The Wisconsin Department of Natural Resources has conducted and is conducting various inventories that have increased knowledge of old growth in the state. They include the Wolf River Biotic Inventory and Analysis and an analysis of old growth in the Northern Highland-American Legion, Brule River, Black River, and Flambeau State Forests. On state forests, the only general policy in regard to protection is not to log types that cannot be regenerated after logging, like Northern White-cedar (Epstein 2002).

For the various types of savanna that once covered extensive areas of Wisconsin,

we describe below only samples of the scattered remnants. Pine barrens once occupied 2,300,000 acres. Today they are limited to areas no greater than 9000 acres where management is maintaining or restoring the natural vegetation. Scrub oak barrens or sand savanna, once 1,800,000 acres in extent, may be said to have fared somewhat better due to preservation of a large area in a military reservation. Oak openings, with mesic or wet-mesic prairie, once covered 5,500,000 acres; today they are reduced to small pockets. Sand savanna and oak openings are presently found on a total 100 to 150 sites, most of them overgrown because of a lack of fire and very small and isolated (Haney 1993, Matthiae 1993, Curtis 1959).

Some of the highest quality savannas or savanna complexes are considerably smaller than 40 acres. These areas include 7 acres of oak opening at The Nature Conservancy's relatively undisturbed 129-acre **Chiwaukee Prairie** (Kenosha County); 19 acres comprising the Wisconsin Department of Natural Resources' Bureau of Parks and Recreation's **Blue Spring Oak Opening State Natural Area** (Jefferson County); and 15 acres at the Wisconsin Bureau of Endangered Resources' 52-acre **Genesee Oak Opening and Fen State Natural Area** (Waukesha County) (Walters 1993).

Sites of other types of old growth that are less than 40 acres in size and that lend themselves to visiting include **Devil's Lake State Park** (Sauk County): a few acres of White Pine including 300-year-old trees on a bluff, and a few acres of old-growth White Pine, Red Maple, and Northern Red and White Oak on the lake's south shore (Lange 1993); **Krueger Pines State Natural Area*** (Lincoln County): within Council Grounds State Park, an old-growth northern dry-mesic forest dominated by large even-age White Pine (WDNR 2003); and **Uhrenholdt Memorial Forest** (Sawyer County): a 14-acre, old-growth natural area and a 105-acre managed forest with large White Pines. Now owned by the state, Uhrenholdt Forest once belonged to the family of Elizabeth Olson, wife of the environmentalist and writer Sigurd Olson, who helped to protect the tract (Kaleta 1993).

Menominee Indian Reservation, in eastern Wisconsin (Menominee County)

Two hundred thirty thousand acres of forested land, much of which are often described as "managed old growth." The eastern part of the reservation has a substantial acreage that is second growth rather than old growth, because the reservation was formed after this area had been cut. The second growth is mostly mixed pine and oak, and occurs on a portion of the reservation with sandy soils. Parts of this area were barrens before European settlement.

The reservation's forest has a long history of selective cutting. Today each stand in the uplands, which constitute some 80% of the reservation, is entered once every ten to fifteen years on the average, for the cutting of selected trees (Kotar 1993). Shade-intolerant species are managed with clearcuts no larger than 30 acres in size (Landis 1992). In the past, individual stands have been cut as infrequently as once every 225 years (Waller 1993). As a result of the selective cutting, the original stands have some of the characteristics of old growth, but fewer large trees and snags and less woody debris than are usual with old growth (Epstein 1993).

The three most common types of forest, broadly defined, are dominated by a) Sugar Maple with other deciduous hardwoods (Yellow Birch and hemlock play very minor roles); b) hemlock and Yellow Birch, with Sugar Maple less prominent; c) and

White Pine-Northern Red Oak-Red Maple. The reservation is near the northern limit of American Beech, which is a canopy co-dominant in certain stands. Some individual stands have a fairly even mixture of White Pine and hemlock, with very few hardwoods. The reservation also has a scattering of Northern White-cedar swamps, and 30,000 fairly contiguous acres of White Pine. The White Pine is 160 years old and results from a fire. In presettlement times this section was in brush (Kotar 1993, Epstein 1993).

Stands in the lowlands, including cedar swamps, are not subject to a logging regime (Kotar 1993). Epstein thinks that "virtually none" of the upland forest is virgin, but that some of the wet forests are probably uncut (1993). Kotar says "chances are that there are acreages that have never been logged" (1993).

Fort McCoy Military Reservation, west-central Wisconsin (Monroe County)

Approximately 60,000 acres of sand savanna and sand prairie, remnants of which are probably representative of the presettlement landscape of the central sands area. Much of the savanna and prairie has grown up into a dense forest of Black Oak, Northern Pin Oak and Jack Pine. Thus specific sites vary in ecological value from "marvelous" to "quite poor." Researchers believe that root systems here and in other oak savannas may be as old as 5000 years, although the stems of the trees are usually no older than 200 years. Periodic fires killed the trees, which resprouted from the root systems. The dominant tree in the Fort McCoy savanna is Black Oak. It is accompanied by Northern Pin Oak, Bur Oak, a little White Oak, and Jack Pine (Haney 1993, Epstein 1993).

The 435-acre Fort McCoy Barrens State Natural Area, within the military reservation, includes a barrens of approximately 200 acres, described by WDNR as "one of the least disturbed oak barrens remaining in Wisconsin." The highly diverse understory includes four plants that are uncommon or rare in the area. The Natural Area also has two "spring-fed, headwater riparian communities in pristine condition" (WDNR 2002). The land around the riparian communities was probably logged, but not the riparian corridors. They support large White Pine, Red Pine, maple, oaks, and basswood (Mello 2003). For permission to visit the Natural Area, phone 608-388-5766 or 5734.

Namekagon Barrens, northeast Wisconsin (Burnett County)

Some 7000 acres of pine barrens, consisting of a core of 4000 virgin acres plus 3000 acres in which the larger trees have probably been logged off. The natural vegetation is Jack Pine with an admixture of scrub oak, largely Northern Pin Oak, plus heath-like shrubs, grasses, and forbs. In a portion of the barrens, prescribed burning has been so frequent as to take out the Jack Pine. South of the Namekagon River, which cuts across the barrens, the land is in outstanding condition. Here are Jack Pine and even some Red Pine, under which it is possible to burn without killing the trees. The vegetation here is reminiscent of the original barrens (Matthiae 1993).

Apostle Islands National Lakeshore, in Lake Superior (Bayfield County)

More than 1500 acres of old -growth forest, some of which is apparently virgin, on 5 islands that have never been commercially logged and on portions of 5 other islands in the 21-island National Lakeshore. Non-commercial logging has been minimal. Lighthouse keepers cut firewood, but today one has to look hard to find the stumps. The Lakeshore is on the southern edge of the boreal forest and at the northwestern limit of the

hemlock-hardwood forest. Some of these islands have never been browsed by ungulates. In the unbrowsed areas, hemlock and Northern White-cedar are reproducing prolifically, and Canada Yew grows lushly. The National Park Service (NPS), which controls the Lakeshore, has been carrying out breeding bird surveys since 1990. They show that old growth is "especially rich" in birds (Banta 1992, Brander 1992, Epstein 1993). Fifty to one hundred feet above Lake Superior, on arches of rock carved out by the waves, ancient cedars the size of bonsai grow (Frelich 2002).

In 2001 the US Department of the Interior allocated funding for the National Park Service to conduct a Wilderness Suitability Study for the Lakeshore. The Wilderness Environmental Impact Statement, which is part of this study, is scheduled to be released in 2003. Meanwhile, under the 1989 General Management Plan for the Lakeshore, the 97% of the land that the plan states has wilderness characteristics is managed as though it were already Congressionally designated Wilderness .

Below, moving from east to west, we describe in turn the old-growth areas.

--**Outer Island**: a large island, which, according to the National Park Service, includes a 280-acre hemlock-northern hardwood-White Pine forest, never browsed. The forest is on the northern end of the island, the most northeasterly in the Lakeshore, in a lighthouse "reservation" or conservation area. Prominent trees include Eastern Hemlock, Yellow Birch, and White Pine. The hemlock is from 100 to 300 years old. Among the herbs are Corn Lily, Bunch-berry Dogwood, Spinulose Wood Fern, and Canada Mayflower. Within the stand is a Bald Eagles' nest, active intermittently since 1982; and on the red clay bluffs next to the stand along the shoreline is Marsh Grass-of-Parnassus, a state endangered species (Banter 1992, Brander 1992). Tyrrell and Crow analyzed a stand of hemlock-hardwoods that is apparently within the 280 acres. They describe the smaller area as 100 acres(40.8 ha), an estimated 374 years in age, and 60% hemlock (Tyrrell and Crow 1994).

--**Michigan Island**: an island, south of Outer Island, with a small old-growth hemlock stand on the northeast end.

--**North Twin Island**: a heavily forested 175-acre island never commercially logged. Dominant trees include Balsam Fir, Showy Mountain Ash, Yellow Birch, Paper Birch, Pin Cherry, and Northern White-cedar. Canada Yew and Mountain Maple are in the understory. White Pine forms a scattered super-canopy. Abundant herbs include Corn Lily, Spinulose Wood Fern, Canada Mayflower, and Starflower. Species of "special concern" in Wisconsin are Plains Ragwort and Common Hairgrass. On the island's northern end, a Bald Eagle nest has been active for most of the past decade.

--**Devil's Island**: a 318-acre island protected from commercial logging by designation as a lighthouse reservation in the late 1800s. Like North Twin, it is one of the northernmost islands in the Lakeshore. Devil's Island has a light station and a north-south road, used today only as a foot trail. Trees include Balsam Fir, Northern White-cedar, Yellow and Paper Birch, and White and Black Spruce. White Pine forms a very sparse super-canopy, and Mountain Maple and Canada Yew are in the understory. Herbs include Corn Lily, Bunch-berry Dogwood, Bracken Fern, Canada Mayflower, and Starflower. In the center of the island is a big bog. Sandstone cliffs and sea caves on the northern end provide habitat for rare plants, including Beautiful Sedge, Shore Sedge, and Butterwort, the first two threatened and the third endangered in Wisconsin. The island also harbors the following species of special concern in the state: Bird's Eye Primrose,

Least Moonwort, Bog Reed Grass, Hair-like Sedge, and Chilean Sweet Cicely. This island too has a Bald Eagle nest.

--**Long Island:** a 297-acre barrier spit--since the mid- 1970s, a peninsula attached to the mainland, instead of an island. It shows no evidence of logging. The area is 7 miles long and less than 0.25 miles wide. Approximately 4 miles belong to NPS; The Nature Conservancy protects the remainder through an easement. The island is "a ridge and swale complex." Jack Pine, White Pine, and/or Northern Pin Oak adorn the ridges; and bogs occupy the swales. Large beach and dune communities line the shores. Formerly the peninsula provided nesting sites for the Piping Plover, a federally-listed Threatened species. It is still used heavily by migrating shorebirds, raptors, and songbirds; and is the site of a Bald Eagle nest.

--**Oak Island:** a large island near the Wisconsin mainland with an approximately 20-acre old-growth Sugar Maple forest and ravines with old-growth hemlock and White Cedar.

--**Bear Island:** a large island south of Devil's Island and north of Oak Island, with a 80-acre hemlock forest on its east side.

--**Raspberry Island:** 295 acres, less than 2 miles from the mainland in the western part of the Lakeshore. The entire island became a lighthouse reservation by the mid-1800s. Northern White-cedar, Balsam Fir, Canada Yew, Mountain Maple, Yellow Birch, and Paper Birch are prominent. Corn Lily, Spinulose Wood Fern, Bunch-berry Dogwood, and Canada Mayflower are among the herbs. Species of special concern are Common Hairgrass, Chilean Sweet Cicely, and Round-leaved Orchid.

--**Sand Island:** to the west of Raspberry Island, with approximately 90 acres of old growth, in which White Pine forms a super-canopy over Yellow and Paper Birch, Balsam Fir, White Spruce, and Red Maple.

--**Eagle Island:** the westernmost island in the archipelago. Never commercially logged, its 26 acres are thickly forested, and sport a lush understory of Canada Yew. It has a Great Blue Heron rookery, and, like Gull Island, provides important habitat for colonial nesting Herring Gulls and Double-crested Cormorants (Banta 1992, Brander 1992, Epstein 1993).

Lower Chippewa River State Natural Area, between Nelson and Eau Claire in western Wisconsin (Buffalo, Dunn, and Pepin Counties)

A 15,000-acre area along the Chippewa and Red Cedar Rivers, with extensive old growth of undetermined acreage in the bottomlands. State-owned lands in the flood plain have not been entered for 50 or 60 years and were only selectively logged before that time. In the river channel are islands with floodplain savanna and forest. On the surrounding hillsides are savanna and prairie. More than 25% of the remnants of prairie and oak savanna in the state, equaling more than 2000 acres, are located in the State Natural Area (WDNR 2003).

A feasibility study for the Lower Chippewa area has been conducted, and in 2002 the State Natural Area was approved. As a result, WDNR has the right to acquire up to 15,000 acres of land in the area. However, a management plan has not yet been developed, nor has an analysis of the area for old growth been undertaken. The area is currently under various ownerships with much land in private hands. WDNR would like to protect by one means or another 60 miles along the Chippewa. The area already

includes at least 2 State Natural Areas with old growth.

--**Nelson-Trevino Research Natural Area**, within the Upper Mississippi National Wildlife Refuge, northwestern Wisconsin (Buffalo County). Undetermined acreage of old growth within the 3740 acres of bottomland hardwoods that comprise the Research Natural Area. The Research Natural Area doubles as Nelson-Trevino Bottoms State Natural Area. The area extends for 4 miles along the Chippewa River, where it joins the Mississippi River. Along the main river channel, the forest must have been at least selectively logged for steamboat fuel, although no stumps are evident now (Drieslein 1993). The extent to which the interior was logged is less certain. Epstein, who first told us of the tract, says it is not possible to know how much is old growth, but significant portions show old-growth characteristics (1993). Drieslein thinks that three-fourths of the area is "pretty much undisturbed" (1993). Urich believes that the whole area has been logged since settlement times but probably not clearcut. The cutting was most likely selective but not on a scientific basis (1993). Silver Maple is the dominant tree. Cottonwood and Green Ash are also present. The trees are mostly 60 to 100 years in age and are not regenerating (Drieslein 1993).

--**Tiffany Bottoms State Natural Area*** (Buffalo County). A 402-acre area representative of the larger Tiffany Bottoms. The site includes some 60 or 70 acres of floodplain forest with Green Ash, hackberry, Silver Maple, River Birch, ashes, and basswood. It also has savanna on sandy, gravelly material, with large open-grown Bur Oak and Swamp White Oak. In the savanna little logging but much livestock grazing took place. The amount of grazing varied with the owners. As a result, some areas have a very good herbaceous layer, while others are nothing but exotics (Epstein 2002, WDNR 2003).

Lower Wolf River Bottomlands Natural Resources Area, east-central Wisconsin (Outagamie, Shawano, Waupaca, and Winnebago Counties)

After completion of a feasibility study for a Lower Wolf River Bottomlands Natural Resources Area, designation of the area was authorized in 2002. As of early 2003, a master plan was under development. The Natural Resources Area includes 14 existing WDNR projects—mostly Wildlife Management Areas--and much private land. Total size is 214,000 acres; state-owned lands total 31,000 of those acres (Epstein 2002, WDNR 2002).

The Wisconsin Natural Heritage Inventory Program conducted a three-year integrated land and water biotic inventory of the entire Wolf River Basin, which drains 6400 square miles. The project, in which the Bureau of Endangered Resources and the Land and Water Program of DNR's Northeast Region cooperated, will support WDNR planning, including work on the Lower Wolf River Bottomlands Natural Resources Area and a Wolf River Basin plan on which work began in 1996. The report summarizing the work was released in 2002.

Eric Epstein reports that the Natural Heritage Inventory found bottomland hardwoods along the Lower Wolf River "that are very good." The Natural Resources Area includes many miles of contiguous forest with pockets of old growth from the tens of acres to a few hundred acres in size (Epstein 2002). John Krause points out 80 acres of old-growth bottomland hardwoods on the Lower Wolf River in Shawano County as one example (2002). An example of possible old growth is

--**Mukwa Bottom Forest State Natural Area**,* within Mukwa Wildlife Area, east-central Wisconsin (Waupaca County). A 160-acre State Natural Area comprised of diverse southern wet-mesic forest in the Wolf River floodplain. The forest has at least old-growth characteristics. WDNR, which owns the area, notes that trees range in size from saplings to occasional individuals 30 inches in diameter. "Areas with smaller trees appear quite natural with no evidence of past logging or grazing" (WDNR 2002).

Quincy Bluffs and Wetlands Preserve, in south-central Wisconsin (Adams County)

A 1690-acre tract belonging to The Nature Conservancy, in which are roughly 1000 acres of only selectively cut northern dry forest and 600 acres of selectively logged northern mesic forest. Quincy Bluff is a sandstone mesa, which rises almost 200 feet above wetlands to the east. The complex lies just south of the tension zone across Wisconsin, defining the northern edge of southern plant communities and the southern edge of northern communities. The Bluffs therefore are a mixed pine-oak woodland, with White Pine, Red Pine, and Jack Pine barrens in some places; Red Oak, White Oak, and Bur Oak woodland in others. Where cutting was done, the pines were the species taken out. The remaining pine is in the less accessible areas. Most of the dry woodland has grown up out of savanna, due to fire suppression; but 200 to 300 acres, in ravines and hilly areas, were probably wooded originally. The Nature Conservancy uses prescribed burning to restore savanna in the portions of the 1000 acres that have become overgrown. The preserve also has a "nice Tamarack swamp, probably 100 acres" and a southern sedge meadow (Braker 1993; Drey 2001).

Spread Eagle Barrens, northeast Wisconsin (Florence County)

Some 5000 to 7000 acres, including virgin pockets totaling 1000 acres. Outside the virgin core the larger trees have probably been logged. The trees are Jack Pine with an admixture of scrub oak, predominantly Northern Pin Oak, and an occasional large Red Pine. The understory is somewhat diverse, though not as diverse as that of the oak openings in southern Wisconsin. There are grasses and forbs, along with ericaceous shrubs like blueberries and Sweet-fern. The Department of Natural Resources is in the process of restoring the land around the core by prescribed burns (Matthiae 1993).

St. Croix National Scenic Riverway, northwestern Wisconsin

Old growth of uncertain extent. The unit covers approximately 70,000 acres, extending an average of one fourth of a mile back from the high water mark on either shore of the St. Croix and the Namekagon Rivers. A. R. Weisbrod reported to Tyrrell that possibly "3%?" of this area is old growth, more than "810?" hectares or 2000 acres (Tyrrell 1991). Probably he includes the relevant portion of the Namekagon Barrens, which we describe in a separate entry. Hudick says that the whole riverway was heavily logged in the 1800s and fires burned all but the wettest areas (1993). The fires would have helped maintain the barrens.

Dennis Kaleta speculates that along the Upper St. Croix there may be quite a few places that have not been cut. The trees--mostly Green Ash and Black Ash--are small due to adverse growing conditions. He does not see old stumps in these areas as in some other locations. He also finds along the upper St. Croix trees of considerable size--White Pine, Red Pine, Northern White-cedar, aspen, and even Yellow Birch--usually scattered (1993).

John Daugherty speaks of individual cedar trees located in bogs or swampy areas and spared because of their inaccessibility, also on the upper St. Croix, between Gordon Dam and the Moose River (1992).

--**Farmington Bottoms State Natural Area** (Polk County). A 906-acre Natural Area with bottomland forest showing little evidence of disturbance. Local landowners think that a portion of the southern end may have had some cutting and perhaps some livestock grazing. Back-water channels and bottomland ponds interlace the river-bottom forest. Silver Maple and Green Ash, the predominant trees, overhang the water, forming a closed canopy. Bald Eagle and Red-shouldered Hawks nest in the area. Epstein estimates that Farmington Bottoms has approximately 250 acres of mature forest, but says that with the high rate of disturbance and the rate at which stumps rot along the river, it is hard to determine the acreage (1992). The Natural Area, which also includes areas of water and upland forest, is owned by the National Park Service.

--**Interstate Park** (Polk County). Possibly 100 acres of old-growth bottomland forest within a 1375-acre park (Epstein 1993, 2002). (The Minnesota side of Interstate Park is a separate entity from the Wisconsin side and is managed by the Minnesota Department of Natural Resources.) Within Interstate Park is the 90-acre Lowland Forest State Natural Area with what a WDNR fact sheet describes as "mature lowland forest on what is periodically an island in the St Croix River" (WDNR 2003). Possibly Epstein and the fact sheet are giving different interpretations of the same site.

--**Governor Knowles State Forest** (Burnett County).

----**Brant Brook Pines State Natural Area**. Within the 190-acre State Natural Area, a 34-acre upland old-growth stand dominated by Red Pine. The Red Pine stand, which seems to be just outside the limits of the St. Croix Riverway, originated around 1894, probably after a fire. It was salvage cut after a windstorm (WDNR 2003, Tans 1979). A swamp hardwood forest of oak, Black Ash, and Red Maple is located below the Red Pine stand. Epstein characterizes the swamp hardwoods here as mature with some old-growth characteristics. The State Natural Area overlaps the Riverway.

----Additional "older timber." The Forest Superintendent states that several locations in the forest along the St. Croix, which are relatively inaccessible because of high water tables, have "older timber," normally Northern White-cedar, Black Ash, Silver Maple, and associates (Giles 1992).

--**St. Croix Seeps State Natural Area**.* A 210-acre Natural Area on a four-mile reach of the river. "An old-growth stand of red oak and white pine" grows on the southwest flank of a west-facing bluff. Below the pine is a seepage run with an "overstory of old-growth Sugar Maple and Eastern Hophornbeam." The area, which is owned by the National Park Service, is habitat to rare dragonfly and fish species. (WDNR 2002).

Lower Wisconsin Riverway (Columbia; Dane, Iowa, Sauk, Richland Counties)

Along the lower Wisconsin River from Prairie du Chien to Prairie du Sac, many old bottomland hardwood stands mingled with second-growth stands. The stands are intermixed to such an extent that calculating the old-growth acreage would be a formidable task (Epstein 1993).

Established by state law in 1989, the Riverway has within its boundary 80,000 acres. Eric Epstein reports that the Riverway gives very good protection to a 90-mile

stretch from Madison to the Mississippi (2002). Lands within the Riverway District “are to be maintained and protected to promote the physical and aesthetic characteristics of the riverway through permitting and purchase of riverway lands.” WDNR has already acquired several tracts within the corridor to bring the total state land, as of late 2002, to 43,000 acres. Logging on lands visible from the river is regulated, with only selective logging on the river edge and bluffs.

An example of the state-owned land in the riverway with likely old growth is --**Wauzeka Bottoms State Natural Area**, on the north side of the Wisconsin River (Crawford County). A 798-acre stand of “undisturbed floodplain forest.” Silver Maple, Swamp White Oak, River Birch, and Green Ash dominate the canopy. Hackberry, American Elm, Honey Locust, Black Willow, American Basswood, and cottonwood are also present. The canopy varies from closed with an open understory to semi-open with a brushy understory of Common Buttonbush, Winterberry, Elderberry, and Prickly Ash. The breaks in the canopy are above Beaver ponds, oxbow lakes, and running sloughs. Almost the only evidence of past logging is at the western edge, near the Kickapoo River. A few cows occasionally enter the area from the north, but “the effects of grazing have been minimal.” The Department of Natural Resources manages the area as part of its Lower Wisconsin Riverway (WDNR 1990).

Wyalusing State Park, in southwestern Wisconsin (Grant County)

Some 400 to 800 acres of old growth growing from the Wisconsin River floodplain to the bluffs 400 or more feet above. The old growth is in a single big block comprised of two State Natural Areas, Wyalusing Hardwood Forest and Wyalusing Walnut Forest, and the land between them. Outside the block but adjacent to the Natural Areas is very good second growth. The floodplain is southern wet-mesic forest with Silver Maple, elm, and cottonwood. Above the floodplain are southern dry-mesic forest and southern dry forest. In areas of rich soil in the Walnut Forest Natural Area, Black Walnut grows in two nearly pure stands and in stands with Northern Red Oak, American Basswood, and, to a lesser extent, American Elm, Hackberry, Butternut, and Sugar Maple. Higher, on thinner soil, are Black Oak and White Oak (WDNR 2002, Epstein 1993). Tyrrell cites the park as an example of old-growth mesic and wet-mesic northern oak forests (1998).

Brule River State Forest, in northwestern Wisconsin (Douglas County)

The Brule River flows north into Lake Superior. In the long, narrow state forest, on either side of the river are small areas of old growth that are temporarily or permanently protected.

As of early 2003, WDNR’s Bureau of Forestry is in the process of revising the management plan for Brule River State Forest. The draft revision includes positive changes, in particular an enlargement of the Upper Brule River State Natural Area. However, because of other, less satisfactory aspects of the draft, Friends of the Brule River has asked for a judicial review. As of early 2003, the issue is in the courts (McNeil-Sarri 2003).

--**Bois-Brule Conifer Bog State Natural Area**: a 132-acre, 0.3-mile wide conifer swamp through which the Brule flows. Mature Northern White-cedar, Balsam Fir, and spruce, plus occasional patches of Black Ash and thickets of alder are found here. “The

conifer swamp remains in near pre-settlement condition with evidence of only limited logging" (WDNR 2002, Rau 1999).

--**Upper Brule River State Natural Area:** a 182-acre area with 146 acres of northern wet-mesic forest and 34 of alder thicket. A conifer swamp, dominated by Northern White-cedar, Balsam Fir, and spruce, "is in near presettlement condition, with little evidence of logging." An unnaturally large deer population has, however, limited reproduction of trees and shrubs since 1940 (WDNR 2002, Rau 1999).

--**Jack Pine areas:*** south of the town of Brule, a 40-plus-acre area and smaller scattered areas of never-logged Jack Pine. The state forest service has set aside the 40 acres in a "deferral area" (Rau 1999, Shulz 2003).

--**Brule River Conservation Easement Program:** as of early 1993 covering approximately 5000 privately-owned acres within the boundaries of the southern portion of Brule River State Forest, some portions of which have "probably" never been artificially disturbed. They include stands of old-growth Red and White Pine, totaling perhaps some 100 acres, with individual trees possibly exceeding 300 years in age; and a lowland Northern White-cedar swamp, covering approximately 300 acres. Bald Eagles, Osprey, and Timber Wolves inhabit the Brule as well as 11 species of birds considered rare in Wisconsin: Black-backed Woodpecker, Three-toed Woodpecker, Yellow-bellied Flycatcher, Swainson's Thrush, Ruby-crowned Kinglet, Cape May Warbler, Red Crossbill, Evening Grosbeak, Connecticut Warbler, Black-throated Blue Warbler, and Green Heron (Braker 1993, WTNC [n.d.], Drey 2001).

Dunbar Barrens, northeast Wisconsin (Marinette County)

Thirteen hundred acres, consisting of a virgin core of 300 to 500 acres surrounded by logged land. As at Spread Eagle Barrens, the trees are Jack Pine with an admixture of Northern Pin Oak (Matthiae 1993).

NICOLET NATIONAL FOREST

--**Argonne Esker*** (Forest County). An old-growth hemlock forest covering a braided esker, plus pockets of old growth, within a 6000-acre area. The finest portions of the esker forest are "A' quality hemlock with some cedar and scattered super-canopy white pine." North of the esker is selectively cut hardwood forest dominated by Sugar Maple. Surrounding the esker and associated hardwoods is "an extensive matrix of mixed conifer swamp." The swamp is headwaters for the North Branch of the Popple River. Along the river is an old-growth hemlock/white-cedar stand with an unsalvaged blowdown (Parker 1998, 1999), also islands of old-growth pine (Draft Biotic Inventory 2003). Many pockets of hemlock, some in boulder fields, are scattered through the complex. Many of these stands have had some degree of cutting but others "are still in fine shape" (Parker 1998, 1999)

State Trust Lands occupy 2880 acres of the complex, including the esker and the best stands around it (Draft Biotic Inventory 2003). These lands have no formal protection. Argonne Esker is Nicolet National Forest Special Area #1. On USFS property several stands have been designated as old growth and "numerous" others have had logging deferred (Parker 1998, 1999). However, other upland stands have no

protection, and selective cutting occurred as recently as the winter of 2000 (Draft Biotic Inventory 2003). Argonne Esker is proposed as an Old-Growth and Natural Features Complex in the Proposed Land and Resource Management Plan 2003.

--**Rat Lake Swamp***-Popple River Headwaters (Forest County). "Vast, undisturbed conifer swamp along the upper reaches of the Popple River with extensive stands of black spruce, tamarack, and white-cedar swamp." "Several small drumlins within and adjoining this wetland complex contain remnant stands of older hemlock and hemlock hardwood forest, especially along the swamp margins. Scattered super-canopy white pines are scattered throughout the site" (Draft Biotic Inventory 2003). Second-growth hemlock hardwood forest comprises the majority of the upland forest (Draft Biotic Inventory 2003). USFS data sheets speak of "old growth hemlock forest along riparian fringe" and "remnant hemlock hardwood forest" of only "small acreage." They characterize the site as having 2877 acres, of which 520 acres are State Trust Land (Parker 1998, 1999). The State Trust Land inventory states that the Trust Land at Rat Lake Swamp-Popple River equals 1080 acres. Therefore, a portion of the Trust Land must be outside the boundaries of the National Forest and/or the area that USFS is describing. The Proposed Land and Resource Management Plan 2003 proposes Rat Lake Swamp-Popple River, apparently with Argonne Esker, as an Old Growth and Natural Features Complex.

--**Woods Creek Cedars*** (Florence County). "One of the most extensive and arguably best quality old growth white-cedar swamps on [Nicolet National Forest] lands. Much of this forested wetland is former Trust Lands. This swamp provides the headwaters to Woods Creek," the State Trust Land inventory notes (Draft Biotic Inventory 2003). The USFS Biological Survey characterizes Woods Creek as having an "extensive old growth cedar swamp" (Parker 1998, 1999). An adjacent 40 acres is still State Trust Land. "The older northern hardwood forest type found here is poorly represented on adjoining [Forest Service] lands, especially in protected areas." On lower slopes in the 40 acres are "remnant pockets of old growth hemlock, yellow birch, upland white cedar, and rarely, very large diameter (40"+) super-canopy white pines." The 40 acres have no protection from logging (Draft Biotic Inventory 2003). A USFS evaluation sheet lists the Woods Creek Cedars LAD Complex as 925 acres in total. USFS's Proposed Land and Resource Management Plan 2003 names Woods Creek Cedars as a proposed RNA.

--**Scott-Shelp Lakes** (Forest County). A 46-acre stand of old-growth Eastern Hemlock with a White Pine super-canopy, within a 272-acre Natural Area owned and managed by the US National Forest Service but recognized as a State Natural Area by the state. The Natural Area is in turn within an 1888-acre USFS complex. The only apparent disruption in the northern mesic hemlock-pine stand was the cutting of cedar in a fairly narrow line along the shore of Shelp Lake. The Natural Area also includes 118 acres of state-significant northern wet forest, which has been logged for some timber types "in the distant past" (WDNR 2002). A 266-acre area is a candidate RNA (RNA List). About 40% of the complex is within the Headwaters Wilderness. The Biological Survey notes that much of the complex outside the Headwaters Wilderness and the Scott Lakes-Shelp Lakes Natural Area is lowland conifer swamp, which is "relatively intact" and should be protected (Parker 1998, 1999). The Proposed Land and Resource Management Plan 2003 lists Scott-Shelp Lakes as a proposed RNA, Special Management Area, and Old Growth

and Natural Features Complex.

--**Argonne Experimental Forest*** (Forest County). A 40-acre stand of old-growth hemlock-hardwood forest plus old-growth hemlock forest along a riparian fringe. Tyrrell and Crow estimate the age as 235 years, and note that the stand is 61% hemlock and has an average of 30 cut stumps of all species per hectare (Tyrrell and Crow 1994).

--Franklin-Butternut Wild Lakes and Hardwood Forest (Forest County). A mosaic of upland, wetland, and aquatic communities and old-growth, mid, and early successional forests on 1458 acres of pitted outwash terrain. Old-growth sites include the 25-acre Bose Lake Hemlock Hardwoods State Natural Area, an RNA with no evidence of logging. "Several interconnected stands of hemlock-dominated old growth are on the isthmus between Franklin and Butternut Lakes, on both sides of Butternut-Franklin Creek." "Smaller stands of old-growth hemlock are found on the east side of Sunfish Lake, on the landward end of the sand spit on the north side of Franklin Lake, and on a long esker-like ridge in the vicinity of Two Dutchmen Lake."

Bose Lake Hemlock Hardwoods is protected, as is Sunfish Lake, as a Special management Area. Several other stands are set aside as old growth. Parts of the area, including the Franklin-Butternut Isthmus, get heavy recreational use. The Biological Survey team states that the isthmus should nevertheless "probably" be given RNA status and that "many upland" and "most lowland" stands should have special management status (Parker 1998, 1999). Franklin-Butternut Lakes is proposed in the Proposed Land and Resource Management Plan 2003 for a Special Management Area.

--**Cathedral Pines Tract*** (Oconto County). At least 40 acres of old growth, the Cathedral Pines Special management Area, within a tract of approximately 2000 acres, which is largely upland mesic forest. The Cathedral Pines stand is dominated by hemlock, above which White Pine and Red Pine rise. This stand and a few other pine stands originated after fire. The Cathedral Pines Special Area has trails and a parking area which "receive fairly heavy use."

Also in the 2000-acre complex is the 110-acre Archibald Tract along Archibald Lake, much of which "would likely qualify as old growth" although it has had selective logging. The Archibald Tract, including "some very nice, lightly managed hemlock stands, was owned by the Weyerhaeuser family. The family donated it to The Nature Conservancy, and in 1993 The Conservancy transferred it to USFS. The 2000 acres as a whole have "had a relatively light management history." The Proposed Land and Resource Management Plan 2003 recommends that Cathedral Pines be maintained as a Special Management Area, as recommended in the Biological Survey (Parker 1998, 1999).

--**Fay Lake Hardwoods and Conifer Swamp LAD Complex*** (Florence County). A "lengthy stretch" of old-growth Eastern Hemlock with super-canopy White Pine, along the Fay Lake Outlet river corridor within a 1012-acre complex. Also present in the old growth are Yellow Birch and Northern White-cedar. Large diameter trees (some White Pine over 24 inch dbh (diameter at breast height)), den trees, snags, nurse logs, and other coarse woody debris are common. The Fay Lake river corridor was not protected as of 1999, but, according to the Biological Survey, should be. Northern wet forest of "A" quality," morainal ridge crests, and an esker are also present in the complex. However, much of the complex has experienced heavy logging (:Parker 1998, 1999). In the Proposed Land and Resource Management Plan 2003, Fay Lake is proposed as an

Old Growth and Natural Features Complex.

--**Sevenmile Creek Pines*** (Oneida County). “Undisturbed black spruce swamp” bordering a mile of Sevenmile Creek. “Uplands north of the creek feature old growth white pine with localized patches of hemlock” (Draft Biotic Inventory 2003). The USFS project is 388 acres in extent, but USFS ownership is patchy. State Trust Land comprises 120 acres of the site (Draft Biotic Inventory 2003). The recommended protection status is “representative research natural area for landtype. Past cutting and fragmented ownership may warrant Special Management Area or old-growth designation, however” (Parker 1998, 1999). Sevenmile Creek is proposed as an Old Growth and Natural Features Complex in the Proposed Land and Resource Management Plan 2003.

--**Lost Lake Hemlocks*** (Florence County). Old-growth hemlock-hardwood forest bordering Lost Lake within a 1116-acre complex. The stand is unlogged except for the cutting of a few “hazard trees.” However, it currently “receives heavy recreational use.” The forest around Lost Lake is protected as old growth. The Biological Survey recommended “old-growth designation” for other selected stands, especially those “covering the esker system east of Lost Lake” (Parker 1998, 1999). Lost Lake is proposed as an Old Growth and Natural Features Complex in the Proposed Land and Resource Management Plan 2003.

--**Pat Shay Lake Hemlocks*** (Forest, Oneida, and Vilas Counties). Old-growth hemlock-hardwoods of “excellent quality” bordering Pat Shay Lake, within a 567-acre complex. The old-growth stands are dominated by hemlock. Sugar Maple and Yellow Birch are, also present. The old growth on the north shore has apparently never been logged; skidder trails are visible in the old growth on the south shore. A road winds through the old growth and is causing erosion and compaction. The old growth is presently “managed” as such, but the Biological Survey team recommended that it be an “Old Growth or Special Management Area” (Parker 1998, 1999). Pat Shay Lake is recommended as a Special Management Area in the Proposed Land and Resource Management Plan 2003.

--**Alvin Creek Headwaters** (Forest County). A 200-acre candidate RNA, which includes 20 to 30 acres of old-growth hemlock-hardwoods with a super-canopy of Red and White Pine. Also in the candidate RNA are 80 acres of Sugar Maple-basswood forest that received a “light selective/salvage cut” several decades ago but are reported to have an “intact” overstory and to show only “very minimal” signs of past disruptions. The site as a whole is 1172 acres, at the core of which the State School Trust owns 160 acres (Draft Biotic Inventory 2003, Parker 1998, 1999). In its Proposed Land and Resource Management Plan 2003, USFS proposes Alvin Creek Headwaters as a Special Management Area.

--**Alvin Hemlocks*** (Forest County). A 537-acre site containing a “large” strip-cut conifer swamp with “high quality” old-growth white-cedar in the uncut portions. Among the white-cedar are areas of Black Spruce and Tamarack and “very wet Black Ash forest.” The cut strips now support alder. The complex is also the site of the largest contiguous tract of hemlock-hardwoods in the Florence Ranger District. The hemlock-hardwoods have been selectively cut, and skidder trails run through them. A small stand of hemlock-White Pine contains virgin super-canopy pine. Commercial forestry is the current land use for the complex and for the surrounding land. The Biological Survey suggests that the area “might be an appropriate candidate to manage for old growth

characteristics and for possible designation as old growth” (Parker 1998, 1999). The Proposed Land and Resource Management Plan 2003 proposes Alvin Hemlocks as an Old Growth and Natural Features Complex.

****Tenderfoot Forest Reserve, north-eastern Wisconsin (Vilas County)**

Some 500 acres of old-growth hemlock-hardwoods on a 971-acre area owned and protected by The Nature Conservancy. In addition to the old growth, the reserve includes undeveloped shoreline on Mirror, Roach and Tenderfoot Lakes.

The land was in the possession of the Rahr family, originally of Manitowoc, from the late nineteenth century until 2005 when the Conservancy acquired it. As far as can be learned, 250 acres have never been logged in any fashion; verbal history indicates that another 250 may have been subjected to the selective logging of white pine. However, The Conservancy’s Matt Dallman has not found any pine stumps. The Rahr family collected firewood from downed trees, almost always near trails. Except for an area of approximately fifteen acres, they did not commercially cut any trees.

Unfortunately the land surrounding the reserve is younger successional forest; and deer who browse in the young forest like to bed down under the hemlocks in the old growth in the winter. As a result of the deer, there is a lack of recruitment within the old growth. Dallman notes that Outer Island in the Apostle Islands National Lakeshore has a canopy similar to that of Tenderfoot, but that the structure of the understory differs greatly, because Outer Island has never been browsed. Canada Yew is lush on Outer Island, but not present in Tenderfoot.

David Mladenoff, a professor of forest ecology at the University of Wisconsin-Madison, identified the old growth from the air and mapped it with satellite photos; but did not enter the property until 2005. Then he confirmed its ecological value.

The land was appraised at \$4.26 million. The Rahr family, who have a history of conservationism, cut the price by \$1 million as a donation to The Conservancy. The state’s Knowles-Nelson Stewardship Fund, a public-private partnership, provided \$2.1 million. Bob and Debbie Cervenka gave an additional \$1 million (Dallman 2006; Johnson 2005). *[Added 1/16/06]*

Northern Highland—American Legion State Forest, in northern Wisconsin (Iron, Oneida, and Vilas Counties)

Very good hemlock remnants and a lot of good wetlands, Eric Epstein reports (2002). The six areas below were the only sites out of 52 candidate areas that received a rank of “A” in an assessment on “Community Restoration and Old Growth” on the Forest. An additional 14 were ranked “AB.” All six include old growth, but since the acreage of the old growth has not been determined, we list them in the order of their ranking in the study. A new management plan for the forest is being developed. The plan will presumably designate and set aside these areas as old growth.

--Frog Lake* (Iron County). An 800-acre Candidate Old Growth Site adjacent to Frog Lake in the Manitowish Wilderness Area within the state forest. The Community Restoration and Old Growth Assessment Team (CROG) describes the Candidate Site as a “120-year old red and white pine site . . . Much of the site is 30-year old aspen with old pines in the overstory” (Eckstein 2001). The Wisconsin Department of Natural Resources (WDNR) has designated the 42-acre lake and the 150 acres of forest immediately

adjacent to it as Frog Lake and Pines State Natural Area. WDNR describes the 150 acres as “old-growth northern dry-mesic forest.” The logging history is not known, “but some cutting has occurred,” the agency notes (WDNR 2002).

--**Lake Laura*** (Vilas County). A 3425-acre Candidate Old Growth Site surrounding Salsich Lake and touching Irving and Laura Lakes. The area contains an extensive block of hemlock-northern hardwood forest with an admixture of Northern Red Oak and White Pine. Within the block are “several inclusions of old growth hemlock and white pine” (Eckstein 2001).

--**Plum/Star Lakes** (Vilas County). An 842-acre Candidate Site, characterized by CROG as “old growth hemlock and hardwoods with scattered red oak and old red and white pine between Plum and Star Lakes.” Plum Lake State Natural Area is within the Candidate Site. Researchers have described a hemlock-hardwood stand within and adjacent to the Natural Area. Tyrrell and Crow write of the stand as 249 acres (100.8 ha) in size, and estimate the age at 252 years (1994). The Wisconsin Department of Natural Resources describes the stand as 228 acres and as originating after fire about 1810. The stand was selectively cut for White Pine in the 1880s (WDNR 2002), and has an average of 8.6 stumps per hectare (Tyrrell and Crow 1994). Tree species in decreasing order of frequency are Eastern Hemlock, Sugar Maple, Yellow Birch, and basswood. As a result of a large deer population, “tree reproduction is sparse and the groundlayer depauperate” (WDNR 2002).

--**Lake Alva*** (Vilas County). A 320-acre Candidate Site, within which is “an 80-year old mixed northern hardwood site with old growth yellow birch and hemlock south of Alva Lake” (Eckstein 2001).

--**Catherine Lake*** (Iron County). A 924-acre Candidate Site, within which “old growth hemlock-hardwoods occur south and east of Catherine Lake” (Eckstein 2001).

--**Twin Lakes*** (Iron County). A 288-acre Candidate Site, within which old growth hemlock-hardwoods occur north of Twin Lakes (Eckstein 2001).

Island Lake Hemlocks*—West Branch of the Montreal River Headwaters, north-central Wisconsin (Iron County)

“Hummocky morainal topography with old-growth hemlock-hardwoods, some of which is still virgin forest.” Second-growth northern hardwoods are interspersed with the patches of old growth. In depressions are small stands of swamp hardwoods and mixed conifer swamp. The site is surrounded by industrial forest that has been heavily logged. Iron County owns the bulk of the site. Other owners are the State Trust Lands (120 acres) and forestry companies. Logging is deferred on the state land (Draft Biotic Inventory 2003).

Avoca Prairie-Savanna State Natural Area, southeastern Wisconsin (Iowa County)

One hundred and seventy-five acres of oak opening or savanna within the 1885-acre Natural Area on an outwash sand terrace along the Wisconsin River. In the savanna are Bur Oak and Black Oak, scattered and in groves. The open-grown oaks look “much as they did during the original land survey of 1833.” The Natural Area also includes a 970-acre wet-mesic prairie, the largest prairie remnant in Wisconsin. The Natural Area was mowed from the 1860s until the DNR's Department of Wildlife Management acquired it as a state wildlife area. Some livestock grazing occurred in the 1930s. Parts

of the tract were burned yearly, before and after settlement. The DNR continues to burn the land on a regular schedule (WDNR 1989, 2002).

Black Hawk Island, in the Wisconsin River north of Wisconsin Dells (Juneau County)

A largely undisturbed, forested island of approximately 173 acres. Researchers have shown that the vegetation varies with soil type. Red Pine dominates "on the sandy Entisol" on a terrace about 1.5 meters above the river. "White Pine is most dominant on the Spodosol" on a terrace about 12 meters above the water. Across the top of the island, where soils are "sandy clay loam to clay loam Alfisols," Red Oak and White Oak dominate. Sugar Maple, in company with basswood, is dominant on the silty clay-loam Alfisol. Hemlock grows almost alone on steep cliffs with Histosol, to the north. Where the soil has been plowed, aspen is dominant. "Most stands are old growth stands." The disturbances are infection by oak wilt, of Red Oak growing on Inceptisol; logging and plowing of two small areas (Pastor et al. 1982, 1984) before 1932, and cattle grazing also before 1932; plus trails. The University of Wisconsin Extension owns the area (Lindsey & Escobar 1976).

Cranberry Creek Mound Group State Natural Area,* in south-central Wisconsin (Juneau County)

An old-growth Jack Pine forest, 170 acres in extent, within a 253-acre Natural Area. The forest is "characterized by large forest-grown trees with many windthrows and no signs of thinning." The area features conical and effigy mounds built by Indians of the Woodland period. WDNR owns the site (WDNR 2002).

Totagatic Highlands Hemlocks State Natural Area, northwestern Wisconsin (Washburn County)

A 160-acre State Natural Area composed of 43 acres of old-growth northern wet-mesic forest, 104 acres of old-growth northern mesic forest, and an alder thicket. A stand of Northern White-cedar dominates the wet-mesic forest. The mesic forest includes a large stand of Eastern Hemlock along with Yellow Birch, American Basswood, and American Elm. The wet-mesic forest does not appear to have been cut; the mesic forest has been "lightly cut in the past." The natural area is now under the control of WDNR Endangered Resources, which acquired it from the Board of Commissioners of Public Lands (Kaleta 1993, WDNR 1989, 2002). The Commission still owns a nearby or adjacent 40-acre site that is also called Totagatic Highlands Hemlocks but is in neighboring Sawyer County. The State Trust Land and adjacent land that is owned by Sawyer County support second-growth northern hardwoods with a fringe of old-growth eastern hemlock-upland cedar (Krause 2002).

High Cliff Escarpment State Natural Area,* within High Cliff State Park, in south-central Wisconsin (Calumet County)

Talus slopes supporting approximately 123 acres of wet-mesic forest within the 125-acre State Natural Area beside Lake Winnebago. High Cliff State Park is on the Niagara escarpment. Described by WDNR as "undisturbed," it is made up of basswood, elm, Sugar Maple, White Ash, Green Ash, Hackberry, and Butternut. Near the lake are willows and cottonwood. The herbaceous layer is rich (WDNR 2002).

Clifford F. Messinger Dry Prairie and Savanna Preserve State Natural Area, within the southern unit of Kettle Moraine State Forest, southeastern Wisconsin (Jefferson, Walworth, and Waukesha Counties)

A State Natural Area comprised of 16 separate sites, among them Whitewater Oak Opening with 110 acres of savanna. Bur Oak dominates the south and southwest-facing slopes and the ridge tops; Northern Red Oak, the north-facing slopes; and White Oak elsewhere. Shrubs, including exotic honeysuckle, grew up among the trees after fire was suppressed. However, a wildfire that occurred in the 1950s opened the area somewhat. Now DNR conducts prescribed burns (WDNR 2002; Walters 1993).

Moose Lake State Natural Area,* north-central Wisconsin (Iron County)

A State Natural Area with pockets of old-growth Eastern Hemlock and possibly also old-growth lowland conifer and hardwoods. The lowland conifer and hardwoods are dominated by Black Ash, Black Spruce, and Northern White-cedar. The area centers in the 270-acre undeveloped Moose Lake. A variety of wetland communities surround the lake. The upland forest, beyond the wetlands, has "pockets of higher rocky terrain" dominated by basswood, Paper Birch, Sugar Maple, and Balsam Fir. Moose Lake is owned by WDNR, which purchased it from the Boards of Commissioners of Public Lands (Krause 2002) (WDNR 2002). Sixty acres of conifer swamp in the area still belong to the Board of Commissioners of Public Lands. Logging is deferred on them (Draft Biotic Inventory 2003).

Dunn Lake State Natural Area, in northern Wisconsin near Michigan's Upper Peninsula (Vilas County)

Virgin northern mesic forest, 50-100 acres in size, within a 562-acre preserve, purchased from the Board of Commissioners of Public Lands by the state Bureau of Endangered Resources (Epstein 1992, Krause 2002). The virgin stand is to the northeast of Dunn Lake and stretches eastward across the Presque Isle River. White Pine tower over large hemlock, Yellow Birch, Sugar Maple, and basswood. Bald Eagles nest here. Another old-growth stand is west of Sanborn Lake on an upland peninsula. Along Presque Isle River are "excellent examples of northern sedge meadow [80 acres], alder thicket [130 acres], and northern wet forest [28 acres]." While the northern half of the site is "virtually untouched," the uplands in the southern half have been heavily cut. (WDNR 1991, 2002).

Squirrel River Pines State Natural Area,* north-central Wisconsin (Oneida County)

The main feature of the 240-acre State Natural Area is northern dry-mesic forest on a "narrow, sandy peninsula running northeasterly towards the Squirrel River." A stand of big Red Pine, intermingled with White Pine saplings, is the dominant feature of the forest. The Red Pine are in the 16"-24" dbh size class, with a few trees as big as 30" dbh. Charred stumps and snags suggest that the stand probably had a fire origin. Around the peninsula is a wetland complex with northern sedge meadow, northern wet forest, and alder thicket (WDNR 2002). The land belongs to WDNR, which bought it from the Board of Commissioners of Public Lands (Krause 2002).

Haskel-Noyes Memorial Woods State Natural Area, within the Northern Unit of Kettle Moraine State Forest, in southeastern Wisconsin (Fond du Lac County)

Sixty-seven acres (27 ha) of forest that, with the possible exception of a couple of acres at the north end, have not been logged or burned by Euro-Americans. Fifty-two acres (21 ha) are composed of mesic forest. The overstory of the mesic forest is primarily Northern Red Oak and Sugar Maple. The mid-story dominant is Sugar Maple. The mixture of Northern Red Oak and Sugar Maple is probably the result of a wind storm that formed moderately large gaps in which the shade-intolerant Red Oak established itself. Such a disturbance has not occurred in the last hundred years. If there are no such events in the future, the forest will shift to Sugar Maple. The balance of the area is wet-mesic forest, also dominated by Sugar Maple and Red Oak. The forest was purchased by the state in 1947 “to prevent its imminent destruction by logging” (Cook 2000, WDNR 2002)

Jung Hemlock-Beech Forest State Natural Area,* in east-central Wisconsin (Shawano County)

A 63-acre remnant of the northern mesic forest that once covered “millions of acres.” The forest is within an 80-acre State Natural Area that also includes several sedge-sphagnum bogs covering a total of about 7 acres and, at the south end, abandoned fields that are succeeding to forest. In the forest, which appears to be 150-200 years in age, are hemlock, beech, Sugar Maple, Yellow Birch, and White Pine. The site shows no evidence of grazing or “recent” logging. The Biotic Inventory of the Wolf River Basin identified it as old growth (WDNR 2002, Epstein et al. 2002).

CHEQUAMEGON NATIONAL FOREST, in north-central Wisconsin

--**Memorial Grove Hemlocks and Squaw Creek Marsh Project** (Price County). Within the tract, which according to a USFS draft is in the 100-500-acre category (USFS 2000), is the 64-acre Memorial Grove Research Natural Area. The RNA includes 47 acres (19.2 ha) of old-growth hemlock-hardwoods. The stand is 69% hemlock, has an estimated age of 302 years, and exhibits 20 cut stumps per hectare, the majority of them hemlock (Tyrrell and Crow 1994). The old growth is surrounded by birch hardwoods, which are succeeding to hemlock-dominated forest or mixed pine type. Adjacent to the old-growth tract is the largely privately-owned Squaw Creek Corridor, with “good quality wetland communities.” Only the RNA, which contains the old growth, is protected. The Biological Survey recommended giving special management status to the remaining federal land in the tract and the purchase of the Squaw Creek corridor (Parker 1998, 1999). Memorial Grove Hemlocks is proposed as an Old-Growth and Natural Features Complex in the Proposed Land and Resource Management Plan 2003 for the Chequamegon National Forest.

--**Tucker Lake Hemlocks**. Old-growth hemlock and Yellow Birch, which Epstein describes as a little less than 40 acres (1992), Hulbert as approximately 80 acres (1993), and Parker as occupying the majority of the 158-acre RNA (1993). Actually the original RNA evaluation report spoke of 60 acres of old growth. Some harvesting of White Pine probably took place about 80 years ago, but there has been no harvesting since (Hulbert 1993). The old growth is located on an isthmus between two lakes; on a

point on the north shore of Tucker Lake; and in “small scattered inclusions.” South of the Research Natural Area, aspen/birch stands have “significant inclusions of old-growth hemlock and mature pine forest.” Tucker Lake Hemlocks as a whole is 500-1000 acres in size (Parker 1998, 1999).

--**Chequamegon Hardwoods Research Natural Area.** An 80-acre old-growth hardwood stand with Sugar Maple, American Basswood, and Yellow Birch (Parker 1993).

--**Doering Tract,*** south of South Fork Flambeau River (Price County). Large pockets of old-growth hemlock hardwoods with light cutting in the distant past, intermixed with mature second-growth northern hardwoods within a tract that is 100-500 acres in size. The hemlock-hardwoods south of FR 144 were selectively logged in the late 1980s (Farlinger 2002, Parker 1998, 1999). The Proposed Land and Resource Management Plan 2003 proposes the Doering Tract as a Research Natural Area and as an Old Growth and Natural Features Complex.

--**Mud Lake Cedars,*** north-central Wisconsin (Price County). “Undisturbed, old-growth, wet-mesic cedar swamp at the foot of a large drumlin system south of Foulds Springs.” According to a USFS draft, the site, which it there names “Mud Lake Bog and Cedar Swamp,” belongs in the category of 1000-5000 acre areas (Parker 1998, 1999). In the swamp are small hemlock-White Pine islands. The “swamp portion of this site is essentially pristine with 20'+ cedar common. Regeneration is balsam fir and mountain maple thickets.” On the uplands surrounding the swamp are second-growth northern hardwoods. The site is next to “one of the largest most significant peatland complexes in the forest.” State Trust Lands comprise 120 acres of the site; the balance is owned by the US Forest Service. Logging is deferred on the State Trust Land (Draft Biotic Inventory 2003). USFS proposes Mud Lake as an Old-Growth and Natural Features Complex in its Proposed Land and Resource Management Plan 2003.

--**Stony Creek,*** north-central Wisconsin (Price and Oneida Counties). “Extensive stands of undisturbed black ash and white cedar swamp. Much of the cedar is in old-growth condition. A tiny amount of old-growth hemlock occurs along the swamp margin.” Second-growth northern hardwoods cover the uplands. State Trust Lands comprise 160 acres of the area. USFS owns the balance. On the State Trust Lands logging is deferred (Draft Biotic Inventory 2003).

Kickapoo Valley Reserve,* in southwest Wisconsin (Vernon County)

A total of several hundred acres of old-growth forest within the 8569-acre Kickapoo Valley Reserve between the villages of La Farge and Ontario. Types of old growth include maple-basswood, hemlock-White Pine, and red oak-White Oak (Epstein 2002).

In the 1960s, the federal government planned to build a dam on the Kickapoo River for flood control. The scheme was abandoned in 1973, and in 1996 federal legislation ordered that the US Army Corps of Engineers transfer 1200 acres of the land acquired for the dam to the Bureau of Indian Affairs in trust for the Ho-Chunk nation and the remaining 7369 acres to the State of Wisconsin. The former Corps land now constitutes the Reserve and is managed on a day to day basis by a Kickapoo Reserve Management Board, the majority of whose members are local people. They have set

aside a 3600-acre Kickapoo Valley Reserve State Natural Area within the Reserve (WDNR 2002).

Adjoining the Kickapoo Reserve is **Wildcat Mountain State Park**, owned by WDNR. The 3512-acre State Park has old growth similar to that in Kickapoo Reserve (Epstein 2002).

Patterson Hemlocks State Natural Area,* north-central Wisconsin (Oneida and Vilas Counties)

Within a 310-acre State Natural Area, an old-growth hemlock-Yellow Birch-White Pine forest. The old growth is situated “on an isthmus between Clear and Fuller Lakes, with the stand on the west side of Clear Lake being undisturbed.” Super-canopy White Pine grow in scattered clumps. The hemlock and Yellow Birch are up to 30 inches in diameter, and some White Pine are 3 feet in diameter and 120 feet high (WDNR 2002).

Germain Hemlocks State Natural Area* (Oneida County)

A State Natural Area comprised of 88 acres of old-growth northern mesic forest on steep-sided stony ridges. Large hemlock, over which super-canopy White and Red Pine tower, dominate the forest. Associates in the canopy include Yellow Birch, Sugar Maple, Red Maple, and Red Oak. Hemlock are reproducing well. The sparse to moderate shrub layer includes Mapleleaf Viburnum and Beaked Hazelnut. The area is owned by WDNR and received its Natural Area designation in 2002 (WDNR 2003).

Pine Hollow, in south-central Wisconsin (Sauk County)

Some 30 to 50 undisturbed acres in 204 acres of mature northern hardwood forest owned by The Nature Conservancy. Nearby is another Nature Conservancy preserve, Hemlock Draw, a relic hemlock forest of some 30 acres (Braker 1993).

Finnerud Pine Forest State Natural Area, in northern Wisconsin (Oneida County)

A northern dry-mesic forest dominated by Red Pine with a few White Pine, occupying approximately 80 acres of a 120-acre State Natural Area. Kline estimates the Red Pine to be at least 150 years of age (1992); the DNR describes them as being over 140 years old. Many are 2 feet in diameter. They are believed to have grown up after a fire. A very little cutting has been done on the site (Kline 1992). In addition to the pine, the canopy includes Paper Birch, Red Oak, Red Maple, and aspen. In the dense shrub layer are tree saplings, Beaked Hazelnut and briars. The Natural Area also encompasses an open sphagnum bog and a mile of the Lake Kawaguesaga shoreline. The Natural Area and additional land forming a total of 300 acres are owned by the University of Wisconsin and managed by the University of Wisconsin Arboretum. Access is restricted, and anyone seeking permission to visit must contact the Arboretum (Kline 1992, Lindsey & Escobar 1976, WDNR 2002).

The Big Block, within Flambeau River State Forest, north-central Wisconsin (Sawyer County)

A 1600-acre area, containing two State Natural Areas, in which most trees were blown down during a severe wind storm July 4, 1977. The state had purchased the Big Block and forbidden cutting in a 0.25 mile strip along the river, as the result of a battle by

conservationists in the 1940s to save the area (WDNR 2002). The Big Block was reportedly virgin when purchased (Dunn et. al. 1983).

--Flambeau River State Natural Area: formerly known as a Scientific Area. Three hundred and seventy acres containing what was once a "landmark old-growth northern mesic forest" (WDNR 1989). In 1976 the age of the stand was estimated to be 220 years (Lindsey & Escobar 1976); and the stand was dominated by Eastern Hemlock, Yellow Birch, and Sugar Maple with some American Basswood, White Ash, and White Pine (WDNR 2002). The 1977 blow-down was not complete in two small sections of the Big Block within and next to the Natural Area. Part of the leveled forest was salvage cut; deer and hare exclusion zones have been established in both salvaged and unsalvaged areas. Sugar Maple, Yellow Birch, and American Basswood are now growing in the Natural Area; hemlock is disappearing (WDNR 2002).

--Lake of the Pines Conifer-Hardwoods State Natural Area. A 156-acre State Natural Area that was originally Eastern Hemlock and Yellow Birch. A band of these trees on the peninsula was left standing after the storm. In the blow-down area, young Sugar Maple, Yellow Birch, and American Basswood are growing. After the storm, some of the Natural Area was salvage cut. In the past, the Natural Area had been logged on the small portions that are not hemlock-hardwood (WDNR 2002).

Port Wing Boreal Forest State Natural Area, in northern Wisconsin (Bayfield County)

Two areas of virgin dry-mesic boreal forest on sand spits, inland from current beaches on Lake Superior, within a 188-acre, two-unit State Natural Area. The boreal forest, which totals 100 acres, probably originated after a blow-down or fire in the mid- or late-1800s. The small size of the trees may have forestalled cutting. Red Pine and White Pine dominate. Beneath them grow White Spruce, Balsam Fir, and other species. An open water-sedge bog complex separates the forest from the beaches. Homes have been built next to the east woods. The Wisconsin Bureau of Endangered Resources owns the site (Epstein 1993, WDNR 2002).

Page Creek Marsh* (Marquette County)

More than 100 acres of Black Oak openings within a 591-acre preserve owned by The Nature Conservancy. The preserve has been disrupted by livestock grazing and fire suppression in the past (Walters 1993; Richter 1998; Drey 2001).

Plagge Woods State Natural Area,* in west-central Wisconsin (Chippewa County)

An 80-acre old-growth northern mesic forest, dominated by basswood, red and white oaks, and Sugar Maple. The forest covers the northern and southern slopes of a ridge on the southeastern edge of the Flambeau Ridge. It "was cut only sporadically prior to 1920" and "much virgin timber remains." Trees are of varying ages. Donated to the state by Henry and August Plagge, the site is controlled by WDNR, Parks and Recreation (WDNR 2002).

Lulu Lake Preserve, southeastern Wisconsin (Walworth County)

"Small but viable oak openings" totaling 50 acres within a 1500-acre preserve, half of which belongs to the WDNR and half to The Nature Conservancy. In the past the openings have been disrupted by livestock grazing and fire suppression. The Nature

Conservancy is conducting prescribed burns to restore the natural species and structure (Walters 1993; Richter 1998).

Spring Green Preserve (Sauk County)

Within the 900-acre Spring Green Preserve, 60 acres of oak barrens, disrupted by livestock grazing and lack of fire in the past. The Nature Conservancy, which owns the preserve, is removing invading trees such as Black Locust and Eastern Red-cedar from the prairie and oak savanna as well as conducting prescribed burns (Walters 1993; Richter 1998).

Renak-Polak Maple-Beech-Woods State Natural Area, in southeastern Wisconsin (Racine County)

An "outstanding" 46-acre southern mesic forest and an 8-acre southern wet-mesic forest within a 60-acre preserve. Sugar Maple, American Basswood, and American Beech dominate. The forest is "predominantly old-growth," but trees have been cut for fuelwood, and the northeastern portion was at one time lightly grazed by livestock. Shrubs dominate openings left by the death of elms. Wildflowers put on a spectacular display in the spring. The University of Wisconsin owns the land. Nature Conservancy volunteers and Wisconsin Department of Natural Resources staff have taken on management tasks, primarily removing exotic species such as Garlic Mustard (WDNR 2002, Braker 1993; Richter 1998).

Baxter's Hollow, in south-central Wisconsin (Sauk County)

Four thousand acres owned by The Nature Conservancy, in which are 30 to 50 acres of "undisturbed" White Pine forest and 40 acres of "undisturbed" Northern Red Oak forest, dominated by Red Oak, White Oak, and American Basswood (Braker 1993). Otter Creek, a rapid and clear stream, flows through Baxter's Hollow, a gorge cut in quartzite. Most of the site is covered by southern dry-mesic forest, a remnant of the Big Woods (WDNR 2002). Epstein characterizes Baxter Hollow as probably southern Wisconsin's most intact watershed, but says that it is mostly second growth, with only some 200 acres of old growth (Epstein 1993). Welsh believes that the entire area was grazed by livestock (2003). A 1995-acre area within The Nature Conservancy's preserve is a State Natural Area (WDNR 2002).

Ellison Bluff State Natural Area,* northeast Wisconsin (Door County)

A "vertical forest" of Northern White-cedar in a 170-acre State Natural Area. The State Natural Area is within Ellison Bay County Park on the Niagara Escarpment. The park, which is located in the Town of Liberty Grove, consists of the Heineman tract, an 86.2-acre parcel with approximately 2000 feet of Green Bay shoreline, and the land in the original 88-acre Ellison Bluff County Park. Ellison Bluff rises almost 200 feet above the waters of Green Bay in a series of terraces showing post-glacial lake levels. The exposed rock ledges and perched talus of these terraces form the habitat for rare snails. The vegetation of the talus includes Northern White-cedar, Mountain Maple, Canada Yew, and Elderberry. A white-cedar on the Heineman tract has been aged at 250 years (Drey 2001). The tract needs further study to determine the history of the vegetation (Grimm 2003). The Heineman tract is undeveloped and will remain that way; in a portion of the

original park, a lookout was constructed (Wolken 2001; Door County 2001).

****Lee Frelich reports that Deathdoor Bluff County Park** has a mile of high bluffs similar to those at Ellison. As at Ellison, large, ancient Northern White-cedar grow on terraces on the cliffs. On the steep slopes between the terraces are small white-cedar that have grown, been broken, and regrown into bizarre shapes (2005). [*Update 1/12/06*]

Washington Island and Rock Island to the north of the Door Peninsula may have old growth on cliffs overlooking Lake Michigan, Mike Grimm reports, but, as far as he knows, no researcher has investigated the situation there (2003).

Weir White Oaks State Natural Area,* in southwestern Wisconsin (Lafayette County)

A 52-acre “old-growth southern dry-mesic forest dominated by abundant large white oaks with red oak, basswood, sugar maple, and white ash.” The Pectaonica River west of the forest protected it from prairie fires, which moved from west to east. No livestock grazing took place. Therefore the ground layer is “extremely rich.” Sugar Maple is reproducing on the eastern but not the western portion of the site. The site is privately owned and was designated a State Natural Area in 2002. The Natural Area is not open to the general public.

Tellock’s Hill Woods State Natural Area,* in east-central Wisconsin (Waupaca County)

An “old-growth northern mesic forest” on the north-facing slope of a drumlin within the 54-acre State Natural Area. The gentler portion of the slope supports a “relatively undisturbed beech-maple forest.” The steeper portion is nearly pure hemlock, growing amid large boulders. The Natural Area is owned by WDNR (WDNR 2002, Epstein et al. 2002).

Bass Lake Preserve,* northern Wisconsin (Iron County)

A 1000-acre site, within which are pockets of Eastern Hemlock and White Pine that have experienced only minimal disturbance. On ridges and islands that were hard to reach, these pockets are in a matrix of wetlands. The wetlands grade up to deciduous uplands that have been cut quite heavily in the past (Richter 1998).

Oakfield Ledge State Natural Area*, in south-eastern Wisconsin (Fond du Lac County)

“Mostly undisturbed” woodland within a 40-acre State Natural Area on an exposure of the Niagara Escarpment. The site is a west-facing, boulder-strewn slope, with rock ledges and 40-foot deep crevices. It is on the east side of Horicon Marsh, well known as a stopover for migrating birds. Tree species include basswood, Sugar Maple, Slippery Elm, Rock Elm, Northern Red Oak, and Shagbark Hickory. Beneath them are Canada Yew, ferns, and a rare rock cress. The top of the escarpment was grazed by livestock (WDNR 2002).

****Ridges Sanctuary,** Bailey Harbor, northeast Wisconsin (Door County)

Ancient Northern White-cedar within a privately-owned non-profit preserve on the Lake Michigan side of Door Peninsula. Here parallel ridges up to fifteen miles long are separated by water-filled swales 100-150 feet in width. The ridges range in age from seventy-five years, nearest the present beach, to four thousand years, a mile inland. Each

ridge is a former Lake Michigan beach. On the ridges is forest in which White Spruce and Balsam Fir predominate. Most of the forest was cut and burned in the 1870s. However, large ancient white-cedar line the swales. Other white-cedar have fallen into the swales but have turned upwards individual branches that became new trees. These new trees may later have fallen. Thus the white-cedar gradually formed tangled masses that may be as much as a thousand years in age (Frelich 2005). [*Updated 1/16/06*]

- Banta, Alford J., Superintendent, Apostle Islands National Lakeshore. 1992. Personal communication.
- Board of Commissioners of Public Lands. 2003. Web site: <http://bcpl.state.wi.us/home/landpf.htm>
- Braker, Nancy, Director of Science and Stewardship, Wisconsin Office of The Nature Conservancy. 1993. Personal communication.
- Brander, Bob, Apostle Islands National Lakeshore. 1992. Personal communication.
- Cook, James E. Disturbance History of Two Natural Areas in Wisconsin: Implications for Management. 2000. *Natural Areas Journal* 20:24-34.
- Curtis, John T. 1959. *The Vegetation of Wisconsin: An Ordination of Plant Communities*. Univ. of Wisconsin Press, Madison, WI.
- Dallman, Matt, Director of Conservation for Northern Wisconsin, The Nature Conservancy. 2006. Personal Communication.
- Daugherty, John, Chief of Interpretation, St. Croix National Scenic Riverway. 1992. Personal communication.
- Door County Parks, Office of the Director. 2001. Personal communication.
- Draft Biotic Inventory of State Trust Lands. 2003.
- Drey, Kelly, Stewardship Assistant, The Nature Conservancy. 2001. Personal communication.
- Drieslein, Bob, US Fish and Wildlife Service. 1993. Personal communication.
- Dunn, C. P., G. R. Guntenspergen and J. R. Dorney. 1983. Catastrophic Wind Disturbance in an Old-Growth Hemlock-Hardwood Forest, Wisconsin. *Canadian Journal of Botany* 61:211-17.
- Eckstein, Ron et al. 2001. *Community Restoration and Old Growth on the Northern Highland-American Legion State Forest*. Madison, Wisconsin: Wisconsin Department of Natural Resources.
- Epstein, Eric, Ecologist, Wisconsin Natural Heritage Program. 1992 and 1993. Personal communication and interview in Wisconsin.
- Epstein, Eric, Ecologist, Wisconsin Natural Heritage Program. 2002. Personal communication.
- Epstein, Eric, et al. 2002. *Wolf River Basin Biotic Inventory and Analysis*. Madison, Wisconsin: Wisconsin Department of Natural Resources.
- Farlinger, Clint, Photographer. 2002. Notes from an interview with Linda Parker, June 10, 2002.
- Fouse, Fred, Nicolet National Forest. 1993. Personal communication.
- Frelich, Lee E. 2002. Personal communication.
- Frelich, Lee E. 1995. Old Forest in the Lake States Today and before European Settlement. *Natural Areas Journal* 15 (2):157-67.
- Frelich, Lee E. 2005. Trip report to the Eastern Native Tree Society, September 5, 2005. Available on the web site of the society, www.uark.edu/misc/ents/.

- Giles, Michael T., Forest Superintendent, Gov. Knowles State Forest. 1992. Personal communication with enclosures.
- Grimm, Mike, Conservation Ecologist, Wisconsin Chapter of The Nature Conservancy. 2003. Personal communication.
- Haney, Alan, Dean of the College of Natural Resources, University of Wisconsin at Stevens Point. 1993. Personal communication.
- Hudick, Joseph P., Lower District Ranger, St. Croix National Scenic Riverway. 1993. Personal communication.
- Hulbert, Bill, Chequamegon National Forest. 1993. Personal communication.
- Johnson, Mark. 2005. Forest Purchase Preserves History, Milwaukee Journal Sentinel, August 30, 2005.
- Kaleta, Dennis, National Park Service. 1993. Personal communications and a letter with fact sheets and maps.
- Kline, Virginia M., University of Wisconsin Arboretum Ecologist and Research Program Manager. 1992. Personal communication with enclosures.
- Kotar, John, Department of Forestry, University of Wisconsin-Madison. 1993. Personal communications.
- Kotar, John and Timothy L. Burger. 1989. Forest Habitat Type Classification for the Menominee Indian Reservation. Department of Forestry, University of Wisconsin, Madison, WI.
- Krause, John, Ecologist. 2002. Personal communication.
- Landis, Scott. 1992. Seventh-Generation Forestry. Harrowsmith, Nov./Dec., pp. 27-33.
- Lange, Ken, Devil's Lake State Park. 1993. Personal communication.
- Lindsey, Alton A. and Linda K. Escobar. 1976. Eastern Deciduous Forest. Volume 2: Beech-Maple Region. Natural History Theme Studies, No. 3. National Park Service, Washington, DC.
- Matthiae, Paul, Department of Natural Resources. 1993. Personal communication.
- McNeil-Saari, Kay, Friends of the Brule River. 2003. Personal communication.
- Mello, Greg, Wildlife Biologist, Fort McCoy. 2003. Personal communication.
- Parker, Linda, Forest Ecologist, Chequamegon National Forest. 1993. Personal communication, followed by written material on the forest's Washburn District.
- Parker, Linda, Forest Ecologist, Chequamegon-Nicolet National Forests. 1998, 1999, and 2002. Personal communications and copies of printed data sheets from the Nicolet and Chequamegon National Forest Biological Survey Project Evaluation, which are dated from 1996 through 1999.
- Pastor, John, John D. Aber, Charles A. McClaugherty, and Jerry M. Melillo. 1982. Geology, Soils and Vegetation of Blackhawk Island, Wisconsin. *American Midland Naturalist* 108:266-277.
- Pastor, John, J. D. Aber, C. A. McClaugherty, and J. M. Melillo. 1984. Aboveground Production and N and P Cycling along a Nitrogen Mineralization Gradient on Blackhawk Island, Wisconsin. *Ecology* 65:256-68.
- Rau, Jim, Superintendent, Brule River State Forest. 1999. Personal communication.
- Richter, Steve, Wisconsin Chapter of The Nature Conservancy. 1998. Personal communications.
- Rinaldi, Tony, Forest Biologist, Nicolet National Forest. 1992. Letter with enclosure.
- Rogers, Sara, Environmental Management Technical Center, US Fish and Wildlife Service. 1993. Personal communication.
- Shulz, Dave, Forester, Brule River State Forest. 2003. Personal communication.
- Tans, William. 1979. Scientific and Natural Area Report: Brant Brook Pines and Hardwood Forest.
- Tyrrell, Lucy E. 1990. Personal communication.
- Tyrrell, Lucy E. 1991. Old-Growth Forests on National Park Service Lands: NPS Views

and Information. Great Lakes Cooperative Park Studies Unit Report 91-1, University of Wisconsin, Madison, WI.

Tyrrell, Lucy E. and Thomas R. Crow. 1994. Structural Characteristics of Old-Growth Hemlock-Hardwood Forests in Relation to Age. *Ecology* 75:370-86.

Tyrrell, Lucy E. et al. 1998. Information about Old Growth for Selected Forest Type Groups in the Eastern United States. USDA Forest Service, General Technical Report NC-197.

United States Forest Service (USFS). 2000. Ecologically Significant Areas and Their Attributes—Medford-Park Falls Ranger District [draft].

Urich, Randy, Mississippi River Project Office, US Army Corps of Engineers. 1993. Personal communications.

Waller, Don, Botany Department, University of Wisconsin-Madison. 1993. Personal communication.

Walters, Cathy, Communications Coordinator, Wisconsin Chapter of The Nature Conservancy. 1993, April 14. Letter with fact sheets on selected Conservancy preserves and State Natural Areas.

Welsh, Jim, Director of The Nature Conservancy's Baraboo Hills Project. 2002. Personal communication to Clint Farlinger.

Wisconsin Chapter of The Nature Conservancy (WTNC). [n.d.] *The Places We Save*. Wisconsin Chapter of The Nature Conservancy, Madison, WI.

Wisconsin Department of Natural Resources [WDNR], Bureau of Endangered Resources. 1989-1991, 2002, 2003. [Fact Sheets on Individual State Natural Areas and Natural Resources Areas. The 1989-1991 dates in our text refer to the years when the respective fact sheets were written. We have paper copies of these fact sheets. The 2002 and 2003 dates refer to the years when we downloaded fact sheets in question from the Web. WDNR does not date the copies of fact sheets on the Web.]

Wolken, Sandy, Outreach and Media Relations Coordinator, The Nature Conservancy. 2001, March. Undated articles from the periodical of the Wisconsin Nature Conservancy.