Threatened and Endangered Species in Forests of Wisconsin

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Threatened and Endangered Species in Forests of Wisconsin

A Guide to Assist with Forestry Activities

Threatened and Endangered Species in Forests of Wisconsin

A Guide to Assist with Forestry Activities

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Introduction

Wisconsin is governed by both the federal and state endangered species acts. The Federal Endangered Species Act (ESA) was passed by the U.S. Congress in 1973 to protect species of plants and animals that are in danger of disappearing from the face of the earth. The ESA also protects the habitats on which these species depend. Under the ESA, plants or animals currently facing extinction are classified as "endangered." In other situations, such dangers are less imminent though still quite real. In such cases, and where species are declining and may disappear in the near future, they are classified as "threatened." The Wisconsin Endangered Species Act, passed by the state legislature, uses similar definitions for the words "endangered" and "threatened." The state law includes a list of plants and animals that are especially rare in Wisconsin, activities that require permitting and how plant and animal rules may differ.

The federal ESA treats plants and animals differently. Animals that are listed as either endangered or threatened are automatically protected on both public and private lands. Listed plants, however, are protected primarily on federal lands such as national forests, national wildlife refuges and military bases.

Although listed plants need adequate protection on both public and private lands, ESA violations occur on private lands only if state laws, such as trespass or state endangered species laws, are broken.

Most forestry-related activities do not negatively affect threatened or endangered species as long as ecosystem-based sustainable forestry practices are used. However, situations may arise where there are conflicts between land management practices (such as forestry) and the protection of these species. In most of these cases, there are workable solutions. Compromises that not only protect the species in question, but also allow the land to be used for other legitimate purposes should be the goal of everyone. Through education, cooperation and compromise, these goals can and will be achieved.

The primary purpose of this manual is to acquaint those who work or recreate in Wisconsin's forests with the rare species that occur there. Also, this manual will assist foresters, landowners, loggers, site-preparers, herbicide applicators and other woods workers to avoid violations of either the federal or state endangered species acts. And, just as important, it will help avoid placing listed species of plants and animals in further jeopardy and making their recovery even more difficult.

If you believe your forestry or other land-use activity could harm or kill a listed species, or if you are uncertain whether it would, please contact the Wisconsin Bureau of Endangered Resources or the U.S. Fish and Wildlife Service at the locations noted in Appendix II for assistance.

Scope

This manual is intended primarily for use in Wisconsin, although many of the species covered also occur in other Great Lakes states. This manual does not include all Wisconsin federally and state-listed plants and animals, those species that are protected by state and federal laws. Instead, this manual includes only those species most likely to be affected by logging and other forestry operations. This manual was further limited to those species reasonably identifiable. A complete list of both federally- and state-listed endangered and threatened species is available from the Wisconsin Bureau of Endangered Resources. (See Appendix II.)

Periodically, species are added to and removed from the list of those protected by the federal and state endangered species acts. Information about changes in the status of rare species can be obtained from the sources listed in Appendix II.

There are individual accounts for the majority of species in this manual. Most accounts include a photograph or an illustration of the organism, a map showing where in the state it may be found and a written description. This description includes information on identifying characteristics and

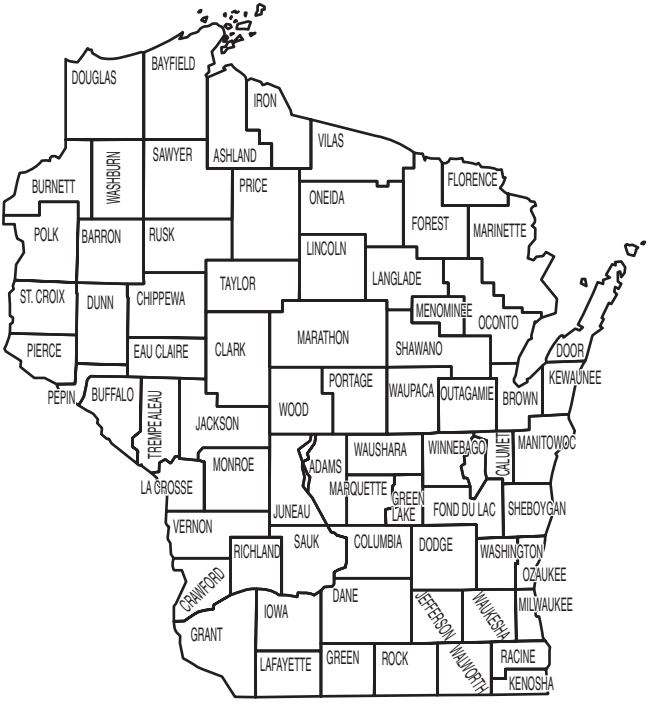
habitat. Forestry practices that affect these protected plants and animals are also discussed.

Due to difficulties in individual species identification for fish and mollusks (clams and snails), and the fact that recognition beyond general group identification is not needed in most cases to protect these species, they are indicated only by name and range map. The field guides listed in Appendix II will provide additional information about many of these species.

Appendix I includes an alphabetical list of all the counties in Wisconsin and protected forestry-influenced species known to exist in each one. This list includes only documented sightings. Populations of species covered in this manual may exist in other counties.

This manual contains the best knowledge currently available from resource professionals about forestry considerations. However, there is still much to learn concerning management practices. The authors invite comments, corrections, new sightings and suggestions from readers.

Wisconsin Counties



Mammals

TIMBER WOLF

American Marten

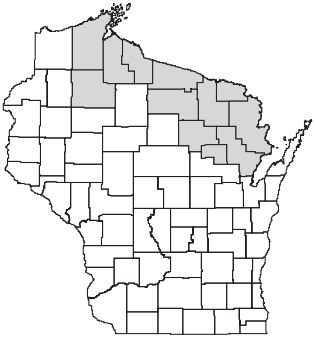
(Martes americana)

Federal Status: Not Listed
State Status: Endangered

Description: The American marten looks similar to the much larger fisher. Martens have thick fur that ranges from reddish-brown to dark brown, with darker colors on the legs and bushy tail. Martens weigh 1-3 pounds compared to 5-15 pounds for the fisher. Martens have proportionally larger ears than the fisher and have a bright yellow chest patch.

Habitat: Martens prefer a habitat of mature conifer forests or a mixed forest, with much woody debris in the understory. Martens avoid large open areas.

Forestry Considerations: Practices that benefit martens include selective cuts that leave treetops scattered throughout stands, and retention of large, dead trees. Limited road access also benefits the marten by reducing opportunities for accidental death and trapping, and by avoiding the creation of barriers to movement.



Timber Wolf

(Canis lupus)

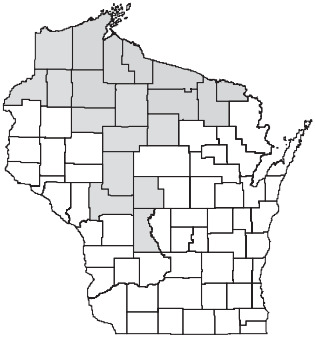
Federal Status: Endangered
State Status: Endangered

Description: The timber wolf, or gray wolf, looks somewhat like a large dog but has a narrow chest, longer legs, and larger feet than most dogs. Its coat is colored a mixture of gray, brown, tan, and black, with a light cream color on the underside. Wolves in Wisconsin normally weigh 50-100 pounds, about two or more times the size of a coyote. Wolf and coyote tracks normally follow in straight lines, with the hind foot stepping into the track of the front

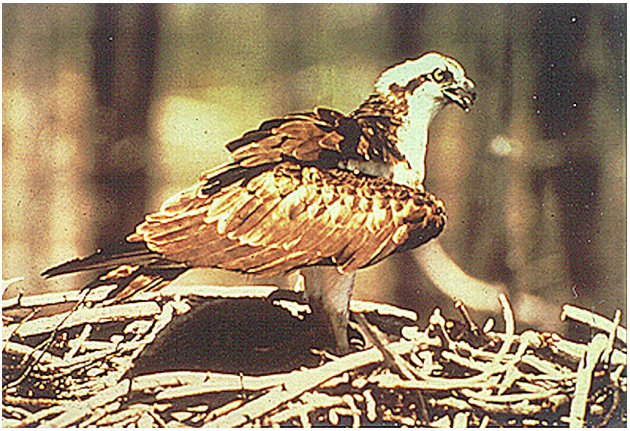
foot. Dog tracks normally do not overlap and have a more zigzag pattern. Wolf tracks are usually 3 1/2 to 4 1/2 inches compared to less than 2.7 inches for coyotes.

Habitat: Wolf packs occur in heavily forested areas where few people live and where there are few roads. Such conditions occur most commonly in the mixed deciduous and coniferous forests of northern Wisconsin. Wolves also are expanding their range into parts of west central Wisconsin.

Forestry Considerations: Maintaining low, active road densities (including logging roads) of less than 1 mile of road per square mile of land, benefits wolves. Gating logging roads after the timber harvest, or using winter-only roads, would reduce disturbance. Harvesting activities should be avoided within 1/2 mile of an active den from March through July, and no tree cutting should occur within 110 yards (5 chains) of active dens.



Birds



OSPREY

Acadian Flycatcher

(Empidonax virescens)

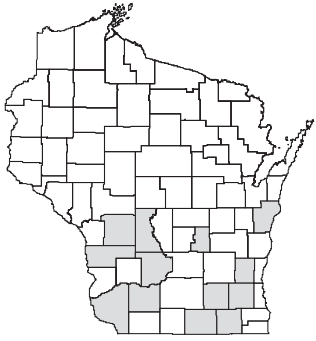
Federal Status: Not Listed
State Status: Threatened

Description: The acadian flycatcher, about 5 1/2 inches long, is greenish above and washed yellow on each side. Otherwise, it is nearly identical in appearance to other members of its genus. The *Empidonax* group of flycatchers, all of which have a light eye-ring and whitish wing bars, are distinguished from one another during the breeding season by their songs, habitats and ranges. The best way to differentiate this bird from other flycatchers is by its emphatic vocalization, "Wee-see!" or "Pit-see!", heard from late May to early August.

Habitat: Acadian flycatchers require large (>200 acres) tracts of mature (>50 years), moderately moist forests with semi-open understories. They breed primarily in southern portions of the state, preferring streamsides and

ravines. Hemlock, yellow birch and white pine forests are favored sites, along with overmature pine plantations within the extensive hardwoods of the Kettle Moraine State Forest. In the Baraboo Hills, their nests occur in the forks of hemlocks, sugar maple and witch hazel branches. In the Kettle Moraine, their nests occur in buckthorns, box elders and pines. Nests are generally 5-20 feet above the ground or water, and suspended from low, drooping branches, and typically consist of grasses, bark shreds, weed fibers, fine twigs, cocoon silk and catkins.

Forestry Considerations: Where these flycatchers occur, favor single-tree selection within 300 feet of year-round streams. In other areas, group selection of less than 1/4 acre will maintain relatively closed canopies and may minimize cowbird parasitism. Employ *Wisconsin's Forestry Best Management Practices for Water Quality* and provide buffers along stream corridors. Retain patches of low shrub cover and saplings when harvesting timber or when doing timber stand improvement. This provides acadians with perches 6-21 feet above the ground from which they can forage for insects.



Bald Eagle

(Haliaeetus leucocephalus)

Federal Status: Threatened
State Status : De-listed

Description: Adult bald eagles have dark brown bodies and wings contrasting with the familiar white head, neck, and tail feathers. The adult female (34-43 inches long) is larger than the male (30-35 inches long). The eagle's wingspan is 7 feet, with adults weighing 8-14 pounds. Immature eagles are dark brown with spatterings of white on the underwings and tail. Their head and tail feathers turn white as they approach 4 to 5 years old.

Habitat: In Wisconsin, eagles are found along rivers and lakes where they catch and eat fish

and other prey. They will also eat dead animals along lake and river shores as well as in agricultural fields and on roadsides. Bald eagles nest in large trees, usually near water. These nests usually are located near the tops of the tallest trees and are added to and reused year after year.

Forestry Considerations: Eagles are very sensitive to disturbance by human beings, especially during the breeding and nesting season (February 15 to August 15).

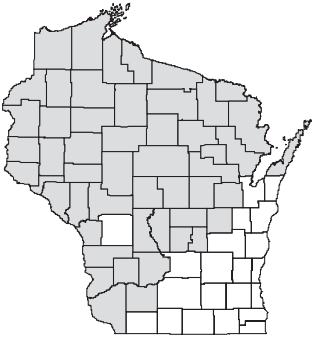
Within 330 feet of a nest, major habitat changes should be avoided including timber harvest, land clearing, building and road or trail construction. Mature live and dead trees should be maintained for perches and protection from the wind. Human activity should be avoided from March 15 to July 15, and kept to a minimum from July 16 to August 15.

Within 330 to 660 feet of a nest, human activity should be kept to a minimum from March 15 to July 15. From July 16 to August 15, moderately disturbing activities, such as hunting, fishing, and hiking, are possible. Heavier disturbance, including harvest and road building, should be conducted during the remainder of the year.

Within 660 feet to 1/4 mile of a nest, bald eagle roosts or feeding sites should be protected. If timber cutting occurs, it is suggested that

several supercanopy pine trees be left for future nest tree replacement. Ideally, activities that are within sight of eagles on their nest should be conducted outside of the breeding and nesting season.

Land within 90 feet of the shoreline of rivers and lakes should be managed to promote large white pines. As many large dead trees as possible should be left standing, especially trees with a diameter of >12 inches, for use as perch trees.



Bell's Vireo

(Vireo bellii)

Federal Status: Not Listed
State Status: Threatened

Description: The Bell's vireo, 5-5 1/2 inches long, is drab gray to green above, and white or yellow below. Distinguishing markings include a faint white eye-ring and two pale wing-bars, the lower bar being more prominent.

Habitat: From mid-May to early July, Bell's vireos are uncommon residents of southwestern and south central Wisconsin. They nest in upland and lowland mid-successional shrub habitats along or near rivers and streams. Bell's vireo habitats often include such shrubby plants as lilac, multiflora rose, staghorn sumac, hazelnut, grape, gooseberry and brambles among scattered small trees such as box elder, aspen, hawthorn, hackberry, black cherry and mulberry. Mean height of nest trees and shrubs is 12 feet,

with a range of 2 1/2 to 30 feet. The nest tree or shrub is usually located at the edge of a thicket with adjacent taller trees. A common feature of the nest tree is a low, near-horizontal branch with enough space for the construction of a pendulous nest within a fork of the branch. Nest sites are typically where the nest is protected and concealed by the surrounding vegetation. Tall grasses, forbs and thorny plants as well as vines help form an enclosed space. At least one tree over 9 feet tall from which a bird can sing or call is also necessary for Bell's vireo habitat. During the breeding season, Bell's vireos forage for insects on the lower limbs of trees and shrubs. Usually they establish territories where only short flights across open spaces are required to reach the protection of cover.

Forestry Considerations: Forestry practices that enhance the small tree, shrub and ground cover component of the forest would be beneficial to Bell's vireo. Disturbance should be minimized during the nesting season, around known nest sites.

Cerulean Warbler

(Dendroica cerulea)

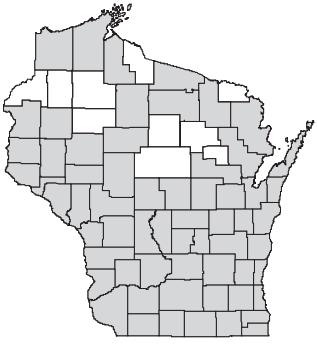
Federal Status: Not Listed
State Status: Threatened

Description: The male cerulean warbler's breeding plumage is sky-blue with faint, dark streaks above; below it is white with a narrow black breast band and blue-gray streaking on the sides. The adult female is greenish above with a pale yellowish stripe over the eye and pale below with dull streaked sides. Both sexes have two white wing bars.

Habitat: Throughout its breeding range the cerulean warbler is found in a variety of moderately moist habitats, containing tall, mature, deciduous trees. It is found both in floodplain and upland forests of medium to large size (greater than 40 acres). Important breeding habitat features include a closed

canopy forest with some smaller (< 2.5 inches dbh) trees and a few smaller dead trees. Habitat loss and fragmentation of mature forests are key factors limiting breeding populations. In Wisconsin, it is estimated that a 200-acre, unfragmented woodlot would have a 50% chance of supporting a breeding population of this warbler. In addition to reducing the acres of suitable habitat, forest fragmentation enhances the conditions for nest parasitism by brown-headed cowbirds and nest predation by other animals.

Forestry Considerations: In areas with cerulean warblers, favor the use of single-tree or group-selection silviculture. Groups should be less than 1/4 acre in size to maintain a relatively closed canopy to avoid cowbird parasitism of cerulean warbler nests. Employ *Wisconsin's Forestry Best Management Practices for Water Quality*, providing buffers along riparian corridors. Avoid harvest during the April 15 to July 15 nesting season in areas with known active nests.



Great Egret

(Casmerodius albus)

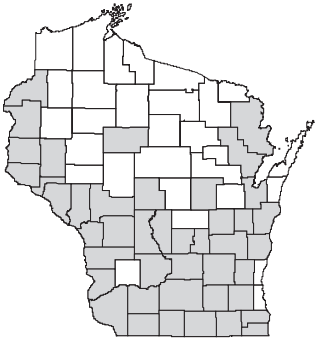
Federal Status: Not Listed
State Status: Threatened

Description: The great egret is a large predatory wading bird averaging 37-41 inches in length and weighing 32-40 ounces. Its wingspan measures 55 inches. The plumage of the great egret is entirely white; the bill and a spot in front of the eyes is yellow. The feet and long legs are black.

Habitat: Great egrets inhabit floodplain forests, riparian swamps and associated islands. They nest in colonies, often with great blue herons. Their nests are built with sticks, are 2 feet in

diameter, and are 20-40 feet high in the crowns of both trees and shrubs. Egrets often nest close (as close as 3 1/2 feet) to one another. Egrets will re-use nests and a rookery area from year to year. They feed in nearby shallow waters, 4-9 inches deep.

Forestry Considerations: Single-tree selection is favored within 300 feet of streams, rivers, lakes or marshes in areas where egret nesting colonies occur. Follow *Wisconsin's Forestry Best Management Practices for Water Quality*, including providing buffer zones along riparian corridors. During the nesting period of April 1 to July 15, disturbance (including tree harvest) should be minimized within 150 yards of active nesting colonies.



Hooded Warbler

(Wilsonia citrina)

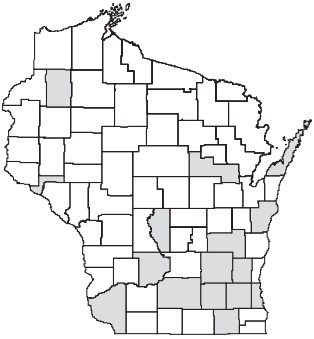
Federal Status: Not Listed
State Status: Threatened

Description: The hooded warbler, about 5 1/2 inches long at maturity, has a black hood surrounding a bright yellow face, and a tail with large white spots. Female and young are similar in appearance to the male, but are duller in color and have no black hood. Their nests are usually made of leaves, bark strips, and spider webs, placed between 1 and 5 feet above the ground.

Habitat: The hooded warbler inhabits shrubby openings (1/4 to 2 1/2 acres in size) in moist to wet deciduous woods in large tracts (>200 acres) of mature (>50 years old) forest in southern Wisconsin. Nesting occurs during mid-May to mid-July, with nests in hardwood

saplings (like sugar maple) 1 to 6 feet in height. The nest is made of grape vine, tree bark, leaves and grass, all interwoven with spiderwebs. This warbler is an "area sensitive" species that is likely to experience poor nesting success—and hence declining populations—in smaller or fragmented forests. A mature forest of 240 acres is believed to have at least a 50% chance of supporting a breeding population.

Forestry Considerations: Utilize single-tree selection or small group-selection silviculture since it mimics natural windthrow, maintaining the small canopy gaps that benefit this species. These openings within a mature forest will provide interior edge conditions for foraging and nesting. Minimize disturbance (including tree harvest) during the nesting season where this species is known to occur.



Kentucky Warbler

(Oporornis formosus)

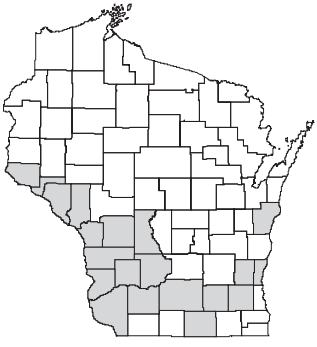
Federal Status: Not Listed
State Status: Threatened

Description: The Kentucky warbler is an insectivorous, ground-nesting bird, slightly more than 5 inches long. The adult male has olive-green upper parts, bright yellow underparts. It has a distinctive black "mask" across its forehead, crown and side of head. It has no wing bars or tail spots. The adult female is similar to the male, but the black on the head is usually reduced or a mottled gray-olive. Immature birds are similar to adults, but duller in color.

Habitat: During the nesting season, Kentucky warblers prefer large (>200 acres) mature (>50 years old) bottomland hardwood forests. They thrive in a relatively dense understory with such plants as red maple, American hornbeam and

wild grape. Other preferred habitat features include a stream or river, a rich plant community, an abundance and high density of invertebrates associated with moist soils and leaf litter. The Kentucky warbler's nest is well-concealed and located close to the ground. However, it may be built up to 3 feet above the ground in brush or shrubs. The nest consists of an open cup of grasses lined with rootlets and grass.

Forestry Considerations: In general, forest management practices that promote dense understory and well-developed ground cover in Wisconsin's floodplain forests will benefit this rare neotropical migrant. Where this species is known to occur, disturbance, including tree harvest, should be limited during the May 15 to July nesting season. Small (less than 1 acre, ideally less than 1/4 acre), group-selection silviculture would benefit this warbler by providing understory growth while maintaining sufficient canopy closure.



Osprey

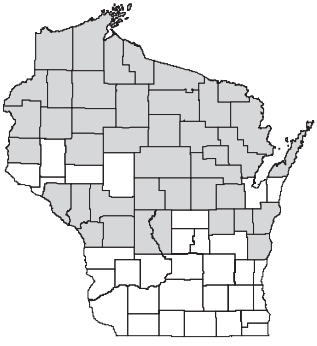
(Pandion haliaetus)

Federal Status: Not Listed
State Status: Threatened

Description: The osprey is a large bird of prey (body length 23 inches, wingspan 5 feet) that plunges into water to capture fish. The bird is black-brown above and mostly white below. Its white head has a broad black cheek patch and its tail is barred with brown. The osprey's long, narrow wings are angled back at the wrist when it flies. A black wrist patch contrasts with the white underwings. Ospreys weigh 3 to 3 1/2 pounds.

Habitat: The osprey is a bird of waterways: rivers, lakes and shorelands. In northern Wisconsin, breeding habitat is generally mature second-growth hardwood and pine forests. Primary nest sites are supercanopy snags and dead-topped pines located along lake and stream shorelines. Additionally, nests may be located in recent clearcuts adjacent to water, on snags in marshes or bogs and in swamp conifer stands. These nests are highly vulnerable to being toppled by wind. Ospreys also nest on powerline poles or other human-made structures. The osprey nest is made of sticks and measures more than 3 feet in diameter. Nests are often repaired and reused year after year.

Forestry Considerations: Since osprey usually nest directly over or near water, following *Wisconsin's Forestry Best Management Practices for Water Quality* will protect their streamside or lakeside habitat. BMPs will also protect water quality, which enhances survival of the fish upon which osprey feed. Avoid disturbances such as timber-cutting and road-building within 660 feet of an active osprey nest during the May 1 to August 15 nesting season.



Red-shouldered Hawk

(Buteo lineatus)

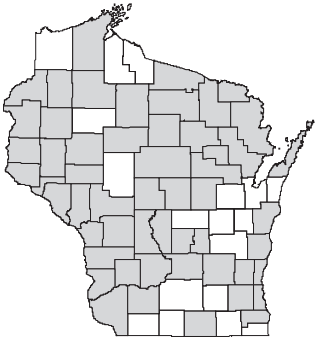
Federal Status: Not Listed
State Status: Threatened

Description: The red-shouldered hawk is a medium-sized raptor of the *Buteo* group. Adult males (17 to 23 inches long) are slightly smaller than adult females (19 to 24 inches long). It has a rusty-red shoulder marking and barred, rusty to reddish underparts. Its flight feathers have distinct black and white bars above. When viewed from below, the spread wings display a translucent, crescent-shaped patch. The hawk's grayish tail is marked by several wide dark bars alternating with narrow white bars and a white tip.

Habitat: In central Wisconsin, red-shouldered hawks use large (>200 acres), unfragmented tracts of mature (>50 years old), moderately moist forest. Preferred habitat contains numerous large trees. The majority of nests are found in red oaks. Nest tree diameters range from 18 to 35 inches. Nests are usually placed near the main trunk in a crotch 40 to 60 feet above ground.

Often the same nest tree is used year after year. Along the Mississippi River, red-shouldered hawks use medium to mature floodplain or riparian forests as nesting habitat. These forests are often dominated by 45- to 70-year-old silver maples and/or cottonwoods. Red-shouldered hawk nest sites along the Mississippi are usually associated with still water, backwater pools, open marshes, temporary waterways or the confluence of two streams. These wetlands provide important foraging habitat where frogs and crayfish occur.

Forestry Considerations: Forestry practices that maintain an average canopy closure of 70% or more would be beneficial to red-shouldered hawks. An aspen component (1- to 5-acre patches on a 55-year rotation) also would be beneficial. Cutting should not isolate an active nest tree and disturbance (including road construction and logging) should be minimized within 300 feet of a nest from March through July 15. Use of *Wisconsin's Forestry Best Management Practices for Water Quality* should be followed, especially the provision of a buffer zone along riparian corridors.



Spruce Grouse

(Dendragapus canadensis)

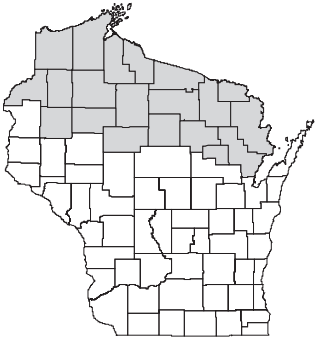
Federal Status: Not Listed
State Status: Threatened

Description: This dark-colored grouse is 15 to 17 inches long. The adult male has a black breast and face. When viewed at close range or through good binoculars, one can see a bright red fold of skin above the eye. The female is a speckled brown. Both the male and female have a rusty brown band along the tip of the tail. It usually shows no fear of human beings; this tame behavior also helps identify the spruce grouse.

Habitat: Boreal coniferous forests (containing white spruce, red pine and balsam fir) in the

northern part of Wisconsin are the primary habitat of the spruce grouse. In the same part of the state, it may also be seen in jack pines or spruce bogs (containing black spruce and tamarack), and feeding in wild blueberry patches.

Forestry Considerations: This grouse utilizes extensive conifer forests, especially black spruce in the lowlands and jack pine in the uplands. In a broad landscape, conifer forests of all classes will ensure long-term habitat needs. Therefore, limited group-selection silviculture is compatible with spruce grouse. Where spruce grouse are found, some dense coniferous forest should be retained for cover and nesting. Lower living branches that touch the ground should be retained. Since black spruce and tamarack appear to be an important element of this bird's habitat, ground-water levels in these areas should not be altered.



Worm-eating Warbler

(Helmitheros vermivorus)

Federal Status: Not Listed
State Status: Endangered

Description: The worm-eating warbler is a small (5 to 5 1/2 inches long) olive-green bird with two bold black stripes on the side of its buffy-orange head. Its back and wings are an olive-brown; the breast is a rich buff.

Habitat: This migratory bird inhabits the upper slopes of stream gorges, often on south-facing slopes, in dry oak and oak/pine woods in semi-open sites. It may also be found near clearings within a large (>200 acre) tract of forest. However, when these clearings become too large, or the forest is fragmented and broken into small blocks, the worm-eating warbler no longer finds the habitat suitable.

Forestry Considerations: Where worm-eating warblers are found, favor single-tree selection and group-selection silviculture to mimic natural tree fall dynamics. Single- tree selection is preferred within 300 feet of perennial streams. Group-selection cuts should be less than 1/4 acre in size to help minimize parasitism by cowbirds and predation by other animals. When this prescription is not possible, a uniform plan of rotation cutting is desirable, so that the older sections are adjacent to each other and the younger sections are also together. Employ *Wisconsin's Forestry Best Management Practices for Water Quality* and provide buffers along stream corridors. Retain patches of low shrub cover during tree harvesting or timber stand improvement. Maintain a well-developed woody and herbaceous understory to provide food, nesting sites and cover.

Yellow-crowned Night-heron

(Nyctanassa violacea)

Federal Status: Not Listed
State Status: Threatened

Description: This medium-sized (22 to 28 inches long) heron weighs $1\frac{1}{2}$ to $1\frac{3}{4}$ pounds. It has a glossy black head with a white crown and cheek patch. The neck and body are bluish-gray. The legs are yellowish-green, turning coral pink to scarlet during courtship.

Habitat: Yellow-crowned night-herons are a rare summer resident and typically may occupy a small portion of a southern floodplain forest during the breeding season. They may return to the same nesting site for 20 years or more. Their

nests are constructed 25 to 45 feet above the ground, or over the water. A variety of different-aged trees and shrubs are used for nesting, depending on the landscape configuration and proximity to water. Nests in mature trees are placed away from the trunk on the outermost fork of a limb and, if the canopy is closed, on the lowest horizontal limb. Nests consist of sticks and twigs, lined with grasses or leaves and reeds. This heron usually breeds during May through July in small colonies or as scattered pairs in forested habitats with an open understory, near water. They depend on aquatic animals for food. When foraging during the nesting season, these birds prefer long, narrow marshes with extensive edge.

Forestry Considerations: In general, no disturbance such as tree harvest should occur during the nesting season within 450 feet of an active nest. Where this heron has been found, single-tree selection should be favored within 300 feet of a stream or river. Employ *Wisconsin's Forestry Best Management Practices for Water Quality*, including the provision for buffers along riparian corridors.

Yellow-throated Warbler

(Dendroica dominica)

Federal Status: Not Listed
State Status: Endangered

Description: The yellow-throated warbler is a mid-sized wood warbler, 5 to 5 1/2 inches long as an adult. This beautiful small bird is distinguished by its bright yellow throat and upper breast, white belly and black face. It also has a white eyebrow stripe, large white patches on the side of the neck, white wing bars and black streaking on the sides.

Habitat: Most breeding yellow-throated warblers occupy mature woods in corridors bordering creeks and rivers, particularly where tall sycamores are prevalent. This warbler also lives in pine/oak forests on dry hillsides. These

birds prefer tall trees and may be found nesting as high as 90 feet above the ground. Their well-concealed nests are built on branches 6 to 9 feet out from the main trunk. The yellow-throated warbler forages on the upper surfaces of horizontal branches, usually high in the forest canopy.

Forestry Considerations: In areas with yellow-throated warblers, favor the use of single-tree or group-selection silviculture. Groups should be less than 1/4 acre to maintain a relatively closed canopy. Single-tree selection should be preferred within 300 feet of a stream or river. Employ *Wisconsin's Forestry Best Management Practices for Water Quality*, including the provision for buffers along riparian corridors.

Reptiles and Amphibians

ORNATE BOX TURTLE

Eastern Massasauga Rattlesnake

(Sistrurus catenatus)

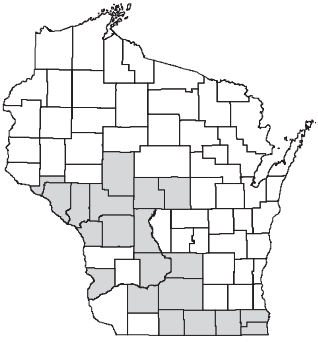
Federal Status: Not Listed
State Status: Endangered

Description: The adult eastern massasauga rattlesnake usually is 2 to 3 feet long with a tan body heavily covered with dark blotches edged with black. Its head is flattened and broad, with one white and three dark stripes radiating from its head. Nine enlarged plate scales cover the head like a helmet. The massasauga's tail has 5 to 7 dark cigar-band rings and is tipped by a grayish-yellow rattle.

Habitat: Eastern massasauga rattlesnakes live in a variety of habitat types. These snakes

hibernate underground, either in root canals, crayfish burrows or other subterranean tunnels. Juveniles, males and nonpregnant females usually remain in wetlands throughout the year, seeking areas with at least some open canopy for basking in sunlight. Pregnant females migrate to open upland sites with sandy soils where they incubate their young. Moderately moist prairies, oak savannas and open oak woodlands may be utilized where they occur adjacent to wetlands where hibernation takes place.

Forestry Considerations: Forestry considerations in wetlands are minimal, as most timber cutting and clearing occur after freeze-up. On open upland sites with sandy soils where females are known to occur, forestry cutting and other activities that disturb the ground layer are best done from mid-October through early May. This would avoid impacts to pregnant females.



Ornate Box Turtle

(Terrapene ornata)

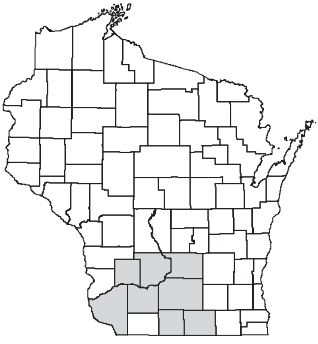
Federal Status: Not Listed
State Status: Endangered

Description: The ornate box turtle is a small, terrestrial turtle of up to 5 inches long. Yellowish lines, bars and spots radiate from the growth center of each upper shell scute (shell segment). The lower shell is brown with radiating yellow lines. Males tend to be a darker brown than females; the males have bright red eyes. Females have jaws that are lined with pale yellow markings and their upper lip is slightly notched.

Habitat: These turtles are found primarily on dry sand prairies and adjacent oak savannas and oak woodlands. Prickly pear cactus is frequently

found in such habitats along with a variety of other drought-resistant plant species.

Forestry Considerations: Heavy equipment and rural road traffic contribute significantly to the mortality of ornate box turtles in Wisconsin. Where the turtles are found and when the turtles are most active (early April to late September) heavy equipment use should be minimized. Forestry cutting, especially where pine plantations are cleared or heavily thinned, may benefit this species by adding either temporary open habitat if the site is regenerated, or long-term open habitat if the site is restored to an oak savanna or allowed to regrow as dry prairie.



Western Slender Glass Lizard

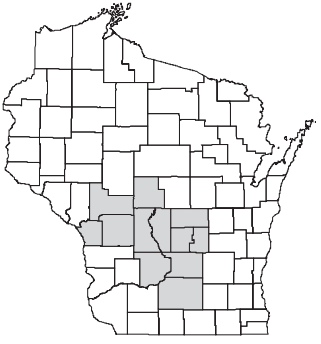
(Ophisaurus attenuatus)

Federal Status: Not Listed
State Status: Endangered

Description: The western slender glass lizard resembles a snake more than a lizard, with its pointed snout, narrow head, and a long cylindrical body with no limbs. Unlike a snake, this lizard has eyelids and external ear openings. The western slender glass lizard averages 18 to 24 inches in length. It is usually brown or tan, with a dark brown or black stripe running down the middle of its back from head to tail. Also, two dark stripes run above and four narrow stripes run below the lateral groove (a groove along the side of the animal). The underside of the lizard is white to light yellow. When caught, the lizard will often shed its tail to escape.

Habitat: This lizard's preferred habitat is oak savannas and open oak woodlands and adjacent mesic (moist) prairies. It is also found in sand prairies, abandoned agricultural fields and pine barrens.

Forestry Considerations: Plantings of pine and Christmas trees in prairies, or underplantings in oak savannas and open woodlands result in a loss of critical slender glass lizard habitat. However, forestry cutting may add habitat for this species. Managing to maintain a mosaic of different open or early-age classes of trees may help perpetuate this species on a landscape scale. Developed forest roads (roads containing no vegetation, whether paved or not) represent a formidable movement barrier to these lizards, leading to increased mortality from predators and vehicle traffic. Minimizing forest roads can benefit this lizard.



Wood Turtle

(Clemmys insculpta)

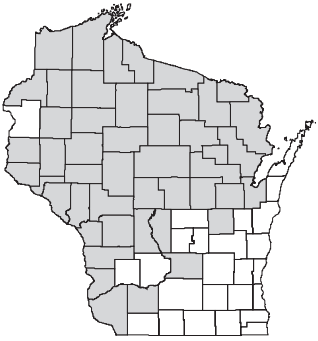
Federal Status: Not Listed
State Status: Endangered

Description: Each segment of the wood turtle's 6- to 8-inch shell looks like the wood-grained cross-section of a tree branch, complete with growth rings and usually displaying yellowish rays radiating from the center. The shell also has a noticeable dorsal (top) rib. Its bottom shell is yellow with black blotches. The wood turtle has a black head and brown limbs highlighted by yellow or occasionally orange skin on the throat and forelegs.

Habitat: This semi-aquatic turtle shares its time between clean rivers and streams dominated by sand or gravel substrates and adjacent lowland

hardwood forests. The wood turtle may even range into some upland forest types, remaining away from water for several months at a time. Usually, however, it doesn't travel more than several hundred yards from water.

Forestry Considerations: Because wood turtle activity is quite variable, it is difficult to make sound recommendations about terrestrial forestry activities. A major concern is to avoid heavy equipment use or timber stockpiling in sandy soil openings within 100 feet of rivers and streams occupied by wood turtles. These may be critical nesting sites. These sites can be inspected quickly by looking for eggshell fragments left on the surface by turtle nest predators. If eggshells are found, these sites should be avoided between late May through September. Following *Wisconsin's Forestry Best Management Practices for Water Quality* would benefit this species.



Fish

PUGNOSE SHINER

Overview

Forestry activities directly and indirectly affect streams, rivers and lakes—and the organisms that live in them. Forested and otherwise well-vegetated slopes near streams are less subject to erosion and siltation.

For most native fish, pure water and clean rocky or sandy streambeds are essential for reproduction, feeding and respiration. Excessive amounts of sediments, whether suspended in water or settled on streambeds, are detrimental to water quality and the fish or other rare, interesting, and valuable organisms living in the streams.

Wisconsin's Department of Natural Resources, Bureau of Forestry, developed a set of Best Management Practices (BMPs) to assist landowners in protecting water quality. Interested landowners should contact the Bureau (see Appendix II) for a copy of *Wisconsin's Forestry Best Management Practices for Water Quality*.

There are 21 state-listed endangered and threatened fish species in Wisconsin. Following are a series of maps that show the ranges of the 9 species of fish associated with forested watersheds.

CRYSTAL DARTER

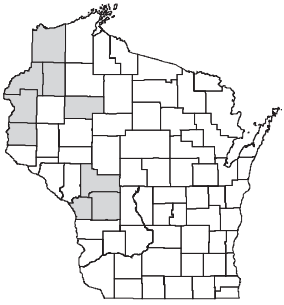
(Ammocrypta asperlla)

Federal Status: Not Listed
State Status: Endangered

GILT DARTER

(Percina evides)

Federal Status: Not Listed
State Status: Threatened



GRAVEL CHUB

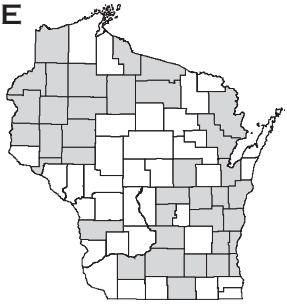
(Hybopsis x-punctata)

Federal Status: Not Listed
State Status: Endangered

GREATER REDHORSE

(Moxostoma valenciennesi)

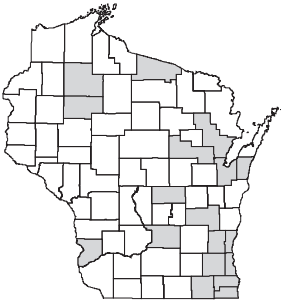
Federal Status: Not Listed
State Status: Threatened



LONGEAR SUNFISH

(Lepomis megalotis)

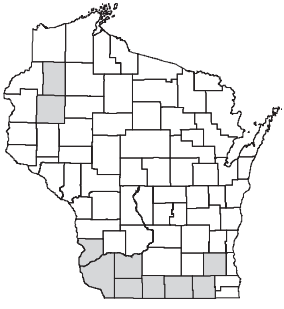
Federal Status: Not Listed
State Status: Threatened



OZARK MINNOW

(Dionda nubila)

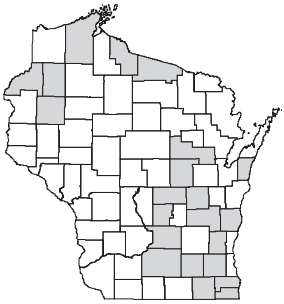
Federal Status: Not Listed
State Status: Threatened



PUGNOSE SHINER

(Notropis anogenus)

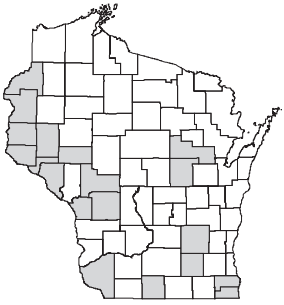
Federal Status: Not Listed
State Status: Threatened



RIVER REDHORSE

(Moxostoma carinatum)

Federal Status: Not Listed
State Status: Threatened



STARHEAD TOPMINNOW

(Fundulus nottii)

Federal Status: Not Listed
State Status: Endangered

Mussels and Snails

PURPLE WARTYBACK MUSSEL

CHERRYSTONE DROP SNAIL

Overview

Mussels and snails are important because they serve as indicators of water quality and are vital members of stream, river and lake aquatic communities. Dwindling numbers of native mussels in Wisconsin rivers and lakes are an indication that water quality is being degraded and habitat is being lost. These animals have varied lifestyles, habitats and methods of reproduction, and several species are commercially valuable.

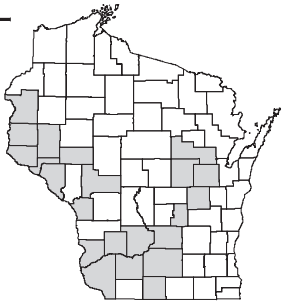
Eighteen species of freshwater mussels and four species of terrestrial snails are federally and/or state-listed in Wisconsin. Like fish, mussels and snails are best protected by protecting water quality, streambed integrity, and associated terrestrial habitat. Forestry operations in watersheds where these rare mollusks (mussels and snails) occur should be conducted in a manner to avoid soil erosion and prevent sediments and other pollutants from entering the waterways. Refer to *Wisconsin's Forestry Best Management Practices for Water Quality* by the Wisconsin Bureau of Forestry.

There are 22 state-listed endangered and threatened mollusk species in Wisconsin. Following are a series of maps that show their known ranges.

BUCKHORN MUSSEL

(Triogonia verrucosa)

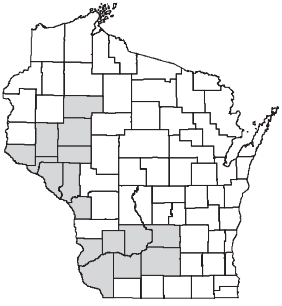
Federal Status: Not Listed
State Status: Threatened



BULLHEAD MUSSEL

(Plethobasus cyphus)

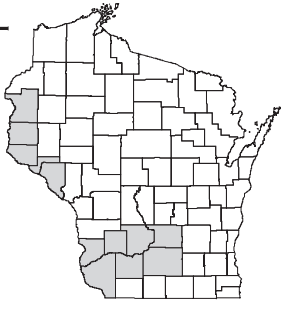
Federal Status: Not Listed
State Status: Endangered



BUTTERFLY MUSSEL

(Ellipsaria lineolata)

Federal Status: Not Listed
State Status: Endangered



CHERRYSTONE DROP SNAIL

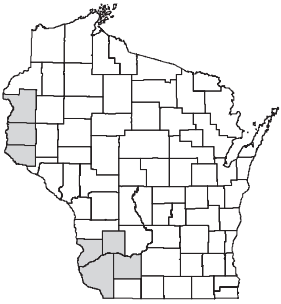
(Hendersonia occulta)

Federal Status: Not Listed
State Status: Threatened

EBONY SHELL MUSSEL

(Fusconaia ebena)

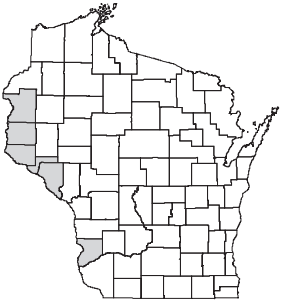
Federal Status: Not Listed
State Status: Endangered



ELEPHANT EAR MUSSEL

(Elliptio crassidens)

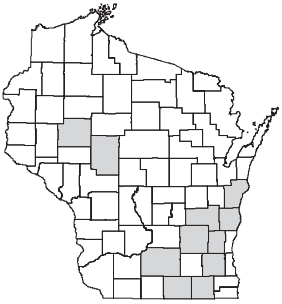
Federal Status: Not Listed
State Status: Endangered



ELLIPSE MUSSEL

(Venustaconcha ellipsiformis)

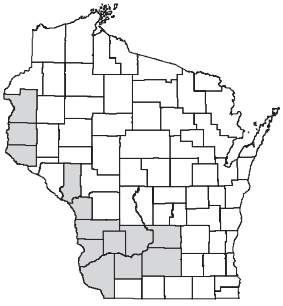
Federal Status: Not Listed
State Status: Threatened



HIGGINS' EYE PEARLYMUSSEL

(Lampsilis higginsi)

Federal Status: Endangered
State Status: Endangered

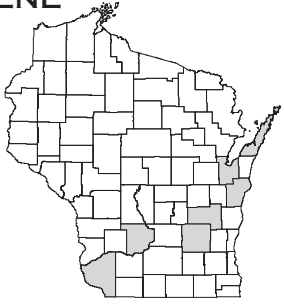


MIDWEST PLEISTOCENE VERTIGO SNAIL

[HUBRICHT'S VERTIGO SNAIL]

(Vertigo hubrichtii)

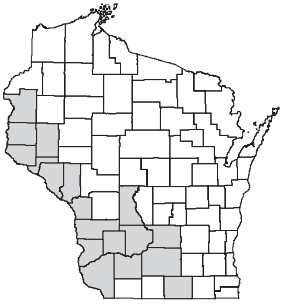
Federal Status: Not Listed
State Status: Endangered



MONKEYFACE MUSSEL

(Quadurla metanevra)

Federal Status: Not Listed
State Status: Threatened



OCCULT VERTIGO SNAIL

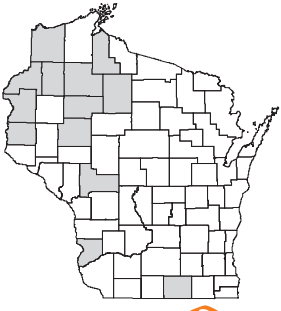
(Vertigo occulta)

Federal Status: Not Listed
State Status: Endangered

PURPLE WARTYBACK MUSSEL

(Cyclonaias tuberculata)

Federal Status: Not Listed
State Status: Endangered



RAINBOW SHELL MUSSEL

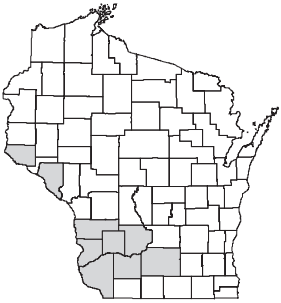
(Villosa Iris)

Federal Status: Not Listed
State Status: Endangered

ROCK POCKETBOOK MUSSEL

(Arcidens confragosus)

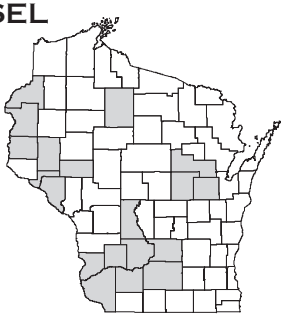
Federal Status: Not Listed
State Status: Threatened



SALAMANDER MUSSEL

(Simpsonaias ambigua)

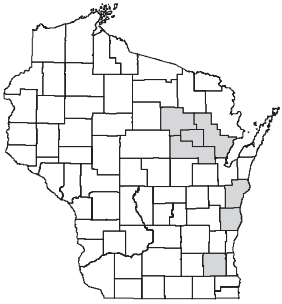
Federal Status: Not Listed
State Status: Threatened



SLIPPERSHELL MUSSEL

(Alasmidonta viridis)

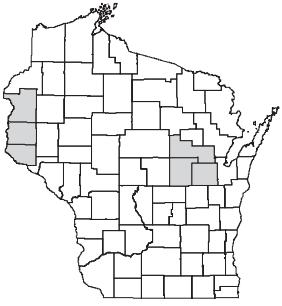
Federal Status: Not Listed
State Status: Threatened



SNUFFBOX MUSSEL

(Epioblasma triquertra)

Federal Status: Not Listed
State Status: Endangered



SPECTACLE CASE MUSSEL

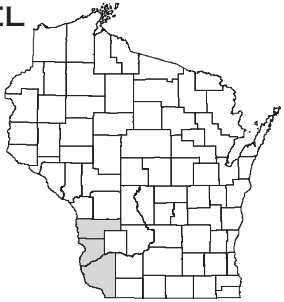
(Cumberlandia monodonta)

Federal Status: Not Listed
State Status: Endangered

WARTYBACK MUSSEL

(Quadrula nodulata)

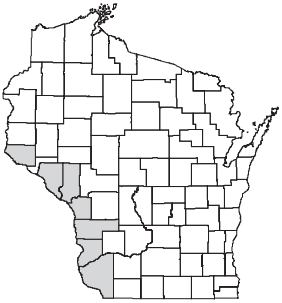
Federal Status: Not Listed
State Status: Threatened



WING SNAGGLETOOTH SNAIL

(Gastrocopta procera)

Federal Status: Not Listed
State Status: Threatened



WINGED MAPLELEAF MUSSEL

(Quadrula fragosa)

Federal Status: Endangered
State Status: Endangered

YELLOW SANDSHELL

[Slough Sandshell]
(Lampsilis teres)

Federal Status: Not Listed
State Status: Endangered

Insects

KARNER BLUE BUTTERFLY

Frosted Elfin Butterfly

(Incisalia irus)

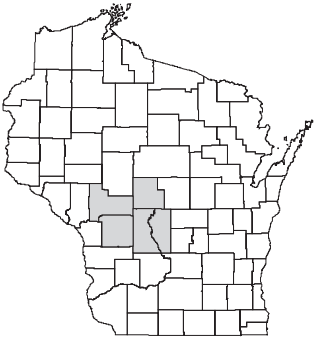
Federal Status: Not Listed
State Status: Threatened

Description: The frosted elfin is a small gray-brown butterfly, $^{7}/_{8}$ to $1\,^{1}/_{2}$ inches from forewing tip to forewing tip. The underside of the hindwing is primarily brown with light gray "frosting" on the outer portion. The wing is somewhat hooked on the bottom edge and includes a stubby tail with a black spot near its base. The underside of the forewing has a crooked white line.

Habitat: In Wisconsin, the frosted elfin inhabits oak/pine forest openings, edges, jack pine barrens and oak scrub areas. The larval (caterpillar) food plant, wild lupine (*Lupinus perennis*), grows where there is a partial canopy cover. The Karner blue butterfly and phlox flower moth may also be observed on these sites. The frosted elfin adult

lays its greenish-white or bluish-white eggs on lupine in mid May to early June, just before the peak of blooming. It spends the late spring and early summer as larvae on these same lupine plants. The frosted elfin overwinter as pupae in the surface leaf litter, or possibly underground.

Forestry Considerations: Limited timber harvest is compatible with, and perhaps even beneficial to, frosted elfin populations. Frosted elfin have been observed where there is moderate (not intensive) timber management and along timber lanes in oak barrens. Few frosted elfin have been found on a site within ten years of a burn. If fires are used to maintain openings in a wooded landscape, they should be applied on a rotational basis and always before May. Mowing after mid-summer (every year or every other year) and localized cutting and herbiciding of brush favor the frosted elfin and its habitat. Spraying of Bt for gypsy moth control will kill elfin larvae if the spray campaign is conducted while the elfin is in a susceptible life stage. It is best to avoid spraying sites where the frosted elfin butterfly or phlox flower moth are known to occur, or use gypsy moth-specific toxins.



Karner Blue Butterfly

(Lycaeides melissa samuelis)

Federal Status: Endangered
State Status: Not Listed

Description: The Karner blue butterfly is a native of the jack pine/oak barrens of central and northwestern Wisconsin. It has a one-inch wingspan and is colored deep blue above (in the male) or blue-brown with orange spots on the hindwing (in the female). It is distinguished by the lack of a tail and a band of prominent orange spots between pale blue iridescent spots along the entire margin of the underside of both the hind- and forewings. Similar species include the northern blue (found in northeastern Wisconsin and always associated with the shrub

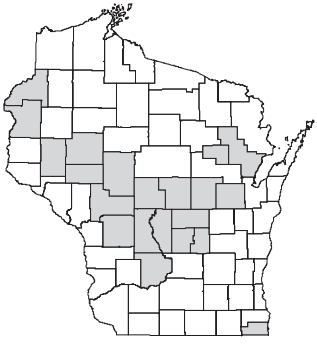
dwarf bilberry) and the Melissa blue (found in northwestern Wisconsin), which has prominent orange spots on the top of the forewing of the female.

Habitat: The Karner blue is always found close to its larval food plant, wild blue lupine (*Lupinus perennis*). Both can be found in savannas, open woodlands, jack pine/oak barrens and prairies where the soil is often sandy.

Forestry Considerations: Forestry activities that affect canopy closure will affect both wild lupine and Karner blue populations. The larval stage (caterpillar) of the Karner blue survives best on lupine in semi-shaded conditions; however, canopy closure of more than 75% leads to reduced, nonflowering lupine stands and fewer butterflies. A mixture of shaded and open sites providing both lupine and a diversity of nectar-producing plants throughout the summer months will benefit Karner blue butterflies. Winter, frozen ground, logging and the use of lighter-weight equipment is advised. Repeated use of the same skid trail is to be avoided as this can cause soil compaction and floristic changes. If it is necessary to conduct forestry activities during the growing season, protect lupine patches from disturbance. Retaining hardwood slash piles (< 2 feet high) can benefit this butterfly, as these areas may be

used for egg-laying. Creating and maintaining haul roads that connect Karner blue butterfly sites benefit the butterfly, as the roads could act as dispersal corridors. Herbicides, if needed, should be applied after August 31.

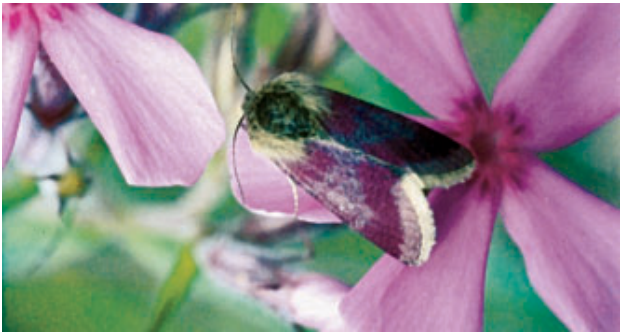
Detailed information on the effect of forestry practices on Karner blues can be found in *Forest Management Guidelines: Developing Management Plans Compatible with Karner Blue Butterfly Persistence*. Copies are available from the U.S. Fish & Wildlife Service Field Office in Green Bay (see Appendix II).



Phlox Flower Moth

(Schinia indiana)

Federal Status: Not Listed
State Status: Endangered

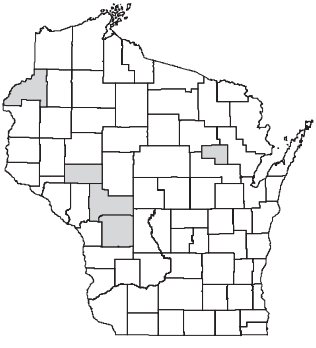


Description: The phlox flower moth, about 3/4 inch long, is a distinctive pink, day-flying moth about the same color as the downy phlox (*Phlox pilosa*) blossoms on which it rests. Close inspection of phlox blossoms in the cool of the day or on rainy or overcast days may reveal the moths on top of or hanging below the petals. The moths appear wedge-shaped with a lighter band near the outer edge of the wings. Large downy phlox patches hold the best chance of supporting phlox flower moth populations.

Habitat: The phlox flower moth occurs in sandy, scrub oak/pine barrens and prairies, and drier oak savannas, the same habitat in which

Karner blue butterflies and frosted elfin butterflies may be found. The food plant of the phlox flower moth is downy phlox, which thrives in barrens, savannas and along rights-of-way. The adult phlox flower moth lays its eggs on the flower buds of downy phlox; the larvae of the moth feed only on the developing seeds of this plant.

Forestry Considerations: Maintaining openings in oak savanna and jack pine/oak habitats through selective harvest of trees or prescribed burning would benefit the phlox flower moth. Burning should be conducted on no more than a 4- to 5-year rotation with no more than 20% to 25% of the area burned at any one time. If possible, include unplanted dispersal corridors in Christmas tree and other evergreen plantations that otherwise could pose as barriers to dispersal. Spraying of Bt for gypsy moth control will kill phlox flower moth larvae if the spray campaign is conducted while the phlox flower moth is in a susceptible life stage. If possible, avoid spraying sites where the frosted elfin butterfly or phlox flower moth are known to occur, or use gypsy moth-specific toxins.



Plants

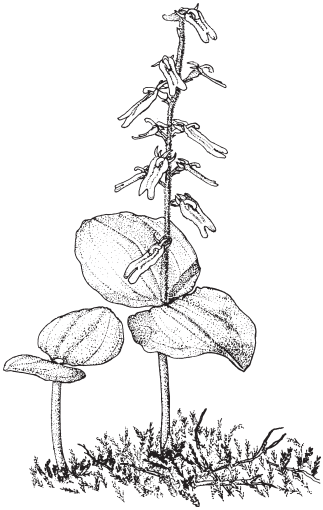
MOUNTAIN CRANBERRY

Auricled Twayblade

(Listera auriculata)

Federal Status: Not Listed
State Status: Endangered

Description: The auricled twayblade is a delicate orchid with a main stem about 8 inches tall bearing two blue-green oval leaves about a third of the way up from the base. The stem is hairy above but not below the leaves. Each stem bears around 15 tiny, green orchid flowers from late June to early August.



Habitat: Auricled twayblade plants grow in sandy-muck soil on alder shorelines. It is an orchid of cool climates, growing in Wisconsin near the shore of Lake Superior.

Forestry Considerations: Landowners along Lake Superior who clear beaches of alder and brush to keep an open view of the inland sea inadvertently destroy potential auricled twayblade habitat. Following *Wisconsin's Forestry Best Management Practices for Water Quality* would help protect this plant.

Beak Grass

(Diarrhena americana)

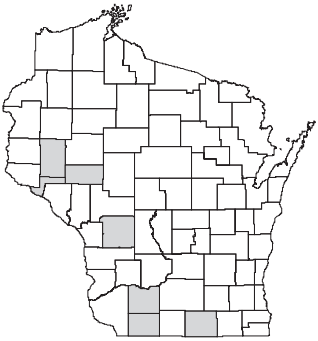
Federal Status: Not Listed
State Status: Endangered

Description: Beak grass grows about 3 feet tall with arching, dark green leaves which may be nearly 1 inch wide. The name "beak grass" comes from its fruits, which have a conspicuous blunt beak at the tip.

Habitat: This native Wisconsin plant is a perennial of wet woods, such as floodplain forests and shaded river banks. In some cases it also grows on the bank above the floodplain level.

Forestry Considerations: In those lowland woods where beak grass has been found, it is best to use single-tree or group-selection

silviculture conducted during the wintertime. Then the ground is solidly frozen and it is easier to avoid damaging this grass.



Blue-stemmed Goldenrod

(Solidago caesia)

Federal Status: Not Listed
Status: Endangered

Description: The blue-stemmed goldenrod gets its name from the blue-gray hairless stem which is covered with a waxy film. Sharply toothed, lance-shaped leaves, about 1 inch wide and 4 inches long, alternate along the stem. Small yellow flowers cluster at the bases of these leaves and at the plant's summit. The plant grows about 3 feet tall. It has a short, thick underground stem and fibrous roots.

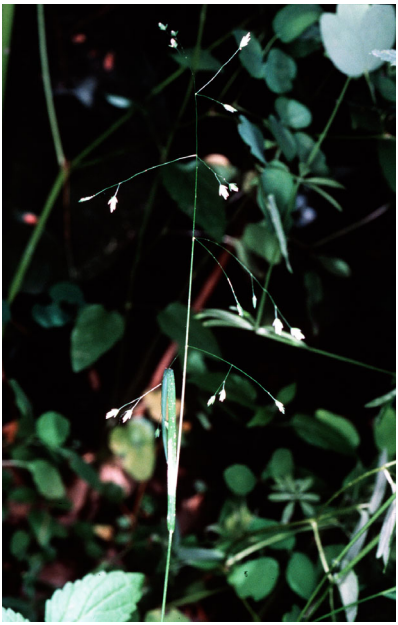
Habitat: This extremely rare yellow wildflower occurs in southeastern Wisconsin's deciduous forests.

Forestry Considerations: Blue-stemmed goldenrod lives in the shade of deciduous forests. Single-tree or small group-selection harvest, that allows the forest canopy to remain essentially intact, would be the technique most compatible with the continued existence of this rare wildflower.

Bog Bluegrass

(Poa paludigena)

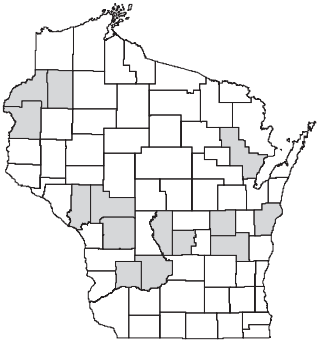
Federal Status: Not Listed
State Status: Threatened



Description: Bog bluegrass has slender, weak stems from 10 to 20 inches tall that are round and hollow, and have nodes where the leaves are attached. The leaves are slender, measuring about $^{1}/_{16}$ inch wide and 4 inches long. The flowers are small and inconspicuous; a hand lens is required for accurate identification. The little scales called lemmas that surround the even smaller flowers, are webbed at their bases and have hairs on them. Bog bluegrass grows in clumps; it does not have underground stems or runners from which new plants grow.

Habitat: Sometimes called marsh bluegrass because of its affinity for wet places, bog bluegrass is found in wet, mossy woods, along springs and in tamarack bogs. At such places the soil is soggy and "springy." In addition to tamarack, bog bluegrass often is found with black ash, yellow birch, poison sumac, cinnamon fern and/or skunk cabbage.

Forestry Considerations: This plant is particularly sensitive to alterations in soil hydrology. Any change in water level, including either flooding or drainage, should be avoided. Forestry activities should include leaving enough of the surrounding swamp forest for shade and natural regeneration. Following the recommendations in *Wisconsin's Forestry Best Management Practices for Water Quality* is advisable.



Braun's Holly Fern

(Polystichum braunii)

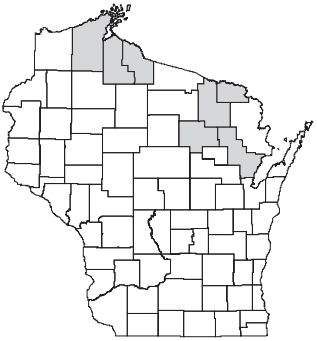
Federal Status: Not Listed
State Status: Threatened

Description: Braun's holly fern is distinctive among ferns. It grows in clumps from short, scaly rootstocks. The fronds (fern leaves) are a lustrous dark green and feather-shaped, tapering at both ends from a wide middle. The frond's midrib also resembles the rib of a feather. The midrib of the fern is chaffy with light brown papery scales. The undersides of the frond leaves are pale green and dotted with clusters of rust-colored spores which ripen in mid-summer.

Habitat: Braun's holly fern grows in the shade of rich woods, along rocky streambanks, in

glades, on shaded rock slides and among the shattered rocks in ravines. It prefers soil with abundant organic matter. In Wisconsin, this unusual fern has been found only in northern counties.

Forestry Considerations: Single-tree selection silviculture which maintains a closed canopy is compatible with the continued existence of Braun's holly fern. Clearcut harvest or heavy thinnings that open the canopy should be avoided.



Broad-leaved Twayblade

(Listera convallarioides)

Federal Status: Not Listed
State Status: Threatened

Description: Broad-leaved twayblade is a dainty orchid, only 4 to 8 inches tall. Two round leaves are paired opposite each other at mid-stem. Below the leaves, the stem is hairless; while above, it is coated with glandular hairs. The flowers are pale, yellow-green, almost translucent. The fruit capsules also are hairy.

Habitat: Broad-leaved twayblade requires cool soils and grows in the humus of moist,

deciduous and mixed coniferous-hardwood forests, often near the edges of swamps. It prefers mossy, springy areas and high humidity.

Forestry Considerations: Selective harvest that leaves most of the forest canopy intact is probably compatible with the continued existence of broad-leaved twayblade. Harvest should occur in winter when the soil is frozen. Employing *Wisconsin's Forestry Best Management Practices for Water Quality* would help protect this plant and its habitat.

Calypso Orchid

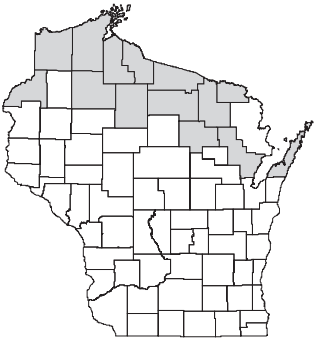
(Calypso bulbosa)

Federal Status: Not Listed
State Status: Threatened

Description: The calypso orchid is a delicate flower that grows about 8 inches tall. Its blossom is shaped somewhat like a slipper, with purple side petals and a white or yellow lip. A solitary broad, pointed, evergreen leaf emerges in late August and remains through winter. The calypso orchid blossoms from late May through early July.

Habitat: The calypso orchid is found mainly in mature conifer forests, especially in mossy swamps dominated by white cedar. In Wisconsin, it has been seen only in the northern counties of the state.

Forestry Considerations: The calypso orchid is intolerant of canopy loss. Therefore, single-tree selection would be the preferred forestry technique in areas where this orchid grows.



Carey's Sedge

(Carex careyana)

Federal Status: Not Listed
State Status: Threatened

Description: This sedge grows in tufts or clumps 1 to 1 1/2 feet tall. The stems are triangular and purple at their bases. The leaves

are 8 to 14 inches long and 1/4 to 1/2 inch wide, evergreen and bright green. From the center of the clump grow spikes, some male and others female, bearing tiny green flowers. The female flowers develop sharply three-angled seeds, each 1/4 inch long and enclosed in a small specialized leaf with many veins. A hand lens is required to identify this plant properly.

Habitat: This sedge occurs in rich, hardwood forests.

Forestry Considerations: Carey's sedge requires shade to grow well. Therefore, in forests where it grows, single-tree selection silviculture is preferred.

Drooping Sedge

(Carex prasina)

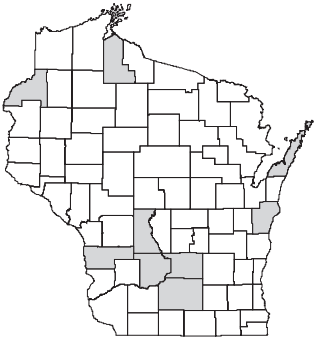
Federal Status: Not Listed
State Status: Threatened

Description: Sedges at first glance resemble grasses, but upon closer examination prove to have some significant differences. For example,

their stems are solid, have no joints and often are markedly triangular. Drooping sedge grows in tufts or dense tussocks about 10 to 24 inches tall. Each stem has several long clusters of minute flowers, the terminal (topmost) spike usually has only male flowers with stamens. The flowers are so small that a hand lens is necessary to see the identifying characteristics.

Habitat: Drooping sedge grows in wet, marshy wooded areas and along streambanks. These sites sometimes remain constantly wet due to springs and seeps. Yellow birch, black ash and skunk cabbage are frequent associates.

Forestry Considerations: Single-tree selection silviculture is the most compatible harvest technique where this sedge grows. Forestry activities that would change the water table in areas where the drooping sedge grows should be avoided, and *Wisconsin's Forestry Best Management Practices for Water Quality* should be followed.



Dwarf Lake Iris

(Iris lacustris)

Federal Status: Threatened
State Status: Threatened

Description: The dwarf lake iris blossoms from early May through the beginning of June. The large flowers of this iris, 3 inches in diameter, are dark blue to purple, with bright yellow crests that decorate the three main petals. The flat, parallel-veined leaves are arranged in fans and grow to about 6 inches in height. This plant often grows in colonies.

Habitat: This beautiful, diminutive iris may be found along the northern shores of the Great Lakes. The dwarf lake iris thrives in the cool, moist air blowing off the Great Lakes. It prefers

the thin, moist, sandy or rocky soil near the shores, and the partial shade of the northern forests. It is often associated with white cedar, paper birch and balsam fir.

Forestry Considerations: Care should be taken not to destroy colonies of the dwarf lake iris because it reproduces primarily vegetatively. Although the plant readily flowers and occasionally sets seed, it rarely sprouts from seed. Because the iris needs just the right combination of sun and shade to grow, major habitat modification should be avoided. Selective harvest techniques that create a mixture of sunny and shady areas are ideal. Wintertime logging is preferred. The use of insecticides and herbicides should be restricted within 100 feet of iris colonies.

Fire Pink

(Silene virginica)

Federal Status: Not Listed
State Status: Endangered

Description: Fire pink is a short-lived perennial that grows 8 to 32 inches tall. The five-petaled, crimson-red flowers appear in early summer. The flowers are about 1 to 1 1/2 inch in diameter, and each petal is notched at its tip. The smooth-edged leaves occur in pairs on the stem. The largest leaves measure 3/4 by 4 inches, and the upper leaves are smaller.

Habitat: Fire pink inhabits rich, moderately moist, deciduous woods. Such woods may be home to basswood, wild black cherry, walnut

and elm trees. Sometimes fire pink also is found in more open woods and on rocky slopes.

Forestry Considerations: Since fire pink tolerates light shade (60% to 70% closed canopy), single-tree selection silviculture is compatible with the growth of this plant. Winter harvest, when the ground is solidly frozen and the fire pink is dormant, is preferred.

Foamflower

(Tiarella cordifolia)

Federal Status: Not Listed
State Status: Endangered

Description: Foamflower is well-named. Where the plants grow in large groups, the clusters of tiny white flowers look like foam floating across the forest floor. Each plant grows 4 to 6 inches tall, with broad, heart-shaped, coarsely toothed leaves arising from the base. Dozens of tiny five-petaled flowers form an oval cluster at the top of the plant. It blooms from April to mid-July. Foamflower spreads by means of stolons (horizontal stems) creeping along the soil surface.

Habitat: The shady floor of mixed hardwood forests in northeastern Wisconsin is foamflower's preferred habitat. It grows where the soil is evenly moist, and where abundant fallen leaves and twigs decompose, producing soil that is rich in organic matter.

Forestry Considerations: In woodlands where foamflower grows, logging should be minimized. Removal of the shading canopy overhead would result in reduced humidity, desiccation of the soil and loss of this rare wildflower. Therefore, winter harvest along with single-tree selection silviculture is favored.

Forked Aster

(Aster furcatus)

Federal Status: Not Listed
State Status: Threatened

Description: The forked aster is an early fall-blooming wildflower that grows 1 to 3 feet tall. From August through September it is crowned by flat-topped or rounded clusters of white flowers, each blossom 1 to 1 1/2 inches in diameter. With age, the flowers may take on lilac to rosy tones. Below the flowers are a series of jagged-edged leaves, rough on top and smooth below. Upper leaves are oval; lower leaves are heart-shaped.

Habitat: It may be found in southeastern Wisconsin at the edges of mixed oak woods and often near streams under semi-open canopy.

Forestry Considerations: The forked aster actually thrives in places of moderate disturbance, such as forests that have undergone selective cutting. Clearcutting and severe habitat modification should be avoided. Winter harvest, when the ground is solidly frozen, will minimize impact to this species. Following *Wisconsin's Forestry Best Management Practices for Water Quality* would provide additional protection.

Goblin Fern

(Botrychium mormo)

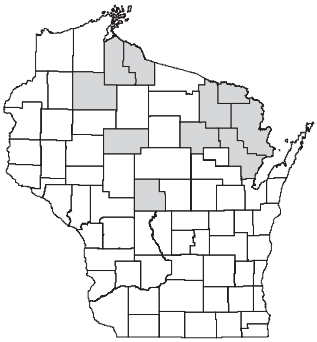
Federal Status: Not Listed
State Status: Endangered

Description: The goblin fern is a tiny, succulent fern, about 3 1/2 inches tall, that can be identified by its yellowish-green leaves. This fern is inconspicuous because it doesn't always rise above the leaf and twig litter of the forest floor.

Habitat: The goblin fern is often associated with nutrient-rich sites in northern hardwood and sugar maple forests.

Forestry Considerations: Unfortunately, little is known about the effects of forestry on the goblin fern. It is recommended that in forests where the plant has been discovered, a botanist

or the Wisconsin Bureau of Endangered Resources be contacted prior to initiating forestry activities. The fern is not easily seen and is very susceptible to trampling.



Great White Lettuce

(Prenanthes crepidinea)

Federal Status: Not Listed
State Status: Endangered

Description: Great white lettuce grows 3 to 6 feet tall before flowering in late summer. Nodding clusters of creamy to green flowers form at the summit of the plant; their outside bracts (small, specialized leaves at the base of

the flower cluster) are tipped with black. The largest leaves at the base of the plant can measure 8 inches by 10 inches, and are coarsely toothed. The upper leaves are smaller and have fewer teeth. All leaves are unlobed.

Habitat: Moist deciduous woods, especially floodplain forests, are the favored habitat of great white lettuce. It also is sometimes found along streambanks, in thickets at the edges of woods, or even in prairies.

Forestry Considerations: Because great white lettuce appears to tolerate some direct sun, single-tree selection and group-selection silviculture probably are compatible with its continued existence. Following the guidelines in *Wisconsin's Forestry Best Management Practices for Water Quality* would benefit this species.

Handsome Sedge

(Carex formosa)

Federal Status: Not Listed
State Status: Threatened

Description: Handsome sedge grows in tufts or clumps 1 to 2 feet tall, its stems purple at their bases. The main leaves are slender, 1/8 to 1/4 inch wide and hairy on their underside. From the

center of the clump of leaves arises a stem on which the small greenish flowers are borne. The seeds that ripen from female flowers are about $^1/_4$ inch long and $^1/_8$ inch wide, with three sharp lengthwise ridges. A good hand lens or dissecting microscope helps when identifying sedges.

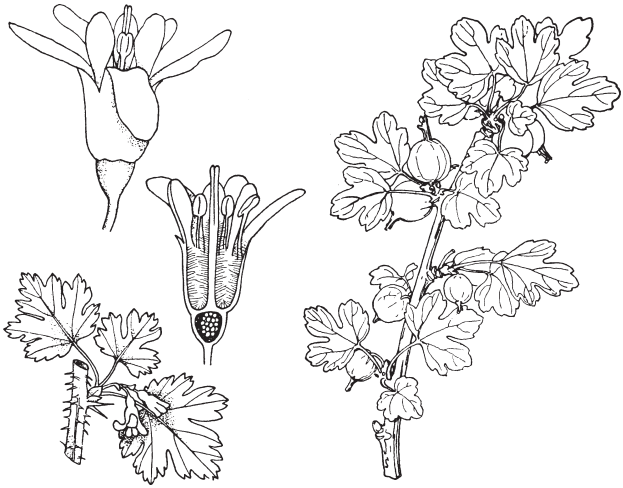
Habitat: Handsome sedge grows in moist calcareous soil in deciduous woods and thickets. Also, it is sometimes found in meadows.

Forestry Considerations: Handsome sedge prefers sites with light, dappled shade. Selective tree harvest that maintains this level of shade is compatible with the continued existence of this rare sedge.

Hawthorn-leaved Gooseberry

(Ribes oxyacanthoides)

Federal Status: Not Listed
State Status: Threatened



Description: In spring the hawthorn-leaved gooseberry shrub bears small, white, tubular, bell-shaped flowers singly or in groups of two or three. Spines occur where the flower stem meets the branch. Young branches are yellow-gray and slightly hairy; older branches are reddish-brown and smooth with peeling strips of gray bark. Arching branches may take root when they touch the ground, producing new plants. The leaves of this shrub resemble miniature maple leaves.

Habitat: Hawthorn-leaved gooseberry is a shrub of cool, rocky sites. In Wisconsin it grows in four northwestern counties on "shattered-rock" slopes and at low sites where cold air collects.

Forestry Considerations: Trees growing near hawthorn-leaved gooseberry plants may be lightly thinned, as long as the forest canopy remains relatively intact. This rare shrub is adapted to light shade and the cool air of shady sites. Farther from the site, selective harvest would be compatible with the continued survival of the hawthorn-leaved gooseberry.

Hop-like Sedge

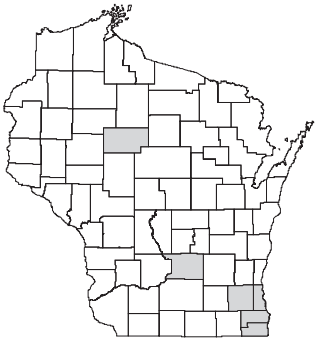
(Carex lupuliformis)

Federal Status: Not Listed
State Status: Threatened

Description: Hop-like sedge is among the largest of the Wisconsin sedges, growing to 20 inches tall. It is a lush, leafy, grassy sedge with fruits and flowers encased in husk-like sacs called "perigynia." The seeds, called "achenes," are three-sided with thick knobs on the edges.

Habitat: Hop-like sedge grows in mature river bottom or floodplain forests. In these and other forests, it may be found near temporary woodland pools.

Forestry Considerations: Selective harvest of trees in floodplain forests may be compatible with the continuation of hop-like sedge, providing that the woodland pools do not dry up rapidly.



Intermediate Sedge

(Carex media)

Federal Status: Not Listed
State Status: Endangered

Description: Intermediate sedge grows in dense tufts from 1 foot to over 2 feet tall, with many soft leaves clustered at its base. Its flowers, which bloom in late May to mid-June, are packed into tight heads at the tips of their stems. This sedge's most notable feature is the ebony scale beneath each flower which gives the plant a striking appearance.

Habitat: This sedge commonly grows in calcareous, rocky woods and shores from

Labrador to Alaska. Its presence in Wisconsin is surprising. This species thrives in the cold. Such conditions prevail in the algific talus slopes (sloping rock piles through which cold air flows) of Grant County.

Forestry Considerations: Harvesting trees in or around the talus slopes where this sedge occurs would remove the cool shade that it requires to survive. Where possible, maintain a 200-foot forested buffer around such sites.

Kitten Tails

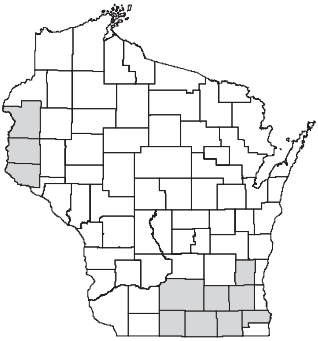
(Besseya bullii)

Federal Status: Not Listed
State Status: Threatened

Description: Kitten tails are identified by their low-lying, basal rosette of hairy, oval leaves with small teeth, and long stems. From April to late May, each plant sends up an 8- to 16-inch spike of numerous yellow flowers. Kitten tails usually are found in small scattered patches.

Habitat: Kitten tails are typically found in mixed oak forests, woodlands and savannas, or on the edges of forests in sandy or gravelly, well-drained soil.

Forestry Considerations: Forestry is compatible with the survival of Kitten tails unless there is severe habitat modification or disturbance. This plant is susceptible to excessive canopy closure and erosion. Single-tree or group-selection silviculture in oak forests that results in small scattered openings is desirable. Logging during the winter months would be preferred.



Lapland Rosebay

(Rhododendron lapponicum)

Federal Status: Not Listed
State Status: Endangered

Description: Lapland rosebay is a small (4 to 12 inches tall), scraggly evergreen shrub. The upper surface of the dark green leaves is dotted with waxy scales. Showy, pink-violet azalea-like blossoms appear in June. In the center of each flower is a cluster of bright yellow anthers.

Habitat: Lapland rosebay has been found in only two sites in southwestern Wisconsin, and both of these sites are shaded sandstone cliffs. The shrub sprawls along the rock face, its roots reaching into crevices in the rock to gain support, moisture and nutrients.

Forestry Considerations: Trees in the immediate vicinity of this plant that shade the cliffs where it grows should not be harvested. Using single-tree selection silviculture in adjacent forests probably would be compatible with this shrub. Care should be taken to avoid physical damage to the cliffs where the Lapland rosebay occurs.

Large-leaved Sandwort

(Moehringia macrophylla)
or
(Arenaria macrophylla)

Federal Status: Not Listed
State Status: Endangered

Description: Large-leaved sandwort has shiny, inch-long tapering leaves that are staggered on the stem in opposite-facing pairs. Ranging from 3 to 5 inches tall, this inconspicuous sandwort develops terminal sprays of tiny, white flowers from May to August. This plant is a perennial and often forms colonies by spreading underground rhizomes.

Habitat: Large-leaved sandwort occurs mainly in dry or moist woodlands and on stony slopes. One Wisconsin site consists of mossy crevices between igneous rocks, a type of rock

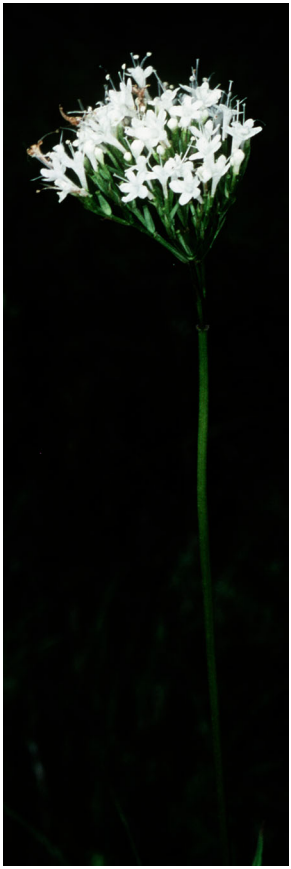
uncommon in Wisconsin. Also, it is sometimes found on shores.

Forestry Considerations: Because of the fragile nature of large-leaved sandwort, harvest of the trees in the immediate area of the plant, and disturbance to the plant should be avoided. If possible, known locations should be marked and protected from logging activities. Winter harvest using single-tree selection or group-selection silvicultural techniques are preferred.

Marsh Valerian

(Valeriana sitchensis)
sometimes
(Valerian uliginosa)

Federal Status: Not Listed
State Status: Threatened

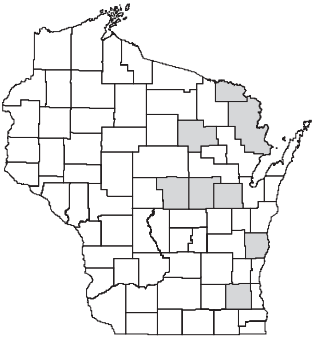


Description: Marsh Valerian is a perennial native plant with clusters of white flowers borne on the tips of its stems. The plant can reach a height of 3 feet or more. The basal leaves have broad blades, but the stem leaves are divided and appear in pairs.

Habitat: Growing in various habitats, the marsh valerian may be found in moist northern woods, bogs and swamps, as well as in openings and wet meadows. In Wisconsin, it is often

found in association with tamarack and white cedar.

Forestry Considerations: Activities that would change the moisture levels in soils within several hundred feet of this rare plant should be avoided. Clearcutting, tilling, ditching or significantly modifying the soil surface with bulldozers or backhoes is not advisable. Single-tree selection or group-selection silviculture likely is compatible with the continued existence of marsh valerian. Avoid harvesting of white cedar, as such sites often revert to alder thickets, a habitat not suitable for this valerian.



Moonwort

(Botrychium lunaria)

Federal Status: Not Listed
State Status: Endangered

Description: Moonwort is a tiny, rubbery, almost-white fern that grows from 1 to 6 inches tall. About halfway up the stem the plant splits into two branches, one containing three to five pairs of fan-shaped leaflets, and the other bearing rust-colored spore cases.

Habitat: In Wisconsin, moonwort is found in cool northern hardwood forests. It also grows on the edges of shrub stands or red cedar woodlands, near native prairies, in open prairies and dunes.

Forestry Considerations: Moonwort is fragile and especially susceptible to trampling. Where moonwort has been found, care should be taken to avoid disturbing the habitat, especially during the growing season. Selective harvest of trees during the winter can be compatible with the continued existence of moonwort.

Mountain Cranberry

(Vaccinium vitis-idaea)

Federal Status : Not Listed
State Status: Endangered

Description: Mountain cranberry is a loose-formed, low-growing shrub, often no more than 6 inches tall. Its small, oval, evergreen leaves are $^1/_2$ to $^3/_4$ inch long; the leaves' undersides are bristled with black hairs. Its small, white, bell-shaped flowers appear in spring. Bright red edible fruits ripen in mid- to late summer. Mountain cranberry is also called cowberry or lingonberry.

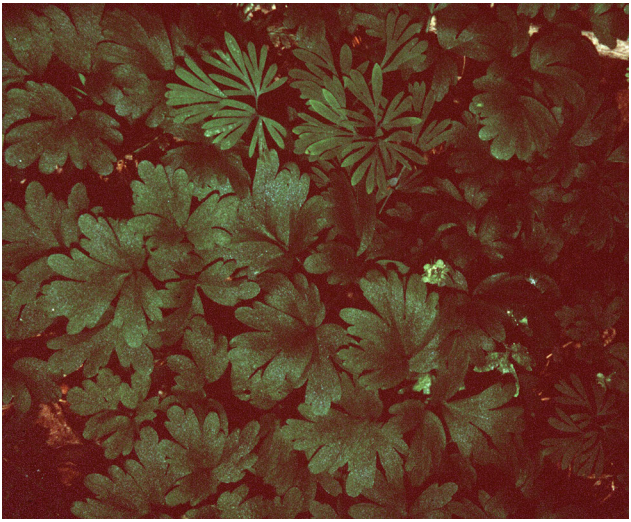
Habitat: This acid-loving shrub may be found clinging to cliffs and rocky places where there are peaty soils. It grows in similar soils in bogs. The same species grows in Scandinavia in similar habitats.

Forestry Considerations: Harvesting trees near the cliffs where this shrub is found could alter the habitat, changing the moisture level in the soil or the humidity in the air. Physical disturbance of the cliff face (by log skids, sawdust or debris) should be avoided. Following the practices described in *Wisconsin's Forestry Best Management Practices for Water Quality* should protect this plant in its bog habitats.

Muskroot

(Adoxa moschatellina)

Federal Status: Not Listed
State Status: Threatened

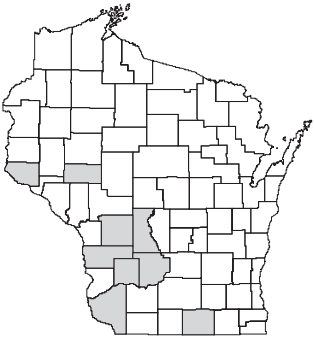


Description: Muskroot is an inconspicuous plant, except for the shiny quality of the three-parted leaves. In June, its greenish-yellow flowers form a cluster at the end of a slender stalk. This plant usually grows in small perennial colonies. On average the plant reaches only 3 to 5 inches in height.

Habitat: This rare wildflower is found in shaded, moist woods, often under hemlock, white pine or birch. These cool woods are often

associated with north-facing cliffs in Wisconsin's "Driftless" area.

Forestry Considerations: Single-tree selection silviculture is preferred in the immediate vicinity of muskroot populations. This technique will not significantly alter the shade levels and cool, moist air that the muskroot favors. Winter tree harvest is preferred, because muskroot is susceptible to damage by trampling, digging, log skidding and erosion.



Northern Comandra

(Geocaulon lividum)

Federal Status: Not Listed
State Status: Endangered

Description: Northern comandra has branched stems up to a foot tall with smallish, green flowers growing in groups of 3 from stem/leaf axils. Its brilliant scarlet fruits attract birds which readily eat them and scatter the seeds. Northern comandra grows in large colonies.

Habitat: This rare wildflower grows on sandy beach ridges and old dunes, partly shaded by conifer woods. In Wisconsin, northern comandra has been found only in Door County. In other states, northern comandra is also found

in moist woods, cedar-spruce swamps and heath bogs. It is a harmless parasite on roots of pine trees.

Forestry Considerations: Forests where northern comandra occurs may be thinned selectively. This might, in fact, encourage the wildflower, which prefers partial shade. Such thinning should be done in midwinter when the ground is frozen solidly and the plant is dormant.

Northern Monkshood

(Aconitum noveboracense)

Federal Status: Threatened
State Status: Threatened

Description: When mature, this wild plant reaches a height of almost 3 feet. In mid-summer the northern monkshood sports a spire of twilight-blue flowers. Each one is shaped like a helmet or hood—hence the plant's name. A single flower stalk may have as many as 15 blossoms held above broad, coarsely toothed, lobed leaves.

Habitat: It thrives and reproduces well on or near the bases of cool, shady, moist cliffs in

southwestern Wisconsin. The moisture on such cliffs results from underground water seeping to the rock surface. Composed of limestone or sandstone, these cliffs are usually north-facing and often found along small streams or rivers.

Forestry Considerations: Trees that provide the required shade for the monkshood and the surrounding cliff habitat should not be harvested. Single-tree selection silviculture in the area surrounding these sites generally will have little effect on the survival of this rare wildflower. Clearcutting is not advisable, as it would reduce the humidity of the air and increase the likelihood that winds would dry out the cliff face. Forestry activities in such woods should be limited to the November-to-March winter season. Following *Wisconsin's Forestry Best Management Practices for Water Quality* would be beneficial.

Pine-drops

(Pterospora andromedea)

Federal Status: Not Listed
State Status: Endangered

Description: Pine-drops has a sturdy, hairy, fleshy-pink stem which grows up to 3 feet tall. From June to August, nodding, bowl-shaped, white to reddish flowers droop from the upper half of the stem. The flowers mature into fruiting capsules, each of which can produce 4,800 minute, winged, wind-spread seeds. This means a single plant can produce as many as 600,000 seeds! The lower part of the stem bears numerous short, tan to pink scales. This plant has no green leaves.

Habitat: Usually this plant is found in humus-rich forests under white pine trees in eastern Wisconsin. In parts of its range, pine-drops can be found in hardwood forests. It

does not produce any chlorophyll, relying instead on dead organic matter for food. Underground, it has a massive snarl of branching roots which, in partnership with various soil fungi, absorb nutrients from decaying plant and animal matter.

Forestry Considerations: It is important to maintain the shaded character of the mixed woods where pine-drops live, along with the humus-rich, loose soil found there. Therefore, single-tree selection silviculture is advisable, along with the use of equipment that does not compact the soil. Spring and summer harvest of trees will disturb or crush growing, flowering and fruiting plants. Winter harvest, when the soil is solidly frozen and the plant is dormant, is best.

Purple Milkweed

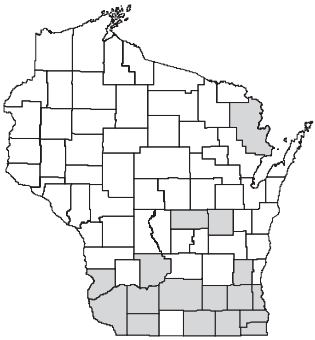
(Asclepias purpurascens)

Federal Status: Not Listed
State Status: Endangered

Description: Purple milkweed grows to a height of 2 to 4 feet tall. It has a smooth stem, and paired tapering leaves with no teeth. Clusters of small purple or pink flowers develop in June or July. Typical of other milkweed flowers, its petals bend back toward the stem. In the fall the plant develops seed pods containing many seeds with fluffy tails.

Habitat: This native milkweed grows in oak forests in partial shade. In addition, it has been seen growing in oak savannas, oak openings in partial shade, and even along some roadsides where similar conditions prevail.

Forestry Considerations: Care should be taken to avoid disturbance of purple milkweed by machinery and the construction of roads. Logging should be done when the ground is frozen, leaving some trees to provide the partial shade this wildflower requires.



Ram's-head Lady's-slipper

(Cypripedium arietinum)

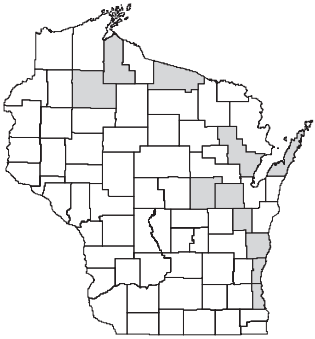
Federal Status: Not Listed
State Status: Threatened

Description: The ram's-head lady's-slipper has broad shiny leaves with conspicuous lengthwise folds. It flowers in late May or early June, and may reach 6 to 12 inches tall. Each blossom consists of three separate, petal-like sepals and true petals on the side, all greenish-brown, and a pinkish inflated petal below.

Habitat: This rare Wisconsin orchid is usually found in cool coniferous swamps and bogs, as well as in white cedar swales, all in the northern and northeastern parts of the state. In addition,

it is found, rarely, in the pine/aspen/spruce uplands of Ashland County.

Forestry Considerations: Ram's-head lady's-slipper is intolerant of disturbance, especially erosion and trampling. Single-tree or group-selection silviculture in wintertime would be preferred in areas where this native orchid occurs.



Small Round-leaved Orchis

(Amerorchis rotundifolia)

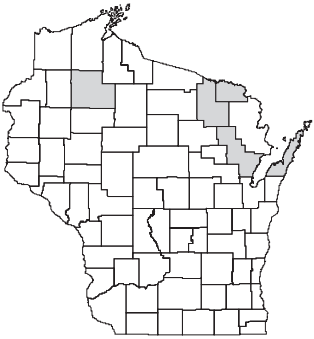
Federal Status: Not Listed
State Status: Threatened

Description: The small round-leaved orchis is identified by the single, round basal leaf, 1 1/2 to 4 inches long, and an erect flower stalk (6 to 17

inches tall) with five or more pinkish, orchid-like flowers with dark purple spots on the lip. These flowers appear in early to mid-summer.

Habitat: This wild orchid occurs mainly in swamps, or forests bordering swamps, and bogs. These conifer swamps are characterized by tamarack, cedar, balsam fir and spruce.

Forestry Considerations: This rare, beautiful wildflower is especially intolerant of canopy removal and soil compaction. Care should be taken to avoid habitat modification and to limit disturbance where the plant is known to occur.



Small Shinleaf

(Pyrola minor)

Federal Status: Not Listed
State Status: Endangered

Description: Only 8 inches tall, small shinleaf has waxy, evergreen leaves that are round, thick, and hairless. Most of the leaves originate at the base of the plant. In June to early August, small shinleaf produces 10 to 12 pale pink, nodding, globe-like blossoms on a single stalk.

Habitat: Small shinleaf grows in high-quality boreal forests. Such forests are characterized by acid soil and a variety of coniferous tree species. Cool summers, high humidity and abundant winter snow cover are typical in this habitat.

Forestry Considerations: True boreal forests are quite rare in Wisconsin. They are found only near the shore of Lake Superior and to a lesser extent on the Door County peninsula. Single-tree selection silviculture would be best to maintain the cool temperatures and high humidity that the small shinleaf requires.

Smith Melic Grass

(Melica smithii)

Federal Status: Not Listed
State Status: Endangered

Description: Smith melic grass stems reach a height of 1 1/2 feet to 3 1/2 feet. The leaves are slender and rough, like fine sandpaper. It blooms in June and July with three to six small greenish-purple flowers arranged in spikelets.

Habitat: In Wisconsin, Smith melic grass has been located only in sugar maple forests in Ashland County.

Forestry Considerations: When working in Ashland and adjacent counties, one should keep an eye out for this rare grass. Where it is

found, harvesting of sugar maple trees should be done sparingly (single-tree selection silviculture) and preferably when the ground is frozen.

Snow Trillium

(Trillium nivale)

Federal Status: Not Listed
State Status: Threatened

Description: Snow trilliums are the earliest of the trilliums to flower in Wisconsin woodlands. Their snow-white blossoms appear from mid-March to mid-April. Growing only 5 inches tall, with blossoms little more than 1 inch in diameter, this wildflower reminds some people of a miniature version of the more common large white trillium. Like all members of the group, this rare trillium has three leaves per stalk.

Habitat: Snow trillium grows in rich calcareous soils in beech/maple/basswood and red oak forests. In Wisconsin, this rare trillium grows in only a few counties in the southeastern and western parts of the state.

Forestry Considerations: Woodlot grazing has eliminated many populations in the state. Single-tree selection and small group-selection silviculture may be compatible with the survival of this wildflower. Such harvest should take place only in the winter when the forest soil is solidly frozen. Avoid late winter or spring logging.

Squashberry

(Viburnum edule)

Federal Status: Not Listed
State Status: Endangered

Description: This 3-foot-tall shrub grows in sprawling clumps on a thin layer of fallen leaves and organic debris. The shrub's paired, lobed leaves, except for those at the tips of branches, resemble maple leaves. The leaves at the tips of the branches are not lobed. Bouquets of white, star-shaped fragrant flowers bloom in early May. These are followed by juicy, red, edible fruits.

Habitat: Squashberry requires the cool, moist conditions of shaded rocky sites, including quartzite talus slopes. It may be found growing

in the cracks of stony cliffs. The humus-rich soil that sometimes accumulates in such situations is chilled by cool air drifting downslope between the rocks.

Forestry Considerations: Mature deciduous trees help to maintain the cool, moist conditions that squashberry requires. Single-tree selection silviculture is preferred. This technique maintains a closed canopy, preventing drying and warming of the soil.

Western Jacob's Ladder

(Polemonium occidentale* var. *lacustre)

Federal Status: Not Listed
State Status: Endangered

Description: The leaves of western Jacob's ladder arise both from the base of the plant and from the flower stems; they are compound, made up of 9 to 13 paired, slender leaflets. Each leaflet is about 1 inch long, while the whole leaf (stem plus leaflets) may be 6 inches long and 2 inches wide. The entire plant is slightly more than 2 feet tall. The five-petaled blossoms of western Jacob's ladder appear in late June to early July. Each flower is about 1/2 inch in diameter, a bright violet-blue fading to white in

the interior. The flowers occur in spreading clusters. The underground part of western Jacob's ladder has a slender, horizontal, creeping rootstock, quite different from the common Jacob's ladder.

Habitat: Wet, open sites amidst black spruce, white cedar and tamarack are good habitat for western Jacob's ladder. Labrador tea, bead lily, swamp saxifrage and wild calla are also good indicators of suitable habitat.

Forestry Considerations: Where western Jacob's ladder occurs, it would be advisable to maintain the openings that the plant prefers. "Strip cutting" has proven to be compatible with western Jacob's ladder. Tree harvest should occur only when the ground is solidly frozen. The ground water levels should not be altered.

Yellow Giant Hyssop

(Agastache nepetoides)

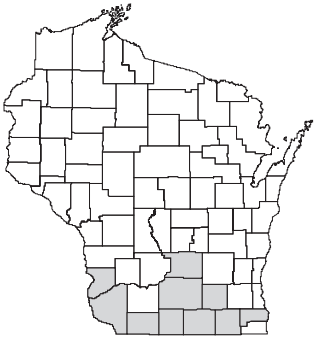
Federal Status: Not Listed
State Status: Threatened

Description: The yellow giant hyssop grows about 3 feet tall, bearing thin, toothed, egg-shaped leaf blades on short stems. The plant's

stalk branches toward the top of the plant. From July through October this hyssop bears a heavy spike of numerous small yellowish flowers.

Habitat: Yellow giant hyssop inhabits open oak or mixed oak forests.

Forestry Considerations: Where the yellow giant hyssop occurs, single-tree selection or group-selection silviculture is favored, as these techniques will not greatly alter the balance of light and shade that this plant requires. Management for oaks is preferred to prevent succession to moist hardwood forest. Clearcutting and/or summer cutting of trees near these plants should be avoided.



Appendix I

Wisconsin Counties and the Federally and State-listed Species Known to Occur in Them

This guide does not include all federally or state-listed species that occur in Wisconsin, only those that are likely to be affected by logging or other forest practices. For a complete list of protected species, contact the Wisconsin Bureau of Endangered Resources (see Appendix II). The following icons are used to identify species groups:

Mammals, Birds,
Reptiles and Amphibians, Fish,
Mussels and Snails, Insects, Plants.

ADAMS Bald Eagle, Cerulean Warbler, Great Egret, Hooded Warbler, Osprey, Red-shouldered Hawk Western Slender Glass Lizard, Wood Turtle Frosted Elfin Butterfly, Karner Blue Butterfly Bog Bluegrass

ASHLAND American Pine Marten, Timber Wolf Bald Eagle, Cerulean Warbler, Osprey, Spruce Grouse Wood Turtle Purple Wartyback Braun's Holly Fern, Broad-leaved Twayblade, Calypso Orchid, Drooping Sedge, Goblin Fern, Hawthorn-leaved Gooseberry, Large-leaved Sandwort,

Moonwort, Mountain Cranberry, Ram's-head Lady's-slipper, Smith Melic Grass

BARRON Bald Eagle, Cerulean Warbler, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Greater Redhorse, Ozark Minnow, Pugnose Shiner Hawthorn-leaved Gooseberry, Squashberry

BAYFIELD American Pine Marten, Timber Wolf Bald Eagle, Cerulean Warbler, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Pugnose Shiner Auricled Twayblade, Braun's Holly Fern, Broad-leaved Twayblade, Calypso Orchid, Mountain Cranberry, Small Shinleaf

BROWN Cerulean Warbler, Great Egret Wood Turtle Greater Redhorse, Longear Sunfish Cherrystone Drop Snail, Midwest Pleistocene Vertigo Snail Dwarf Lake Iris, Foamflower, Handsome Sedge, Snow Trillium

BUFFALO Bald Eagle, Bell's Vireo, Cerulean Warbler, Great Egret, Kentucky Warbler, Osprey, Red-shouldered Hawk, Yellow-crowned Night-heron Eastern Massasauga Rattlesnake, Wood Turtle Crystal Darter, Red Riverhorse Buckhorn, Bullhead, Butterfly, Elephant Ear, Monkeyface, Rock Pocketbook, Salamander Mussel, Wing Snaggletooth

BURNETT Timber Wolf Bald Eagle, Great Egret, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Gilt Darter, Greater Redhorse, Pugnose Shiner, River Redhorse Purple Wartyback, Salamander Mussel, Spectacle Case Karner Blue Butterfly, Phlox Flower Moth Bog Bluegrass, Calypso Orchid, Drooping Sedge

CALUMET Cerulean Warbler, Great Egret, Osprey Greater Redhorse Ram's-head Lady's-slipper, Snow Trillium

CHIPPEWA Bald Eagle, Cerulean Warbler, Osprey, Red-shouldered Hawk Wood Turtle Greater Redhorse Bullhead, Ellipse, Purple Wartyback, Spectacle case Karner Blue Butterfly

CLARK Timber Wolf Bald Eagle, Cerulean Warbler Eastern Massasauga Rattlesnake, Wood Turtle Ellipse Karner Blue Butterfly

COLUMBIA Bell's Vireo, Cerulean Warbler, Great Egret, Red-shouldered Hawk, Yellow- crowned Night Heron Eastern Massasauga Rattlesnake, Ornate Box Turtle, Western Slender Glass Lizard, Wood Turtle Greater Redhorse, Longear Sunfish, Pugnose Shiner Buckhorn, Bullhead, Butterfly, Higgins' Eye Pearly Mussel, Monkeyface, Salamander Mussel Drooping Sedge,

Hop-like Sedge, Lapland Rosebay, Yellow Giant Hyssop

CRAWFORD Bald Eagle, Bell's vireo, Cerulean Warbler, Great Egret, Kentucky Warbler, Red-shouldered Hawk, Yellow-crowned Night-heron Eastern Massasauga Rattlesnake, Wood Turtle Longear Sunfish, Ozark Minnow Buckhorn, Bullhead, Butterfly, Ebony Shell, Elephant Ear, Higgins Eye Pearly Mussel, Monkeyface, Purple Wartyback, Rock Pocketbook, Salamander Mussel, Spectacle Case, Wartyback, Wing Snaggletooth Snail, Yellow Sandshell Great White Lettuce, Purple Milkweed, Yellow Giant Hyssop

DANE Bell's Vireo, Cerulean Warbler, Great Egret, Hooded Warbler, Kentucky Warbler Eastern Massasauga Rattlesnake, Ornate Box Turtle, Western Slender Glass Lizard Greater Redhorse, Pugnose Shiner, Starhead Topminnow Buckhorn, Bullhead, Butterfly, Ellipse, Higgins' Eye Pearly Mussel, Monkeyface, Rock Pocketbook, Salamander Mussel, Yellow Sandshell Drooping Sedge, Kitten Tails, Purple Milkweed, Yellow Giant Hyssop

DODGE Cerulean Warbler, Great Egret, Hooded Warbler, Red-shouldered Hawk River Redhorse Ellipse, Midwest Pleistocene Vertigo Snail

DOOR Bald Eagle, Cerulean Warbler, Hooded Warbler, Osprey, Red-shouldered Hawk Cherrystone Drop Snail, Midwest Pleistocene Vertigo Snail Calypso Orchid, Drooping Sedge, Dwarf Lake Iris, Foamflower, Handsome Sedge, Hawthorn-leaved Gooseberry, Moonwort, Northern Comandra, Pine-drops, Ram's-head Lady's-slipper, Small Round-leaved Orchis

DOUGLAS Timber Wolf Bald Eagle, Cerulean Warbler, Osprey, Spruce Grouse Wood Turtle Gilt Darter, Greater Redhorse Purple Wartyback Calypso Orchid, Hawthorn-leaved Gooseberry, Small Shinleaf

DUNN Bald Eagle, Cerulean Warbler, Great Egret, Red-shouldered Hawk Wood Turtle Crystal Darter, Greater Redhorse, River Redhorse Buckhorn, Bullhead, Monkeyface, Salamander Mussel Karner Blue Butterfly Beak Grass

EAU CLAIRE Bald Eagle, Cerulean Warbler, Red-shouldered Hawk Wood Turtle Greater Redhorse, River Redhorse Buckhorn, Bullhead, Salamander Mussel Karner Blue Butterfly, Phlox Flower Moth Beak Grass, Muskroot

FLORENCE American Pine Marten, Timber Wolf Bald Eagle, Osprey, Red-shouldered

Hawk, Spruce Grouse Wood Turtle Braun's Holly Fern, Calypso Orchid, Foamflower, Goblin Fern, Marsh Valerian, Small Round-leaved Orchis, Western Jacob's Ladder

FOND DU LAC Cerulean Warbler, Great Egret, Hooded Warbler Greater Redhorse, Longear Sunfish, Pugnose Shiner Ellipse, Midwest Pleistocene Vertigo Snail Bog Bluegrass, Forked Aster

FOREST American Pine Marten, Timber Wolf Bald Eagle, Cerulean Warbler, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Braun's Holly Fern, Calypso Orchid, Goblin Fern, Mountain Cranberry, Small Round-leaved Orchis

GRANT Acadian Flycatcher, Bald Eagle, Bell's Vireo, Cerulean Warbler, Great Egret, Hooded Warbler, Kentucky Warbler, Red-shouldered Hawk, Yellow-throated Warbler Ornate Box Turtle, Wood Turtle Crystal Darter, Ozark Minnow, River Redhorse, Starhead Topminnow Buckhorn, Bullhead, Butterfly, Cherrystone Drop Snail, Ebony Shell, Higgins' Eye Pearly Mussel, Midwest Pleistocene Vertigo Snail, Monkeyface, Occult Vertigo, Rock Pocketbook, Salamander Mussel, Wartyback, Wing Snaggletooth Snail, Yellow Sandshell

Intermediate Sedge, Muskroot, Northern Monkshood, Purple Milkweed, Yellow Giant Hyssop

GREEN Cerulean Warbler, Great Egret Eastern Massasauga Rattlesnake, Ornate Box Turtle Gravel Chub, Ozark Minnow, River Redhorse Buckhorn Great White Lettuce, Kitten Tails, Yellow Giant Hyssop

GREEN LAKE Acadian Flycatcher, Bald Eagle, Bell's Vireo, Cerulean Warbler, Great Egret, Red-shouldered Hawk Western Slender Glass Lizard Buckhorn Karner Blue Butterfly

IOWA Acadian Flycatcher, Bald Eagle, Bell's Vireo, Cerulean Warbler, Great Egret, Kentucky Warbler, Red-shouldered Hawk Eastern Massasauga Rattlesnake, Ornate Box Turtle, Wood Turtle Greater Redhorse, Ozark Minnow, Starhead Topminnow Buckhorn, Bullhead, Butterfly, Ebony Shell, Higgins' Eye Pearly Mussel, Monkeyface, Rock Pocketbook, Salamander Mussel, Yellow Sandshell Beak Grass, Fire Pink, Purple Milkweed

IRON American Pine Marten, Timber Wolf Bald Eagle, Osprey, Spruce Grouse Wood Turtle Greater Redhorse, Pugnose Shiner Cherrystone Drop Snail Braun's Holly Fern, Brood-leaved Twayblade, Calypso

Orchid, Goblin Fern, Large-leaved Sandwort, Small Shinleaf

JACKSON Timber Wolf Bald Eagle, Cerulean Warbler, Great Egret, Osprey, Red-shouldered Hawk Eastern Massasauga Rattlesnake, Western Slender Glass Lizard, Wood Turtle Gilt Darter, River Redhorse Buckhorn, Purple Wartyback Frosted Elfin Butterfly, Karner Blue Butterfly, Phlox Flower Moth Bog Bluegrass

JEFFERSON Acadian Flycatcher, Cerulean Warbler, Great Egret, Hooded Warbler, Kentucky Warbler Greater Redhorse, Pugnose Shiner, River Redhorse Kitten Tails, Purple Milkweed, Yellow Giant Hyssop

JUNEAU Timber Wolf Acadian Flycatcher, Bald Eagle, Cerulean Warbler, Great Egret, Kentucky Warbler, Osprey, Red-shouldered Hawk, Yellow-crowned Night-heron Eastern Massasauga Rattlesnake, Western Slender Glass Lizard, Wood Turtle Monkey Face, Salamander Mussel Frosted Elfin Butterfly, Karner Blue Butterfly Drooping Sedge, Muskroot

KENOSHA Cerulean Warbler, Great Egret Eastern Massasauga Rattlesnake Longear Sunfish, Pugnose Shiner, River Redhorse, Starhead Topminnow Karner Blue Butterfly Hop-like Sedge, Purple Milkweed

KEWAUNEE Cerulean Warbler Longear Sunfish, Pugnose Shiner Cherrystone Drop Snail Forked Aster

LA CROSSE Bald Eagle, Bell's Vireo, Cerulean Warbler, Great Egret, Kentucky Warbler, Osprey, Red-shouldered Hawk Eastern Massasauga Rattlesnake, Western Slender Glass Lizard, Wood Turtle Gilt Darter, River Redhorse, Starhead Topminnow Buckhorn, Bullhead, Higgins' Eye Pearly Mussel, Monkeyface, Wing Snaggletooth Snail Carey's Sedge

LAFAYETTE Bell's Vireo, Cerulean Warbler, Great Egret Gravel Chub, Ozark Minnow Beak Grass, Purple Milkweed, Yellow Giant Hyssop

LANGLADE American Pine Marten Bald Eagle, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Slippershell Braun's Holly Fern, Calypso Orchid, Goblin Fern, Marsh Valerian

LINCOLN Timber Wolf Bald Eagle, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle

MANITOWOC Acadian Flycatcher, Cerulean Warbler, Great Egret, Hooded Warbler, Kentucky Warbler, Osprey, Red-shouldered Hawk Greater Redhorse

Cherrystone Drop Snail, Ellipse, Midwest Pleistocene Vertigo Snail, Slippershell Bog Bluegrass, Drooping Sedge, Snow Trillium

MARATHON Bald Eagle, Osprey, Red-shouldered Hawk Wood Turtle

MARINETTE American Pine Marten Bald Eagle, Cerulean Warbler, Great Egret, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Greater Redhorse Goblin Fern, Marsh Valerian, Purple Milkweed

MARQUETTE Bald Eagle, Bell's Vireo, Cerulean Warbler, Great Egret, Red-shouldered Hawk Western Slender Glass Lizard Greater Redhorse, Pugnose Shiner Karner Blue Butterfly Bog Bluegrass

MENOMINEE American Pine Marten Bald Eagle, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Slippershell Karner Blue Butterfly, Phlox Flower Moth

MILWAUKEE Cerulean Warbler, Hooded Warbler, Red-shouldered Hawk Greater Redhorse, Longear Sunfish Blue-stemmed Goldenrod, Forked Aster, Handsome Sedge, Hop-like Sedge, Purple Milkweed, Ram's-head Lady's-slipper, Snow Trillium

MONROE Acadian Flycatcher, Cerulean Warbler, Great Egret, Kentucky Warbler, Osprey, Red-shouldered Hawk Eastern

Massasauga Rattlesnake, Western Slender Glass Lizard, Wood Turtle Gilt Darter, River Redhorse Frosted Elfin Butterfly, Karner Blue Butterfly, Phlox Flower Moth Beak Grass, Bog Bluegrass, Muskroot, Northern Monkshood

OCONTO American Pine Marten Bald Eagle, Cerulean Warbler, Great Egret, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Greater Redhorse, Longear Sunfish Slippershell Karner Blue Butterfly Bog Bluegrass, Braun's Holly Fern, Calypso Orchid, Foam Flower, Goblin Fern, Ram's-head Lady's-slipper, Small Round-leaved Orchis

ONEIDA American Pine Marten, Timber Wolf Bald Eagle, Cerulean Warbler, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Greater Redhorse Calypso Orchid

OUTAGAMIE Bald Eagle, Cerulean Warbler, Osprey Wood Turtle Buckhorn, Salamander Mussel, Snuffbox Karner Blue Butterfly Handsome Sedge, Marsh Valerian, Ram's-head Lady's-slipper, Snow Trillium

OZAUKEE Cerulean Warbler, Kentucky Warbler, Red-shouldered Hawk Greater Redhorse, Longear Sunfish Cherrystone Drop Snail Forked Aster, Handsome Sedge, Pine-drops, Ram's-head Lady's-slipper, Snow Trillium

PEPIN Bald Eagle, Cerulean Warbler, Great Egret, Hooded Warbler, Kentucky Warbler, Red- shouldered Hawk Eastern Massasauga Rattlesnake, Wood Turtle Crystal Darter, Greater Redhorse, River Redhorse Buckhorn, Bullhead, Butterfly, Elephant Ear, Monkeyface, Salamander Mussel Beak Grass

PIERCE Bald Eagle, Cerulean Warbler, Great Egret, Kentucky Warbler, Red-shouldered Hawk Wood Turtle Crystal Darter, River Redhorse Buckhorn, Bullhead, Butterfly, Ebony Shell, Elephant Ear, Higgins' Eye Pearly Mussel, Monkeyface, Rock Pocketbook, Snuffbox, Wing Snaggletooth Snail, Winged Mapleleaf Kitten Tails, Muskroot, Snow Trillium

POLK Bald Eagle, Cerulean Warbler, Great Egret, Osprey, Red-shouldered Hawk Crystal Darter, Gilt Darter, Greater Redhorse, River Redhorse Buckhorn, Butterfly, Ebony Shell, Elephant Ear, Higgins' Eye Pearly Mussel, Monkeyface, Purple Wartyback, Salamander Mussel, Snuffbox, Spectacle Case, Winged Mapleleaf Karner Blue Butterfly Bog Bluegrass, Kitten Tails

PORTAGE Bald Eagle, Cerulean Warbler, Osprey, Red-shouldered Hawk Eastern Massasauga Rattlesnake, Wood Turtle Karner Blue Butterfly Marsh Valerian

PRICE Timber Wolf Bald Eagle, Cerulean Warbler, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Greater Redhorse Purple Wartyback, Salamander Mussel Calypso Orchid

RACINE Cerulean Warbler, Great Egret, Red-shouldered Hawk, Yellow-throated Warbler Eastern Massasauga Rattlesnake Longear Sunfish, Pugnose Shiner, River Redhorse Blue-stemmed Goldenrod, Forked Aster, Hop-like Sedge, Kitten Tails, Purple Milkweed, Yellow Giant Hyssop

RICHLAND Bald Eagle, Cerulean Warbler, Kentucky Warbler, Red- shouldered Hawk Ornate Box Turtle Crystal Darter Buckhorn, Bullhead, Butterfly, Ebony Shell, Higgins' Eye Pearly Mussel, Monkeyface, Rock Pocketbook, Salamander Mussel, Yellow Sandshell Bog Bluegrass, Muskroot, Northern Monkshood

ROCK Acadian Flycatcher, Cerulean Warbler, Great Egret, Kentucky Warbler, Red-Shouldered Hawk, Yellow-crowned Night Heron, Yellow-throated Warbler Eastern Massasauga Rattlesnake, Ornate Box Turtle Gravel Chub, Greater Redhorse, Ozark Minnow, Starhead Topminnow Ellipse, Monkeyface, Purple Wartyback Beak Grass, Forked Aster, Kitten Tails, Muskroot, Purple

Milkweed, Yellow Giant Hyssop

RUSK Timber Wolf Bald Eagle, Osprey, Spruce Grouse Wood Turtle Gilt Darter, Greater Redhorse, Longear Sunfish Bullhead, Purple Wartyback Hawthorn-leaf Gooseberry, Squashberry

SAUK Acadian Flycatcher, Bell's Vireo, Cerulean Warbler, Great Egret, Hooded Warbler, Kentucky Warbler, Red-shouldered Hawk, Worm-eating Warbler, Yellow-throated Warbler Eastern Massasauga Rattlesnake, Ornate Box Turtle, Western Slender Glass Lizard Starhead Topminnow Buckhorn, Bullhead, Butterfly, Cherrystone Drop Snail, Higgins' Eye Pearly Mussel, Midwest Pleistocene Vertigo Snail, Monkeyface, Rock Pocketbook, Salamander Mussel, Yellow Sandshell Karner Blue Butterfly Bog Bluegrass, Drooping Sedge, Great White Lettuce, Muskroot, Northern Monkshood, Purple Milkweed

SAWYER American Pine Marten, Timber Wolf Bald Eagle, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Greater Redhorse, Longear Sunfish Purple Wartyback Calypso Orchid, Goblin Fern, Ram's-head Lady's-slipper, Small Round-leaved Orchis

SHAWANO Bald Eagle, Cerulean Warbler, Hooded Warbler, Osprey, Red-shouldered Hawk Wood Turtle Longear Sunfish, Pugnose Shiner, River Redhorse Buckhorn, Salamander Mussel, Slippershell, Snuffbox

SHEBOYGAN Cerulean Warbler, Great Egret, Osprey, Red-shouldered Hawk Greater Redhorse, Pugnose Shiner Cherrystone Drop Snail, Ellipse, Slippershell Forked Aster, Handsome Sedge, Marsh Valerian, Ram's-head Lady's-slipper, Snow Trillium

ST. CROIX Bald Eagle, Cerulean Warbler, Great Egret, Osprey, Red-shouldered Hawk Wood Turtle Crystal Darter, Gilt Darter, Greater Redhorse, River Redhorse Buckhorn, Butterfly, Ebony Shell, Elephant Ear, Higgins' Eye Pearly Mussel, Monkeyface, Purple Wartyback, Salamander Mussel, Snuffbox, Spectacle Case, Winged Mapleleaf Kitten Tails, Snow Trillium

TAYLOR Timber Wolf Bald Eagle, Cerulean Warbler, Great Egret, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Goblin Fern, Hop-like Sedge

TREMPEALEAU Bald Eagle, Bell's Vireo, Cerulean Warbler, Great Egret, Kentucky Warbler, Osprey, Red-shouldered Hawk Eastern Massasauga Rattlesnake, Wood

Turtle Crystal Darter Bullhead, Higgins' Eye Pearly Mussel, Monkeyface, Wing Snaggletooth Snail Bog Bluegrass

VERNON Acadian Flycatcher, Bald Eagle, Cerulean Warbler, Great Egret, Kentucky Warbler, Red-shouldered Hawk, Worm-eating Warbler Wood Turtle Greater Redhorse Cherrystone Drop Snail, Higgins' Eye Pearly Mussel, Monkeyface, Rock Pocketbook, Wartyback, Wing Snaggletooth Snail, Yellow Sandshell Drooping Sedge, Lapland Rosebay, Muskroot, Northern Monkshood

VILAS American Pine Marten, Timber Wolf Bald Eagle, Cerulean Warbler, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle Greater Redhorse, Longear Sunfish, Pugnose Shiner Calypso Orchid, Ram's-head Lady's-slipper

WALWORTH Acadian Flycatcher, Cerulean Warbler, Great Egret, Hooded Warbler Eastern Massasauga Rattlesnake Longear Sunfish, Ozark Minnow, Pugnose Shiner, Starhead Topminnow Ellipse Forked Aster, Kitten Tails, Purple Milkweed, Yellow Giant Hyssop

WASHBURN Timber Wolf Bald Eagle, Hooded Warbler, Osprey, Red-shouldered Hawk, Spruce Grouse Wood Turtle

Gilt Darter, Greater Redhorse, Ozark Minnow, Pugnose Shiner Purple Wartyback, Yellow Sandshell Bog Bluegrass

WASHINGTON Acadian Flycatcher, Cerulean Warbler, Great Egret, Hooded Warbler, Kentucky Warbler, Red-shouldered Hawk Greater Redhorse, Longear Sunfish, Pugnose Shiner Ellipse Forked Aster, Kitten Tails, Purple Milkweed

WAUKESHA Acadian Flycatcher, Cerulean Warbler, Great Egret, Hooded Warbler, Kentucky Warbler, Red-shouldered Hawk Greater Redhorse, Longear Sunfish, Ozark Minnow, Pugnose Shiner, Starhead Topminnow Ellipse, Rainbow Shell, Slippershell Forked Aster, Handsome Sedge, Hop-like Sedge, Kitten Tails, Marsh Valerian, Purple Milkweed, Snow Trillium

WAUPACA Bald Eagle, Cerulean Warbler, Great Egret, Osprey, Red-shouldered Hawk, Yellow-crowned Night-heron Wood Turtle Greater Redhorse, Pugnose Shiner, River Redhorse Buckhorn, Salamander Mussel, Snuffbox Karner Blue Butterfly Marsh Valerian, Ram's-head Lady's-slipper

WAUSHARA Bald Eagle, Cerulean Warbler Western Slender Glass Lizard Greater Redhorse, Longear Sunfish, Pugnose Shiner Karner Blue Butterfly Purple Milkweed

WINNEBAGO Bald Eagle, Cerulean Warbler, Great Egret, Osprey Wood Turtle Greater Redhorse, Pugnose Shiner Buckhorn Bluegrass, Forked Aster, Purple Milkweed

WOOD Timber Wolf Bald Eagle, Cerulean Warbler, Great Egret, Osprey, Red-shouldered Hawk Eastern Massasauga Rattlesnake, Western Slender Glass Lizard, Wood Turtle Frosted Elfin Butterfly, Karner Blue Butterfly Goblin Fern

Appendix II

Sources of Additional Information and Technical Assistance

International Paper Company

P.O. Box 39
Norway, MI 49870-0039
(906) 563-7545

Wisconsin Bureau of Endangered Resources - DNR

P.O. Box 7921
Madison, WI 53707-7921
(608) 266-7012

Wisconsin Bureau of Forestry - DNR

P.O. Box 7921
Madison, WI 53707-7921
(608) 267-7494

U. S. Fish & Wildlife Service

Endangered Species Coordinator
1015 Challenger Court
Green Bay, WI 54311
(920) 465-7440

Other Wisconsin Reference Books

Endangered and Threatened Vertebrate Species of Wisconsin, Bureau of Endangered Species, Wisconsin Department of Natural Resources

Guide to Wisconsin's Endangered and Threatened Plants, Bureau of Endangered Resources, Wisconsin Department of Natural Resources

Manual of Aquatic Plants of Wisconsin, Norman Fassett, Univ. Wisconsin Press

Natural History of Amphibians and Reptiles of Wisconsin, Richard Carl Vogt, Milwaukee Public Museum

Spring Flora of Wisconsin, Norman Fassett, revised by Olive Thomson, Univ. Wisconsin Press

Wisconsin Birdlife, Sam Robbins, Univ. Wisconsin Press

Wisconsin's Forestry Best Management Practices for Water Quality, Bureau of Forestry, Wisconsin Department of Natural Resources

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Appendix IV

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Kurt Buhlmann, Savannah River Ecology Lab, University of Georgia – *Wood Turtle*

N. L. Britton and **A. Brown,** illustrations in Britton, N. L., and A. Brown. 1913. An illustrated flora of the northern United States and Canada, 2nd ed. Charles Scribner's Sons, N.Y. – *Great White Lettuce*, *Hawthorn-leaved Gooseberry*

Betty Cottrille and **Cornell Laboratory of Ornithology** – *Acadian Flycatcher*, *Kentucky Warbler*

Henry Creutzburg, illustrations in Mackenzie, K. K. 1940. North American Cariceae (2 vols.) New York botanical gardens, NY – *Carey's Sedge*, *Drooping Sedge*, *Handsome Sedge*

Joe Duft, Native Plant Society, New Mexico – *Large-leaved Sandwort*, *Small Shinleaf*, *Western Jacob's Ladder*

John Dunning and **Cornell Laboratory of Ornithology** – *Worm-eating Warbler*

Bill Dyer and **Cornell Laboratory of Ornithology** – *Cerulean Warbler*

Les Ferge, USDA Forest Service, Forest Products Laboratroy – *Phlox Flower Moth*

Vivien Frazier, illustration in Correll, D.S., and H. B. Correll. 1972. Aquatic and wetland plants of southwestern United States. Environmental Protection Agency, Water Pollution Control research Series 16030 DNL 01/72. – *Yellow Giant Hyssop*

C. Kuhn, illustration in Mitchell, R. S., and C. J. Sheviak. 1981. Rare plants of New York State. N. Y. State Museum Bull. No. 445, Albany – *Auricled Twayblade*

Greg W. Lasley, *Bell's Vireo*

James Leupold, U.S. Geological Survey – *Yellow-crowned Night Heron*

Thomas Meyer, Bureau of Endangered Resources, Wisconsin Department of Natural Resources – *Various plants*

Steve Mortensen – *Goblin Fern*

Paul Parmalee and **Arthur Bogan.** 1998. The freshwater mussels of Tennessee. The Univ. of Tenn. Press, Knoxville. – *Purple Wartyback Mussel*

C. O. Rosendahl and **F. K. Butters,** illustration in Rosendahl, C. O., and F. K. Butters. 1928. Trees and shrubs of Minnesota. Univ. Minnesota Press, Minneapolis. – *Hawthorn-leaved Gooseberry*

Caulion Singletary and **Cornell Laboratory of Ornithology** – *Great Egret*

Janice Stiefel – *Blue-stemmed Goldenrod, Handsome Sedge*

Dan Stosits and **Cornell Laboratory of Ornithology** – *Spruce Grouse*

Ann Swengel – *Frosted Elfin Butterfly*

USDA, illustration in Hitchcock, A. S. 1951. Manual of the grasses of the United States (2nd ed., revised by A. Chase). USDA Misc. Pub. 200, U. S. Gov. Printing Off., Washington, D.C. – *Beak Grass*

Ed Voss, University of Michigan – *Auricled Twayblade, Intermediate Sedge, Mountain Cranberry, Pine-drops, Smith Melic Grass, Squashberry*

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