



**Anderson Farm County Park
Natural Communities
Vegetation Management Plan
February 21, 2023**

1. Introduction

Over the course of the last 200 years, the natural vegetation and ecosystems of Dane County have been heavily altered by human activity (Figure 1). Beginning in the 1830s, a growing number of European settlers to the region brought significant changes to the land. Wildfires, which once swept across the land and shaped the vegetation, were extinguished by settlers or halted by farm fields and roads. Agriculture and livestock grazing damaged the soil and displaced native species. Furthermore, the introduction and spread of non-native, invasive species, has contributed to significant losses in biodiversity and creates obstacles to recovery. Today, global forces such as climate change further threaten the health of these lands and waters and the species that reside within this landscape. Through the science and practice of ecological restoration, a discipline with origins tracing back to the University of Wisconsin-Madison, Dane County Parks attempts to restore natural communities that have been heavily altered or lost due to anthropogenic forces.

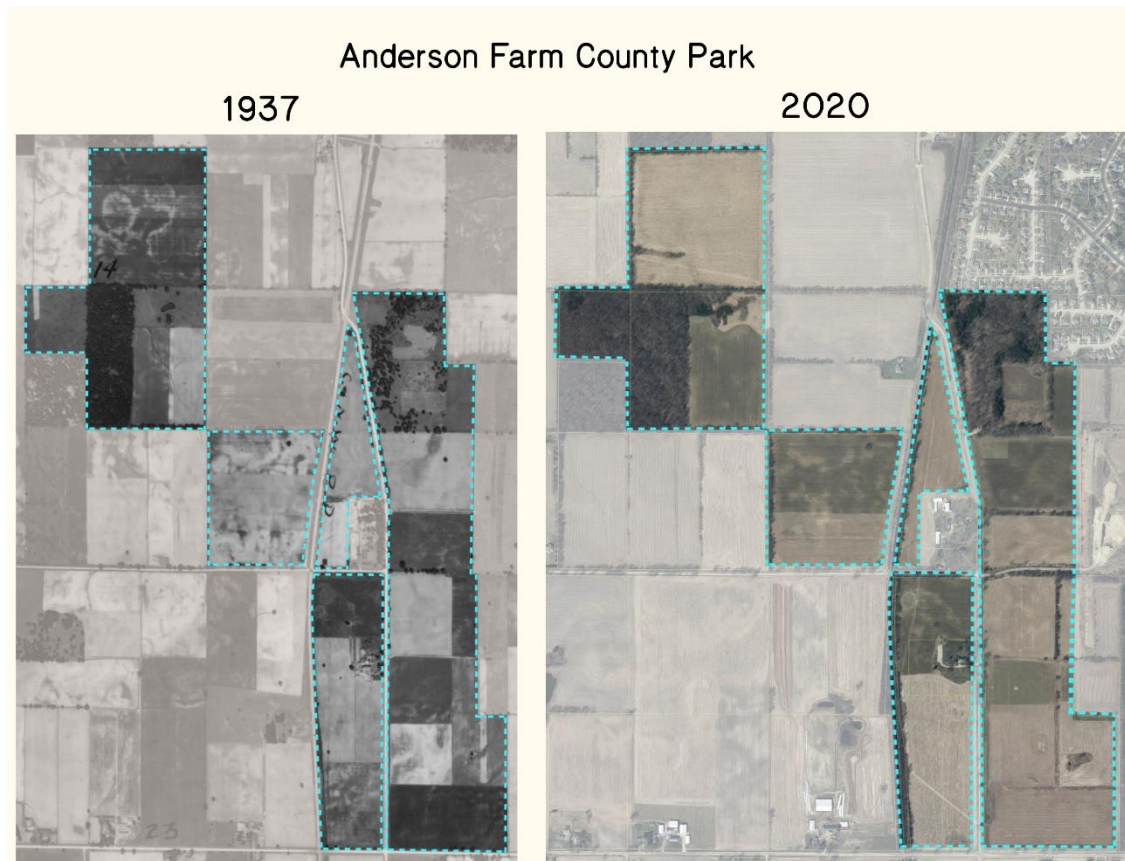


Figure 1. Change in vegetation at Anderson Farm County Park between 1937 and 2020.

Anderson Farm County Park Arthur Sholts Memorial Woods

1937

2020



Figure 2. Change in vegetation at Arthur Sholts Memorial Woods between 1937 and 2020.

A natural community is an assemblage of native plants, animals, and other organisms interacting with each other and their physical environment in a particular area. Around 100 natural communities have been identified across Wisconsin by the Department of Natural Resources (DNR) Natural Heritage Inventory. Environmental factors such as moisture, sunlight, soil type, temperature, and disturbance (e.g. flood or fire) determine which community prevails in a specific location. Natural communities exist in a mosaic across the landscape and repeat where similar environmental conditions exist. Changes in these environmental factors account for transitions from one community to the next. For example, the north facing side of a hill is likely to be more sheltered from the sun and will therefore be cooler and retain more moisture as compared to the south facing side. As a result of these differing environmental conditions, natural communities are likely to be significantly different on opposing sides of the hill.

Vegetation goals and objectives for a particular location are informed by the target natural community for that site. If oak opening is determined to be suitable and attainable for a given location, vegetation management should promote species that comprise this community and deter or remove species that are not associated with this community. Invasive species are obvious priorities for removal. Less obvious, but also important, are native species that have encroached from other natural communities, likely due to fire suppression. Reintroducing appropriate species through direct planting or seeding, as well as replicating natural processes such as burning, are key to restoring desired natural communities.

The restoration and management of natural communities on Dane County lands requires a partnership between county staff and volunteers. County resources alone will never satisfy all stewardship needs required to maintain healthy natural communities. Likewise, volunteers are also limited in what they can do independently and require tools, training, and guidance to work successfully. However, when staff and volunteers work together in a coordinated partnership, there is unlimited potential to restore and enhance natural areas.

2. Public-Use Statement

Anderson Farm County Park is classified as a Recreation Park within the Dane County Park System. Dane County Recreation Parks are large, regional-scale parks with specific outdoor recreation attractions, developed access, and facilities. Anderson Farm County Park contains several different use areas including community gardens, a dog park, paved bike/pedestrian trail, and natural areas.

Natural Areas are used primarily for passive recreation including hiking, snowshoeing, picnicking, wildlife viewing, foraging, and nature study. A paved shared-use bike trail passes through the east side of the park. A maple sugaring demonstration is offered in Arthur Sholts Memorial Woods every year which provides an educational opportunity to local students. The dog park in the southeastern corner of the park includes a trail system winding through a restored tallgrass prairie. A remote primitive camp is planned for the western side of the park. Ecological restoration activities are conducted in natural areas by volunteers and staff and include such tasks as tree and brush removal, brush pile burning, invasive weed control, prescribed burning, and seeding/planting.

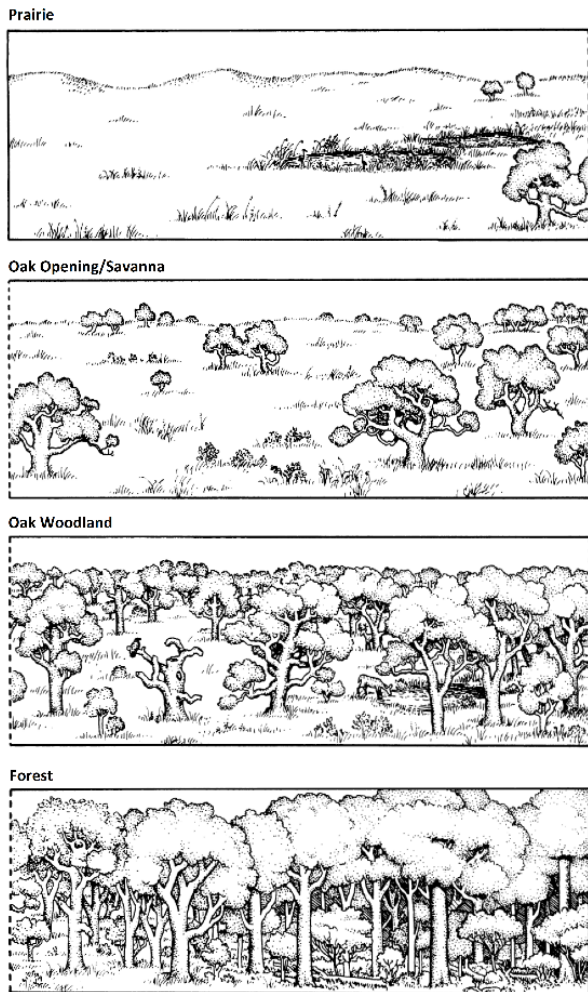
3. Broad vegetation goals, describing the desired physical/biological appearance of the site upon completion.

- Park will include six primary natural communities:
 - Oak Opening/Savanna
 - Oak Woodland
 - Southern Dry-Mesic Forest
 - Mesic Forest
 - Mesic Prairie
 - Southern Sedge Meadow
- Communities will transition naturally into each other providing a seamless landscape that is biologically diverse and offers a varied experience for the park user.
- Exotic/invasive species will be controlled through various methods. Table 1 lists common exotic/invasive species that occur at Anderson Farm County Park.
- Vegetation will assist in the prevention of soil erosion to protect geologic features, biological resources, and water quality.
- Vegetation will provide habitat for wildlife including Species of Greatest Conservation Need (SGCN) that have been declining regionally. Appendices 7-11 list high priority SGCN within each community.

Several figures, tables, and appendices have been included in this plan to describe the composition, structure, and processes that define each community type. Sketch illustrations of natural communities are included in Figure 2. These sketches are most helpful in demonstrating the density

of trees and canopy closure within prairie, oak opening/savanna, oak woodland, and forest community types. Tables 2 and 3 summarize the characteristic species of plants and birds within each community. Detailed descriptions of each community type can be found in Appendices 1-6. These resources can help determine which native species to reintroduce to a given community.

The assignment of desired natural community types for specific areas was based on several factors including native vegetation present on site, soil type, soil moisture, likelihood of restoration success, and compatibility with adjacent land uses. Maps of the desired natural community types are found in Figure 3 and 4. Arthur Sholts Memorial Woods offered a unique opportunity to showcase a spectrum of natural communities within close proximity of each other while preserving locally significant conifer plantings that are valuable within the community.



From *The Tollgrass Restoration Handbook* edited by Stephen Packard and Cornelia F. Mutel. Copyright © 1997, 2005 Society for Ecological Restoration International. Reproduced by permission of Island Press, Washington, D.C.

Figure 2. Sketches of prairie, oak opening/savanna, oak woodland, and forest community types.

Anderson Farm County Park Desired Vegetation

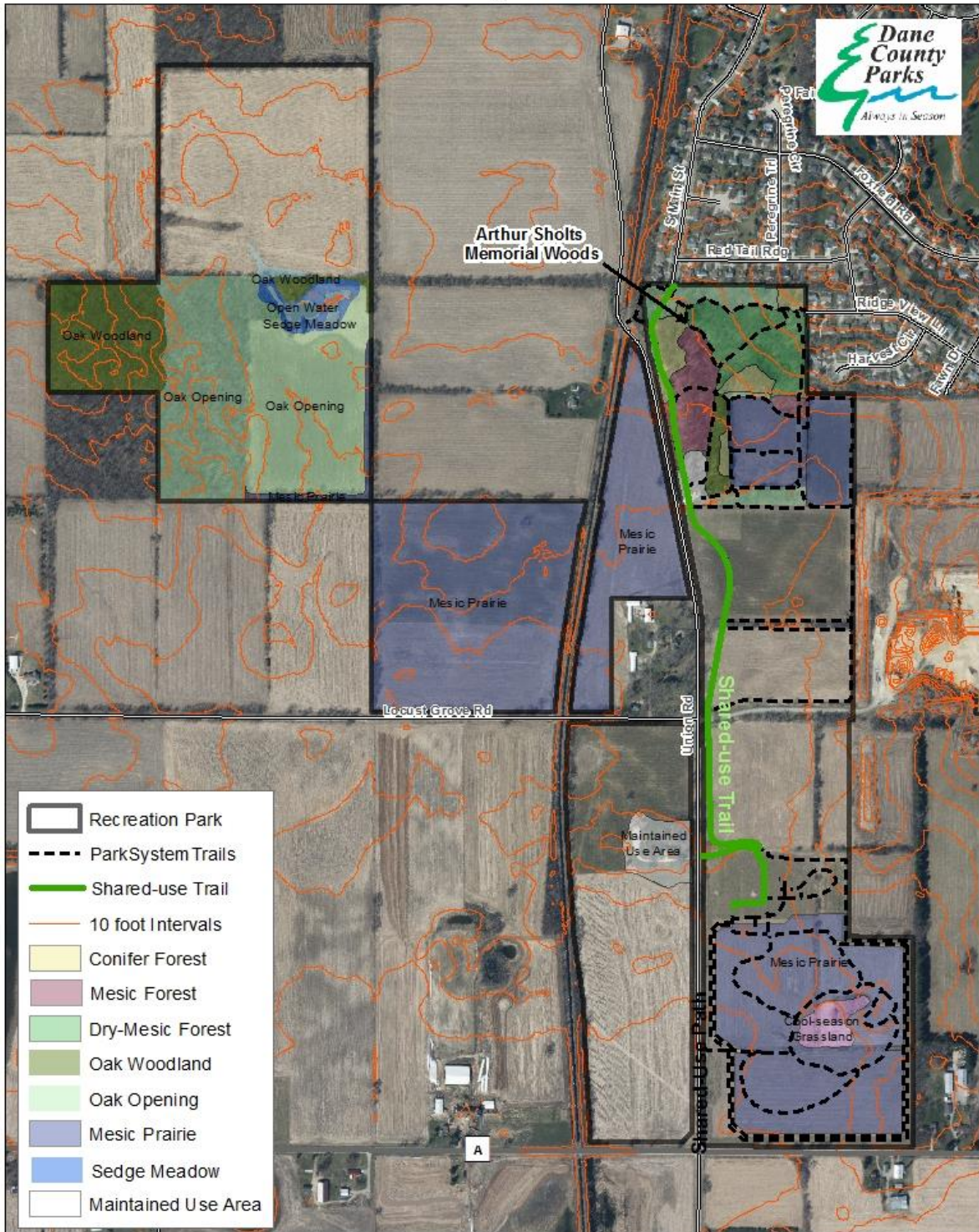
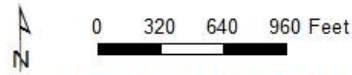


Figure 3. Desired natural community locations at Anderson Farm County Park.

Anderson Farm County Park
Arthur Sholts Woods Desired Vegetation



0 50 100 200 300 Feet

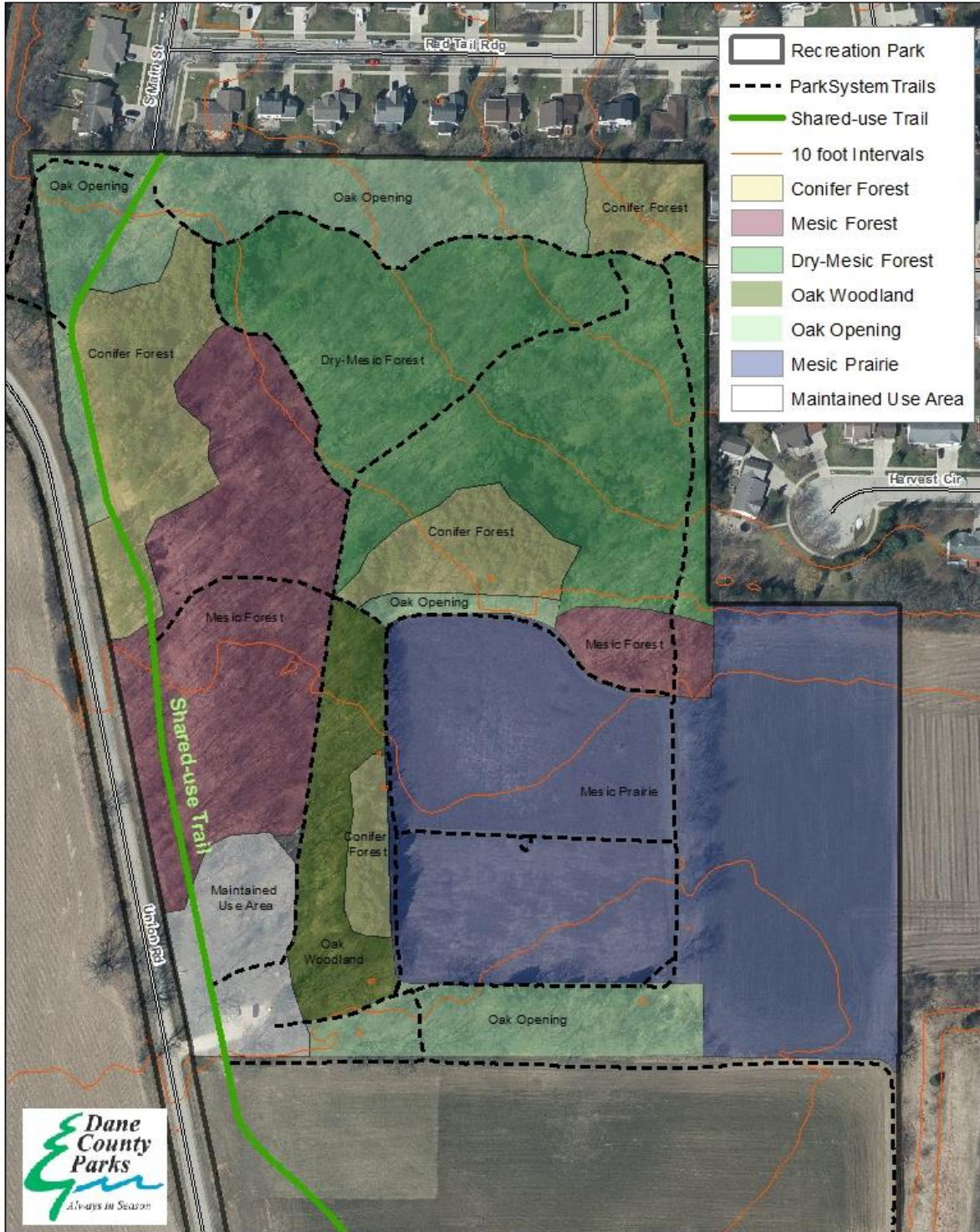


Figure 4. Desired natural community locations at Arthur Sholts Memorial Woods, Anderson Farm County Park.

4. Noteworthy resources and unique opportunities.

- Unique dog park with trails winding through a restored tallgrass prairie.
- Rich agricultural soils well-suited for restoration of mesic tallgrass prairie.
- Restorable wooded areas containing large stately oaks with a variety of native understory species still present.
- Presence of marketable black walnut and other hardwoods to leverage contractor involvement in forest health management and supply revenue to support further restoration of the site.
- Excellent wildlife viewing opportunities including woodland birds, mammals, and waterfowl.

5. Threats/concerns that are likely to be impediments to success.

- Encroachment of persistent woody vegetation and invasive shrubs in all communities.
- Invasion of aggressive exotic herbaceous weeds in all communities including spotted knapweed, Japanese hedge parsley, garlic mustard, wild parsnip, and sweet clovers.
- Declining health of mature oaks and poor natural recruitment of oaks in areas with dense invasive species, heavy shade, and deer herbivory.

Table 1. Summary of common exotic, invasive, or adventitious native species found at Anderson Farm County Park requiring management. (E=Eradicate; M=Manage)

Herbaceous plants:	Shrubs/Trees:
<ul style="list-style-type: none"> • Bird’s foot trefoil (E) • Burdock (E) • Canada thistle (E) • Exotic biennial thistles (E) • Garlic mustard (E) • Japanese hedge parsley (E) • Leafy spurge (E) • Reed Canary Grass (E) • Stickseed (M) • Wild Parsnip (E) • Yellow and white sweet clover (E) 	<ul style="list-style-type: none"> • Autumn and Russian Olives (E) • Black Locust (E) • Burning Bush (E) • Bush Honeysuckles (E) • Common Buckthorn (E) • Gray dogwood (M) • Multiflora Rose (E) • Staghorn and smooth sumac (M) • White Mulberry (E)

6. Priority management recommendations

Management of oak opening/savanna, oak woodland, and dry-mesic oak forest communities

- Cut, treat, pile, and burn trees and invasive shrubs that are not compatible with desired natural community. Table 1 lists common weeds, shrubs, and trees that should be eradicated or managed. Table 2 summarizes desirable native species and their relative dominance for each community.

- Timber harvesting should be considered as a method to reduce the abundance of non-compatible tree species and increase sunlight for oak regeneration.
- Utilize fire as a management tool to suppress invasive weeds and woody growth and encourage recruitment of native vegetation. Fire should be used annually in the early stages, if possible, then less frequently in later maintenance stages.
- Stack and burn or remove brush, firewood, and storm damage (heavy fuels) from along trail sides to help ensure safe and effective breaks for prescribed burning. Heavy fuels toward the interior of the unit should also be reduced when possible with scattered logs retained for wildlife habitat.
- Control and suppress invasive weeds through multiple methods (hand weeding, selective herbicide applications, and mowing/cutting) focusing on garlic mustard, Japanese hedge parsley, and dame's rocket. Care should be taken that control methods do not damage sensitive and rare vegetation. Any new species and infestations should be documented in the EDDmapS database (www.eddmaps.org).
- Prioritize invasive weed control efforts by focusing on the protection of key resources and/or starting control on scattered individuals at the leading edge of the invasion and working in towards the most established part of the population.
- Introduce community appropriate native grasses, forbs, shrubs, and trees to increase diversity and habitat quality.
- Maintain dead snags and dead limbs for wildlife where safety to trail users and prescribed burning operations is not a concern.

Management of mesic forest communities

- Cut, treat, pile, and burn trees and invasive shrubs that are not compatible with desired natural community. Table 1 lists common weeds, shrubs, and trees that should be eradicated or managed. Table 2 summarizes desirable native species and their relative dominance for each community.
- Do NOT use fire to maintain mesic forest stands as dominant trees, including sugar maple, are not tolerant of fire.
- Reduction of heavy fuels is not a priority as prescribed fire will not be used.
- Control and suppress invasive weeds through multiple methods (hand weeding, selective herbicide applications, and mowing/cutting) focusing on garlic mustard, Japanese hedge parsley, dame's rocket. Care should be taken that control methods do not damage sensitive and rare vegetation. Any new species and infestations should be documented in the EDDmapS database (www.eddmaps.org).
- Prioritize invasive weed control efforts by focusing on the protection of key resources and/or starting control on scattered individuals at the leading edge of the invasion and working in towards the most established part of the population.
- Maintain dead snags and dead limbs for wildlife where safety to trail users is not a concern.
- Introduce community appropriate container plants, and bulbs, corms, and rhizomes of appropriate ground layer vegetation.

Management of mesic prairie and sedge meadow communities

- Maintain openness of sites by keeping trees and shrubs to a minimum through regular prescribed burning.
- Restore existing agricultural areas designated for prairie as capacity allows.
- Control and suppress invasive weeds through multiple methods (hand weeding, selective herbicide applications, and mowing/cutting) focusing on sweet clover, wild parsnip, reed canary grass, spotted knapweed and birds-foot trefoil. Care should be taken that control methods do not damage sensitive and rare vegetation. Any new species and infestations should be documented in the EDDmapS database (www.eddmaps.org). Table 1 lists common weeds, shrubs, and trees that should be eradicated or managed. Table 3 summarizes desirable native species and their relative dominance for each community.
- Prioritize invasive weed control efforts by focusing on the protection of key resources and/or starting control on scattered individuals at the leading edge of the invasion and working in towards the most established part of the population.

<i>Oak Savanna/Opening</i>	<i>Oak Woodland</i>	<i>Southern Dry-Mesic Forest</i>	<i>Southern Mesic Forest</i>
<i>Wide-spaced oaks, at least 1 tree/acre but less than 50% canopy cover by trees</i>	<i>Oak dominated, 50-95% canopy cover with partial shade tolerant flowers and grasses</i>	<i>Oak dominated, 95%+ canopy cover with shade tolerant flowers and ferns</i>	<i>Sugar maple dominated, 95%+ canopy cover with shade tolerant flower and spring ephemerals</i>
<p>Native Plants:</p> <ul style="list-style-type: none"> • Bur oak* • White oak* • Black oak • Shagbark hickory • American hazelnut • New Jersey Tea • Lead plant • Big bluestem • Wild bergamot • Shooting stars <p>Native Birds</p> <ul style="list-style-type: none"> • Eastern screech owl • Eastern bluebird • Orchard oriole • Northern bobwhite • Northern flicker • Red-headed woodpecker • Sharp-tailed grouse • Wood duck 	<p>Native Plants:</p> <ul style="list-style-type: none"> • White oak* • Bur oak* • Red oak* • Shagbark hickory* • Figwort giant hyssop • Poke milkweed • American bellflower • Purple Joe-pye weed • Solomon's seal • Yellow pimpernel <p>Native Birds</p> <ul style="list-style-type: none"> • Eastern bluebird • Orchard oriole • Great-crested flycatcher • Eastern wood pewee • Northern flicker • Red-bellied woodpecker • Red-headed woodpecker • Blue-gray gnatcatcher • Yellow-throated vireo 	<p>Native Plants:</p> <ul style="list-style-type: none"> • Red oak* • White oak* • Basswood • Bitternut hickory • Shagbark hickory • Black cherry • Jack-in-the-pulpit • Wild geranium • Large-flowered bellwort • Interrupted fern <p>Native Birds</p> <ul style="list-style-type: none"> • Scarlet tanager • Eastern wood pewee • Great-crested flycatcher • Red-bellied woodpecker • Barred Owl • White-breasted nuthatch • Red-eyed vireo • Yellow-throated vireo • Ovenbird 	<p>Native Plants:</p> <ul style="list-style-type: none"> • Sugar maple* • American basswood* • Red oak • White oak • Bitternut hickory • Wild leek • Blue cohosh • Bloodroot • Spring beauty • Dutchman's breeches <p>Native Birds</p> <ul style="list-style-type: none"> • Wood thrush • Scarlet tanager • Pileated woodpecker • Blue-gray gnatcatcher • Barred owl • Red-shouldered hawk • Cerulean warbler • Hooded warbler • Kentucky warbler
*indicates dominant species			

Table 2. Summary of characteristic native plants and birds in oak openings/savanna, oak woodlands, southern dry-mesic forest, and southern mesic forest.

Mesic Prairie	Southern Sedge Meadow
<i>Tall grass and forb dominated on medium, well drained soils; few trees and shrubs present</i>	<i>Grass and sedge dominated wetland; few trees and shrubs present</i>
Native Plants: <ul style="list-style-type: none"> • Indian grass* • Big bluestem* • Little bluestem • Prairie dropseed • Switch grass • Prairie dock • Leadplant • Heath aster • Smooth blue aster • Prairie coreopsis • Rattlesnake master • Prairie sunflower • Spiderwort Native Birds <ul style="list-style-type: none"> • Northern harrier • Henslow's sparrow • Bobolink • Dickcissel • Sedge wren • Eastern meadowlark • Savannah sparrow • Loggerhead shrike 	Native Plants: <ul style="list-style-type: none"> • Blue joint grass* • Tussock sedge* • Prairie cord grass • Water horehound • Panicked aster • Swamp aster • Blue flag iris • Spotted Joe-Pye weed • Swamp Milkweed • Marsh fern • Greater water dock • Water smartweed • Wool grass Native Birds <ul style="list-style-type: none"> • Northern harrier • Sandhill crane • Sedge wren • American bittern • Common yellowthroat • Red-winged blackbird • Swamp sparrow • Henslow's sparrow
*indicates dominant species	

Table 3. Summary of characteristic native plants and birds in mesic prairie and southern sedge meadow.

Scenic vistas and geology

- Maintain ability of park users to appreciate the geological significance of the park by removing dense trees and brush that obscure views of prominent features and visibility of the terrain.

Management of soil erosion

- Remove dense cover of invasive shrubs that prohibits the growth of low-growing native grasses and forbs, which act to slow runoff and limit erosion.
- Seed or plant low-growing native grasses and forbs where bare ground is exposed.
- Ensure trail system is sustainable, minimizing stormwater channelization and soil erosion.

Wildlife habitat management

- Remove invasive trees and brush and invasive weeds to promote healthy and diverse natural communities.
- Seed or plant a diversity of native wildflowers to provide floral resources for pollinators.
- Protect snags and dead wood, where safe and appropriate, to promote species that require dead standing and fallen wood.
- Concentrate travel to designated areas, thereby limiting disturbance to wildlife.
- Appendices 7-11 summarize high priority Species of Greatest Conservation Need (SGCN) for oak opening/savanna, oak woodland, southern dry-mesic forest, southern mesic forest, mesic prairie, and southern sedge meadow in the South East Glacial Plains ecological landscape.

Ensuring safety to park users

- Volunteers should observe policies and procedures identified in the Dane County Parks Natural Areas Volunteer Handbook. Handbook contains guidance on use of herbicides, power tools, driving on trails, and working safely in groups.
- Lead volunteers should obtain Land Steward Certification as described in the Natural Areas Volunteer Handbook.

7. Coordination and approval of volunteer activities

- Volunteer activities should be consistent with the Anderson Farm County Park Master Plan and this Vegetation Management Plan.
- Volunteers should observe policies and procedures identified in the Dane County Parks Natural Areas Volunteer Handbook.
- Volunteers should develop a work plan every year in coordination with Dane County Parks Natural Areas staff, who will be responsible for review and approval. Plans outside of the scope of the work plan should be discussed with staff beforehand. Volunteers are encouraged to check in with staff regularly or when questions arise.

8. Implementation, methods, and site maintenance

A proposed cycle of vegetation management activities is provided in Table 4, detailing how projects will be completed and maintained. The table includes method of completing tasks, including equipment involved and entity completing the task.

Table 4. Proposed cycle of vegetation management activities

Timeframe	Activity	Method
Winter	Tree and shrub removal	Mowers, skid loader, chainsaw, brushcutter (spot treat stumps w/ herbicide)
Winter	Planting seeds	Scatter seeds by hand or with tractor in project areas
Spring or Fall	Prescribed burning	Burn crew with fire-fighting equipment (hand tools, water cans, UTVs, trucks)
Spring-Summer	Weed control	Parsnip predator, brushcutters, mowers, herbicides
Summer	Water and maintain container plants	Provide water to container plants, maintain caging, remove weeds
Fall	Native Seed collection	Hand collect seed from several parks in the system
Fall	Seed processing and packaging	Clean, weigh, and package seed for planting in parks throughout the county
Fall or Spring	Plant trees and shrubs	Plant county-grown or nursery purchased container plants

References:

Dane County Parks. March, 2013. Anderson Farm County Park Adopted Master Plan. Dane County, WI.

Wisconsin Department of Natural Resources. 2015. 2015-2025 Wisconsin Wildlife Action Plan. Madison, WI.

Wisconsin Department of Natural Resources. 2015. *The Ecological Landscapes of Wisconsin: An Assessment of Ecological Resources and a Guide to Planning Sustainable Management*. Wisconsin Department of Natural Resources PUB-SS-1131 2015, Madison.

Appendix 1. Oak Savanna/Opening Community Description (WDNR Ecological Landscapes of Wisconsin, 2015)

Oak Opening (Global Rank G1; State Rank S1)

Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

Historically, Oak Openings occurred on dry to wet-mesic sites across much of southern and western Wisconsin. Patch size and configuration varied greatly, and the community was found as isolated groves, in draws between ridges, on tongue-like peninsulas, on steep slopes partially protected by waterbodies or wetlands, and sometimes as extensive ecotonal areas separating open prairie from closed forest. According to the interpretations of Curtis (1959) and Finley (1976), Oak Openings covered approximately 5.5 million acres in southern Wisconsin at the time of the federal public land survey in the mid-19th century. Only the vast (and variable) Northern Mesic Forests in the northern part of the state were more extensive.

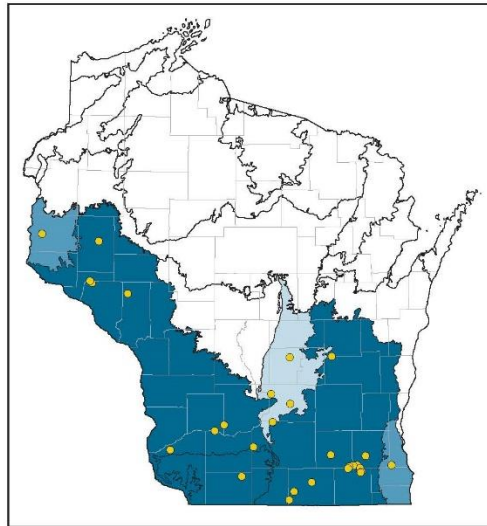
In 1959 Curtis wrote that “an oak savanna with an intact ground layer is the rarest plant community in Wisconsin today.” This statement applies throughout the continental range of the type (Nuzzo 1986) and is even more apt now than it was a half century ago. Virtually all present conservation efforts to maintain and reestablish this type are restorations, wherein prescribed fire, mechanical removal of shrubs and saplings, mowing, and herbicides are employed to eliminate

or control unwanted woody growth and invasive herbs and encourage suppressed native groundlayer plants. In some restoration efforts, it has been deemed necessary to reintroduce native plant species that have been lost.

As defined by Curtis (1959), Oak Openings are oak-dominated savanna communities in which there was at least one tree per acre but where total tree cover was less than 50%. However, he also noted that the “density (of trees) per acre was the most variable of all characteristics,” a key point for managers and restoration planners. It’s also worth noting that Oak Openings could grade seamlessly into communities still influenced by and ultimately dependent on periodic wild-fire but characterized by increasing levels of canopy closure. A continuum of the fire-dependent “oak ecosystem” could grade from open and park-like oak openings, to a more closed oak woodland, and finally to closed canopy oak forest.

By 2012 wildfire suppression in much of the state had been policy for a century or more throughout the former range of these savannas. As a result, canopy cover is not by itself a useful criterion to define an Oak Opening, nor is it necessarily useful to identify a remnant. Multiple factors, such as the spacing and limb architecture of the dominant oaks, stand disturbance history, landscape position with respect to past fire behavior, and floristic associates (if they haven’t been shaded or grazed into oblivion) are arguably of greater importance in identifying stands that have retained some savanna attributes and possess the highest restoration potential (Leach and Givnish 1998).

Few extant remnants are in good condition, and these are now mostly limited to dry, often steep, rocky or gravelly sites. Remnant condition is typically poor owing to explosive



Locations of Oak Opening communities in Wisconsin. The deeper hues shading the ecological landscape polygons indicate geographic areas of greatest abundance. An absence of color indicates that the community has not (yet) been documented in that ecological landscape. The dots indicate locations where a significant occurrence of this community is present, has been documented, and the data incorporated into the Natural Heritage Inventory database.



This morainal ridge in Waukesha County supports a remnant oak opening. The dominant trees are large open-grown bur oaks, with scattered white oak and shagbark hickory also present. A long history of grazing has maintained savanna structure, but the understory is now composed almost entirely of nonnative cool season grasses. Southeast Glacial Plains Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

increases in woody growth, the dominance of invasive plants, the past and present impacts of grazing, and removal of the large oaks for timber or firewood. Oak Openings on mesic sites were formerly abundant, but these have essentially been extirpated, not only from southern Wisconsin but from the entire midwestern range of the community. Lowland savannas (these would occur on alluvial river terraces above the true floodplain) are now extremely rare, and known remnants are weedy and/or badly overgrown with shrubs and saplings.

The loss of the Oak Openings has been primarily due to four factors: the implementation of widespread fire suppression policies leading to an increase in the abundance and cover of woody plants at the expense of the native herbs; conversion of lands supporting savannas to other uses and cover types; prolonged periods of heavy grazing, which maintained savanna structure but caused the decline or loss of many native floristic associates; and recent increases in the abundance of invasive plants.

Fragmentation and the great changes in the vegetation mosaic within which the Oak Openings historically occurred have undoubtedly been significant factors in this formerly abundant natural community's demise, but the absence of intact remnants and the destruction and outright loss of the associated tallgrass prairies make the Oak Openings difficult to describe with precision, let alone manage with accurately predicted outcomes.

Community Description: Composition and Structure

Bur oak (*Quercus macrocarpa*) was the dominant tree on many mesic and dry-mesic sites in southeastern Wisconsin, with white oak (*Q. alba*) a dominant or co-dominant in some stands. Black oak (*Quercus velutina*) and shagbark hickory (*Carya ovata*) were the most important associates. The bur oaks were capable of achieving great girth, and the spreading crowns were often wider than the trees were high. No other upper midwestern plant community featured this unique stand physiognomy.

Shrub cover is highly variable and is often based on the time elapsed since the last fire. Important members of the shrub layer include American hazelnut (*Corylus americana*), gray dogwood (*Cornus racemosa*), New Jersey tea (*Ceanothus americanus*), leadplant (*Amorpha canescens*), and several native roses (*Rosa* spp.).

The herbaceous layer has the potential to support high floristic diversity as it may include plants associated with open oak woodlands, more densely canopied oak-dominated hardwood forests, and treeless prairies. Historically, representative herbs were big blue-stem (*Andropogon gerardii*), little blue-stem (*Schizachyrium scoparium*), needlegrass (*Stipa spartea*), Leiberg's panic grass (*Dichanthelium leibergii*), flowering spurge (*Euphorbia corollata*), wild bergamot (*Monarda fistulosa*), thimbleweed (*Anemone cylindrica*), American pasqueflower (*A. patens*), northern bedstraw (*Galium boreale*), bird's-foot violet (*Viola pedata*), eastern shooting-star (*Dodecatheon*

media), Solomon's-seal (*Polygonatum biflorum*), early buttercup (*Ranunculus fascicularis*), and yellow-pimpernel (*Taenidia integerrima*). Diverse and colorful displays of composites, especially among the asters, sunflowers, and blazing stars, were noted by observers who encountered the Oak Openings prior to the widespread settlement of southern Wisconsin by Euro-American immigrants.

A relatively small number of plants and animals reach their optimal abundance in the somewhat ecotonal Oak Openings. Some of the better known examples include kitten-tails (*Besseyia bullii*), yellow giant hyssop (*Agastache nepetoides*), cream gentian (*Gentiana alba*), smooth phlox (*Phlox glaberrima*), white camas (*Zigadenus elegans* var. *glaucus*), and purple milkweed (*Asclepias purpurascens*), all of which are now rare in Wisconsin. Among other plants that are known to occur in Oak Openings but that are either too rare to be useful as indicators of any particular community assemblage or structure, or which have been more strongly linked to other natural communities, are woolly milkweed (*Asclepias lanuginosa*), great Indian-plantain (*Arnoglossum reniforme*), wild hyacinth (*Camassia scilloides*), violet bush-clover (*Lespedeza violacea*), slender bush-clover (*L. virginica*), and one-flowered broom-rape (*Orobanche uniflora*).



One of the native plants adapted to the filtered shade and patchy canopy conditions of the oak opening is the globally rare kitten-tails. Photo by Robert H. Read, Wisconsin DNR.

Animals of conservation interest that have a substantial association with Oak Openings are Eastern Screech Owl (*Megascops asio*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), Eastern Bluebird (*Sialia sialis*), and Orchard Oriole (*Icterus spurius*). Trees with cavities can be important maternity sites for bats and also provide cover for other species. In years when the acorn crop is heavy, species such as Wood Duck (*Aix sponsa*) and eastern fox squirrel (*Sciurus niger*) may be common.

Conservation and Management Considerations

Because of its current rarity and the highly degraded condition of most remnants, conservation of the globally imperiled Oak Openings will be almost entirely dependent on efforts to restore heavily disturbed examples, most of them with greatly impaired, diminished, or missing components of the community's characteristic composition, structure, and function.

Frequent fires of low intensity are appropriate prescriptions for this community once the maintenance stage has been achieved, but initially, mechanical removal of unwanted competing shrubs and trees, augmented by the judicious use of herbicides, are critical steps. Once the surplus woody growth has been brought under control (this may be more effectively accomplished in stages, rather than in a rapid, massive reduction of woody cover) and reestablishment of a native ground layer is underway, the reintroduction of periodic fire will be the single most important step taken in the restoration process. Stands undergoing restoration will need to be monitored closely to assess ongoing needs to control invasive species (which are now present in virtually all remnants, including managed stands), set back shrubs and saplings, and determine whether or not there is a need to reintroduce missing elements of the native ground layer, ideally from similar habitats nearby.

The list of problematic invasive plants in the degraded, weed-infested remnants is long and includes Canada thistle (*Cirsium arvense*), garlic mustard (*Alliaria petiolata*), spotted knapweed (*Centaurea biebersteinii*), black swallow-wort (*Vincetoxicum nigrum*), common buckthorn (*Rhamnus cathartica*), multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), and the Eurasian honeysuckles (especially *Lonicera tatarica* and the hybrid *Lonicera x bella*). Exotic cool season grasses often dominate the ground layer of stands with a long history of livestock grazing. Prevalent among these are Canada bluegrass (*Poa compressa*), Kentucky bluegrass (*P. pratensis*), and smooth brome (*Bromus inermis*).

Native shrubs can become abundant in remnant Oak Openings, and managers may seek to control or even eradicate them from sites undergoing restoration. Examples include several of the sumacs (*Rhus* spp.), blackberries (*Rubus* spp.), and common prickly-ash (*Zanthoxylum americanum*).

Oak Opening restoration and management will likely be most successful where other natural communities belonging to the mosaic of fire-dependent vegetation comprising the oak ecosystem are also present (such as oak woodland and



Open-grown bur oaks dominate this remnant oak opening in western Waukesha County. Grazing has maintained savanna stand structure, but the understory is now dominated almost entirely by nonnative plants. Southeast Glacial Plains Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

oak-dominated forest types) or where the Oak Opening remnant can be embedded within native or surrogate grasslands. Opportunities to accomplish this are best offered by sites in the Driftless Area in both the Western Coulees and Ridges and Southwest Savanna ecological landscapes. Unlike many of the remnants in southeastern and south central Wisconsin (the southern Kettle Moraine being the exception), the steep slopes, shallow soils, and rougher topography of the Driftless Area have retained areas with unplowed sod, which may harbor seeds and other propagules of native species but also the native microflora and fauna associated with the uncropped substrate.

The southern portion of southeastern Wisconsin's Kettle Moraine region is especially significant as savanna and prairie restoration activities have been occurring there for several decades, a substantial core of public lands well suited (really critical) to these activities exists, and public interest and support for doing work of this nature is high. Excellent partnerships have developed there between public agencies and NGOs (The Nature Conservancy, Waukesha County Land Trust, Friends of the Mukwonago River, and The Prairie Enthusiasts are just a few examples) as well as with many private individuals. Somewhat parallel situations exist in parts of the Driftless Area, though a majority of the public land base there is centered on the larger river corridors. At some of the sites undergoing restoration, the Oak Openings occur within a mosaic of vegetation types that included Wet-mesic Prairie, Southern Sedge Meadow, Calcareous Fen, and Emergent Marsh.

Among the subjects needing additional research are the importance of stand size and connectivity; variability in the spatial and temporal representation of mature trees; compositional differences across the community's Wisconsin range; demographics of the prevalent oak species; representation of native shrubs; the intensity, frequency, and timing of prescribed burns; and differentiating savannas (e.g., those from

which fire has been excluded for many decades) from oak woodland and oak forest. The significance and ecological roles of animals that had been present historically but that are now absent from the range of the Oak Openings such as elk (*Cervus canadensis*), Greater Prairie-chicken (*Tympanuchus cupido*), Sharp-tailed Grouse (*Tympanuchus phasianellus*), and Passenger Pigeon (*Ectopistes migratorius*) also need to be better understood. The Northern Bobwhite (*Colinus virginianus*) might be placed with this group of extirpated species as well.

Savannas on sandy or gravelly alluvium apparently existed on outwash terraces or islands within or in close proximity to several of the major river floodplains, especially in southwestern Wisconsin. To date, documentation of the composition, structure, and function of such alluvial savannas has been very limited, but this is an item that merits further investigation in the near future as good restoration opportunities may exist on some of the public lands bordering rivers such as the Mississippi, Wisconsin, Chippewa, Black, St. Croix, and others.

Wisconsin has a major role to play in the restoration and management of this globally imperiled natural community and is a legitimate focus of land management activities at appropriate sites scattered across southern and central Wisconsin.

Additional Information

For additional information, see the descriptions of Oak Woodland, Oak Barrens, Pine Barrens, Southern Dry Forest, Southern Dry-mesic Forest, Sand Prairie, Dry Prairie, Dry-mesic Prairie, and Mesic Prairie. In parts of southeastern Wisconsin, the descriptions of Wet-mesic Prairie, Southern Sedge Meadow, Calcareous Fen, and Emergent Marsh might also offer information of interest. The U.S. National Vegetation Classification (US NVC) type most closely corresponding to Wisconsin's Oak Openings is GEGL02020 North-central Bur Oak Openings (Faber-Langendoen 2001).

The US NVC type CEGL005284 Chinquapin Oak Limestone – Dolomite Savanna is generally found farther south, e.g., in Missouri, but there is at least one good quality occurrence in Wisconsin on dolomite bluffs near the Mississippi River.

Michigan and Ontario have described CEGL005120 Lakeplain Wet-mesic Oak Openings. This extremely rare natural community is possible in the southeastern corner of Wisconsin and northeastern Illinois within the Chikwaukee Prairie-Illinois Beach complex. There is also at least one occurrence of a wet-mesic savanna in south central Wisconsin, south of Madison (obviously this stand would not fit the “lakeplain” concept). More study is needed to appropriately describe and classify this stand. The proposed state name is Wet-mesic (Alluvial) Swamp White Oak Savanna with a state rank of S1.

Also see:

Bowles and McBride (1998)
Brawn (2006)
Bray (1960)
Bronny (1989)
Haney and Apfelbaum (1990)
Haney and Apfelbaum (1994)
Henderson (2005)
Henderson and Epstein (1995)
Hujik (1995)
Kline (1997)
Leach and Ross (1995)
Leach and Givnish (1999)
Nuzzo (1986)
O'Connor et al. (2009)
Packard (1988)
Packard (1993)
Stout (1946)
WDNR (2010)
White (1986)

FROM: Epstein, E.E. Natural communities, aquatic features, and selected habitats of Wisconsin. Chapter 7 in *The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management*. Wisconsin Department of Natural Resources, PUB-SS-1131H 2017, Madison.

For a list of terms used, please visit the [Glossary](#).

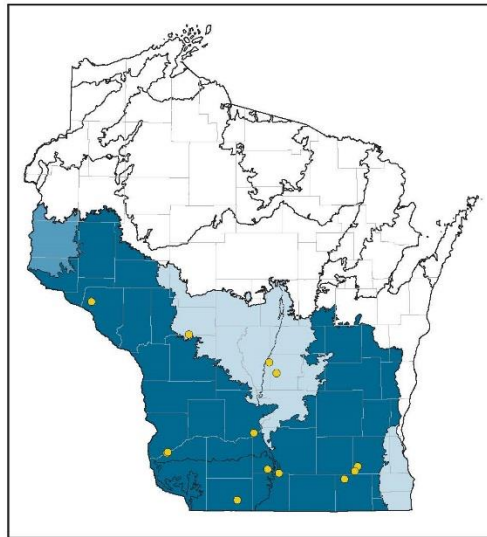
For a reference list, please see the [Literature Cited](#).

Appendix 2. Oak Woodland Community Description (WDNR Ecological Landscapes of Wisconsin, 2015)

Oak Woodland (Global Rank GX; State Rank S1)

Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

Oak Woodland is an integral part of the fire-dependent oak ecosystem complex, which also includes oak-dominated savannas and forests. Structurally, canopy cover in Oak Woodland is greater than that characteristic of the true savanna communities such as the more open, sparsely timbered Oak Opening and somewhat less than or approaching the more densely canopied Southern Dry and Southern Dry-mesic Forests. Canopy cover in Oak Woodland exceeds 50% and may approach 100%. Though this community shares many attributes with savannas and dry forests, a key point in defining Oak Woodland is that the higher canopy cover in remnants or restored stands is not simply due to fire suppression and the subsequent proliferation of fire-sensitive woody species. Besides the higher density of trees and greater canopy cover, the trees in an Oak Woodland lack the short, large diameter boles prevalent in well-developed oak savanna, and the crowns do not exhibit a limb architecture characterized by widely spreading branches, nor will they necessarily have the same form as the narrow crowns entirely lacking the spreading upper limbs of an oak forest.



Locations of Oak Woodland communities in Wisconsin. The deeper hues shading the ecological landscape polygons indicate geographic areas of greatest abundance. An absence of color indicates that the community has not (yet) been documented in that ecological landscape. The dots indicate locations where a significant occurrence of this community is present, has been documented, and the data incorporated into the Natural Heritage Inventory database.

It is thought that frequent fires of low-intensity maintained the understory in an open condition, free of dense growths of shrubs and saplings. It is possible that browsing by large herbivores such as elk and white-tailed deer also played a role in maintaining open understory conditions in this type prior to settlement by Euro-Americans. Though little is known about the historical extent or composition of Oak Woodland, it appears that at least some of the characteristic understory plant species (certain legumes, composites, and grasses among them) may reach their greatest abundance here.

The historical range of this type would have basically coincided with the range of other Oak Savannas, especially Oak Openings and perhaps dry hardwood forests dominated by white oak, which occurred mostly south of the Tension Zone in the Central Sand Hills, Southeast Glacial Plains, Southwest Savanna, and Western Coulees and Ridges ecological landscapes.

Community Description: Composition and Structure

Because so few intact examples have been identified and even fewer described in detail, information on composition is somewhat speculative. The canopy dominants on dry-mesic, mesic, and some dry sites in southern Wisconsin are oaks, commonly including white oak (*Quercus alba*), bur oak (*Q. macrocarpa*), northern red oak (*Q. rubra*), and shagbark hickory (*Carya ovata*). Black oak (*Quercus velutina*) and/or northern pin oak

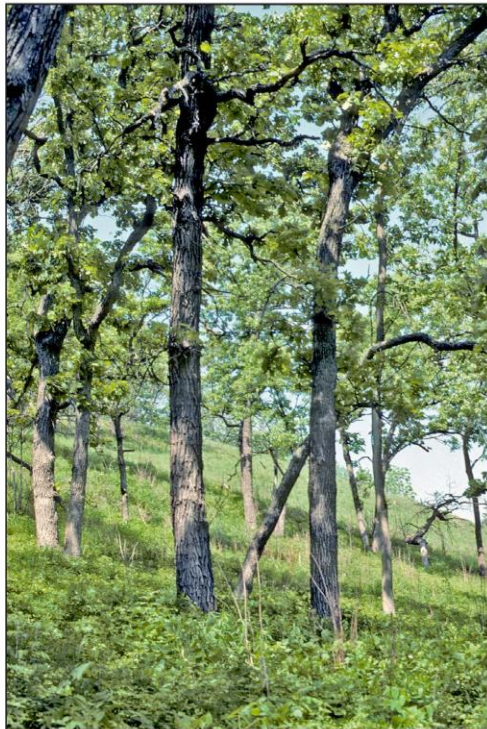


Oak woodland features high canopy closure, but the dominant oaks retain distinctive limb architecture, and the oaks' leaf mosaic allows more light to reach the ground than in stands being invaded by shade tolerant trees such as maples. Such stands are somewhat transitional between more open savannas and true forests. In some situations, they can be managed and maintained to help accommodate both forest interior animals and light-demanding understory plants that tolerate high filtered shade. Kettle Moraine State Forest – South Unit, Jefferson County, Southeast Glacial Plains Ecological Landscape. Photo by Drew Feldkirchner, Wisconsin DNR.

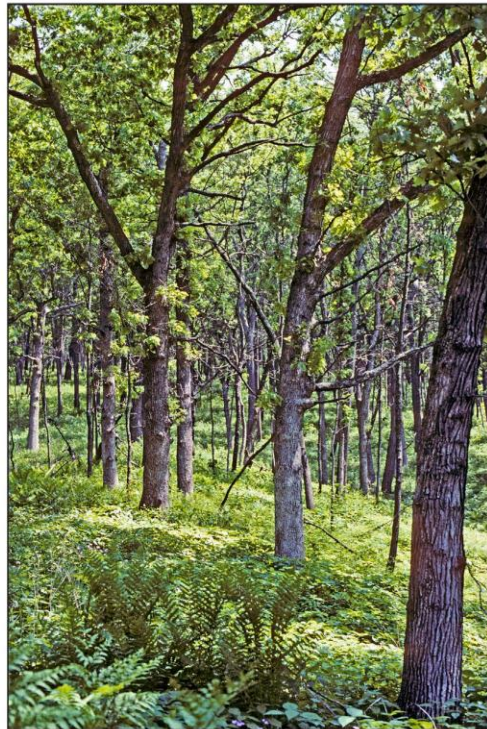
(*Q. ellipsoidalis*) would have been less common, and perhaps absent, on more mesic sites due to their shade intolerance and the competitive advantages some of the other oaks would have had in these environments.

The floristic associates documented by those collecting data that were later analyzed and presented in *The Vegetation of Wisconsin* (Curtis 1959) were compiled about seventy years ago. This was well after fire suppression policies had been widely implemented across the state, and therefore it is thought by some researchers that more of the understory plants representative of an Oak Woodland situation (higher canopy closure and less light reaching the surface) would still have been present and relatively easy to observe. Table VII-3 in Curtis (1959) (Appendix for Chapter 5, "Prevalent Groundlayer Species of Southern Dry Forest") would be worth taking a hard look at for clues to the composition of some oak woodlands during the mid-20th century.

Some members of the Oak Woodland flora are thought to belong to genera or families that are also common in other communities in the oak ecosystem group but represented by a different set of species (belonging to genera that include as members composites, grasses, legumes, mints, and snapdragons). Examples of species observed in and thought to be possibly representative of oak woodland environments include figwort giant hyssop (*Agastache scrophulariaefolia*), poke milkweed (*Asclepias exaltata*), American bellflower (*Campanula americana*), wood thistle (*Cirsium altissimum*), long-bracted green orchid (*Coeloglossum viride*), bracted tick-trefoil (*Desmodium cuspidatum*), purple Joe-Pye-weed (*Eupatorium purpureum*), bottlebrush grass (*Elymus hystrix*), forest bedstraw (*Galium circaezans*), broad-leaved panic grass (*Dichanthelium latifolium*), Solomon's-seal (*Polygonatum biflorum*), Short's aster (*Symphyotrichum shortii*), and yellow-pimpernel (*Taenidia integerrima*).



This white oak-red oak-black oak woodland has been "thinned from below," and several prescribed burns have reduced the heavy shade created by the previously dense understory of deciduous shrubs and saplings. Legumes, composites, and other light-demanding herbs are now thriving in the understory. Rush Creek State Natural Area, Crawford County, Western Coulees and Ridges Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.



Mixed stand of white, black, and red oaks is now managed with prescribed fire to restore and maintain open understory conditions and allow for the habitat needs of the more light-demanding herbs. Oak woodland is an important part of the continuum of fire-dependent communities occurring in southern Wisconsin. Rush Creek State Natural Area, Crawford County, Western Coulees and Ridges Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

Understory plants associated with oak savannas such as large-flowered yellow false foxglove (*Aureolaria grandiflora*), wild lupine (*Lupinus perennis*), and starry campion (*Silene stellata*) are also of potential or even likely occurrence within some oak woodlands. Species more often found in oak forest situations such as rough-leaved sunflower (*Helianthus strumosus*) and black-seeded rice grass (*Oryzopsis racemosa*) may also occur in Oak Woodland. Keep in mind that light conditions and the degree of shading may vary considerably within different parts of an oak savanna, oak forest, or oak woodland.

Plant species of high conservation significance owing to rarity or for other reasons would probably overlap with those more often associated with Oak Openings, at least to some degree. Examples include great Indian-plantain (*Arnoglossum reniforme*), purple milkweed (*Asclepias purpurascens*), yellow giant hyssop (*Agastache nepetoides*), violet bush-clover (*Lespedeza violacea*), snowy campion (*Silene nivea*), hairy meadow parsnip (*Thaspium chapmanii*), purple meadow parsnip (*T. trifoliatum*), and white camas (*Zigadenus elegans*).

Characteristic animals may include not only typical savanna associates such as the Orchard Oriole (*Icterus spurius*), Eastern Bluebird (*Sialia sialis*), Northern Flicker (*Colaptes auratus*), and the declining Red-headed Woodpecker (*Melanerpes erythrocephalus*) but also species more often associated with hardwood forests, such as Great-crested Flycatcher (*Myiarchus crinitus*), Eastern Wood-pewee (*Contopus virens*), Red-bellied Woodpecker (*Melanerpes carolinus*), Blue-gray Gnatcatcher (*Poliotila caerulea*), and Yellow-throated Vireo (*Vireo flavifrons*). Several area-sensitive forest interior birds, such as Cerulean Warbler (*Setophaga cerulean*), Hooded Warbler (*Setophaga citrina*), and Acadian Flycatcher (*Empidonax virescens*), have been documented in Oak Woodland during their breeding seasons. Where stand size is sufficient, community structure is appropriate, and where Oak Woodland adjoins extensive areas of dry-mesic or mesic hardwood forest, it may be possible to maintain populations of these species.

Conservation and Management Considerations

Oak Woodland occurred south of the Tension Zone where it most often occupied a position in the continuum of fire-dependent, fire-maintained natural communities between oak savannas and closed hardwood forests. In the absence of fire or other disturbances, the ground layer was quickly overtaken by shrubs and saplings, and characteristic forbs and grasses were either suppressed and reduced in vigor or disappeared altogether.

Among the numerous obstacles preventing or impeding the conservation and maintenance of Oak Woodland are fire exclusion, logging of the large canopy oaks, livestock grazing, leaf litter build-up, and an increase in shrubs, saplings, and small trees, especially infestations of species formerly excluded or suppressed because of their sensitivity to periodic fire. Colonization by highly invasive species, many of them nonnative, is also a significant problem for managers. The

lack of basic information on this segment of fire dependent oak ecosystems is another problematic factor.

The conservation focus will be on restoration, as remnants are either overgrown with woody understory plants or have lost their most characteristic understory species due to periods of prolonged grazing or the proliferation of invasive plants. Among the benefits to be gained by restoring and maintaining oak woodland is a clearer understanding that many of the native plant species that are currently declining in unburned oak “forests” will ultimately be lost from many parts of southern Wisconsin. Managing proactively for Oak Woodland using prescribed fire could alleviate or forestall this situation, at least locally.

As community stability is inherently low (or nonexistent) in the absence of periodic fire, there is a significant lack of information on the fire regime needed to restore and maintain an understory composed of native herbs in the Oak Woodland community. As a practical consideration, identifying and mapping stands of Oak Woodland using remote sensing imagery alone would be difficult or impossible. Canopy cover alone is not a criterion that will permit the planner, researcher, or natural resource manager to delineate occurrences of Oak Woodland with much confidence.

There are several factors that will aid in the differentiation of Oak Woodland from other fire dependent oak-dominated communities, such as oak savanna or oak forest. Among the potentially important clues to consider are composition of both the canopy and understory, limb architecture of the canopy trees, position in the local landscape with respect to physical features and other plant communities (which are the sources for recolonization of lost or depleted plants and animals from nearby woodland remnants), and perhaps most critically, the amount of light that reaches the soil surface.

The Oak Woodland type is NOT meant to simply indicate an overgrown Oak Opening in need of crown thinning—though that could be an appropriate, even necessary, management action for stands where more mesophytic tree species such as red maple, cherries, ashes, or ironwood have become part of the canopy.

More field inventory is needed to better characterize the community and identify restorable sites, especially those that occupy strategic locations bordered by oak savanna and oak forest. Managers of landscapes in which oak ecosystems are prevalent may be excellent sources of information, especially in areas such as the southern Kettle Moraine in southeastern Wisconsin or at scattered locations within the Driftless Area where management to maintain and restore savannas is an ongoing activity. This may be especially true in the vicinity of rough terrain bordering big rivers where the full complement of southern Wisconsin's fire-dependent natural communities is either present or could potentially be restored to functionality. Ideally these sites will be situated so that they can be managed with prescribed fire and, as needed and appropriate, by other methods such as brushing, judicious cutting, and limited herbicide use.

A potentially significant advantage to managers and conservationists when recognizing and managing Oak Woodland is that it can bridge the gap between stands managed to maintain or restore open savanna conditions with low tree cover of 10% to 50% and closed canopy forest. At some sites, this may mimic historical conditions and at others provide habitat for at least some sensitive forest interior species (Cerulean Warbler would be one of those). It would also mitigate some of the negative impacts associated with “hard,” high contrast edge (such as excessive white-tailed deer (*Odocoileus virginiana*) browse, increased rates of brood parasitism and predation, and more competition from already abundant edge-adapted species).

It is possible, even likely, that important variants of Oak Woodland occur on wet-mesic, mesic, and very dry sites. However, at this time there is a lack of data sufficient to allow for the adequate description of additional oak woodland communities. Stands on extremely dry, droughty, low nutrient sites with coarse textured soils in which the dominant oaks are mostly black oak or northern pin oak may experience somewhat different disturbance regimes (for example, more frequent, catastrophic, stand-replacing fires) and require other management approaches—especially on sites that historically supported open barrens communities. These were most often in the sand country of central Wisconsin and on the broad sandy terraces bordering major rivers in southwestern Wisconsin.

Additional Information

Information on related vegetation types can be found in the natural community descriptions in this chapter for Oak Openings, Oak Barrens, Southern Dry Forest, and Southern Dry-mesic Forest. The U.S. National Vegetation Classification type most closely resembling Oak Woodland on dry-mesic to mesic sites is CEGLO02142 White Oak – Bur Oak – Northern Red Oak / American Hazelnut Woodland (Faber-Langendoen 2001). However, CEGLO02134 Central Midwest White Oak – Mixed Oak Woodland, though described for areas south of Wisconsin, and a wet-mesic type CEGLO02140 Burr Oak Bottomland Woodland may also fit some Wisconsin occurrences with a bit of modification.

Special thanks to Wisconsin DNR botanist Rich Henderson for shedding light on many of the unknowns and other difficulties associated with this often-ignored and somewhat nebulous segment of the fire-dependent oak ecosystem continuum.

Also see:

Bray (1958)
DeLong and Hooper (1996)
Gilbert and Curtis (1953)
Grossman and Mladenoff (2007)
Leach and Ross (1995)
Packard (1993)
WDNR (2010)

FROM: Epstein, E.E. Natural communities, aquatic features, and selected habitats of Wisconsin. Chapter 7 in *The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management*. Wisconsin Department of Natural Resources, PUB-SS-1131H 2017, Madison.

For a list of terms used, please visit the [Glossary](#).

For a reference list, please see the [Literature Cited](#).

Appendix 3. Southern Dry-Mesic Forest Community Description (WDNR Ecological Landscapes of Wisconsin, 2015)

Southern Dry-mesic Forest (Global Rank G4; State Rank S3)

Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

Southern Dry-mesic Forest is most common and best developed south of the Tension Zone, especially in the relatively rugged terrain of the Driftless Area in the Western Coulees and Ridges Ecological Landscape. As almost 70% of the Driftless Area is in Wisconsin, conservation and management opportunities are somewhat greater here than they are elsewhere in the Upper Midwest.

Southern Dry-mesic Forest is also a widespread natural community in densely populated and heavily developed southeastern Wisconsin, but extensive areas of oak-dominated forest are now limited to the northern portions of the Kettle Moraine region where the rough topography of the interlobate moraine has somewhat limited the intensive agricultural and residential uses that are now regionally prevalent. In other parts of southern Wisconsin, Southern Dry-mesic Forest now occurs mostly as scattered farm woodlots or in narrow strips on steep sideslopes bordered by agricultural fields. Apart from the Driftless Area, the northern Kettle Moraine, and a few locations in central Wisconsin, blocks of this forest community exceeding 1,000 acres are generally absent.

Community Description: Composition and Structure

Dominant trees of relatively undisturbed, intact, mature stands are northern red oak (*Quercus rubra*), white oak (*Q. alba*), red maple (*Acer rubrum*), and sometimes American basswood (*Tilia americana*). Associates include shagbark hickory (*Carya ovata*), bitternut-hickory (*C. cordiformis*), black cherry (*Prunus serotina*), butternut (*Juglans cinerea*), and American elm (*Ulmus americana*). In the easternmost parts of southern Wisconsin, American beech (*Fagus grandifolia*) is sometimes a component of Southern Dry-mesic Forest.

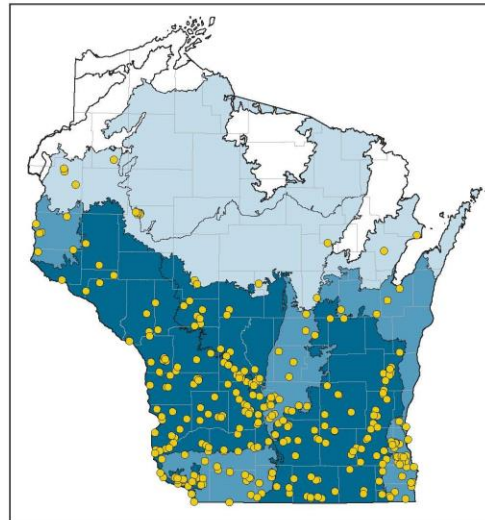


Mature dry-mesic hardwood forest of red oak, white oak, and red maple. Monroe County, Western Coulees and Ridges Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

Saplings and small trees usually belong to the more shade-tolerant mesophytes, such as red maple, sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), bitternut-hickory, and cherries (*Prunus* spp.). Ironwood (*Ostrya virginiana*) may be common as a sapling or small tree. Though oak seedlings can often be found, sapling oaks are generally scarce and may be altogether absent.

Shrubs associated with Southern Dry-mesic Forest include American hazelnut (*Corylus americana*), gray dogwood (*Cornus racemosa*), American witch-hazel (*Hamamelis virginiana*), and maple-leaved viburnum (*Viburnum acerifolium*).

The herbaceous flora may be highly variable as the community is widely distributed and covers a broad geographic range across southern and central Wisconsin. Like other fire-dependent natural communities, the Southern Dry-mesic Forest understory has been undergoing rapid changes in recent decades (Rogers et al. 2008). Among the groundlayer species that are widespread and that might be considered “characteristic” are wild geranium (*Geranium maculatum*), broad-leaf enchanter’s-nightshade (*Circaea lutetiana*), false Solomon’s-seal (*Maianthemum racemosum*), pointed tick-trefoil (*Desmodium glutinosum*), hog-peanut (*Amphicarpaea bracteata*), wood anemone (*Anemone quinquefolia*), American lop-seed



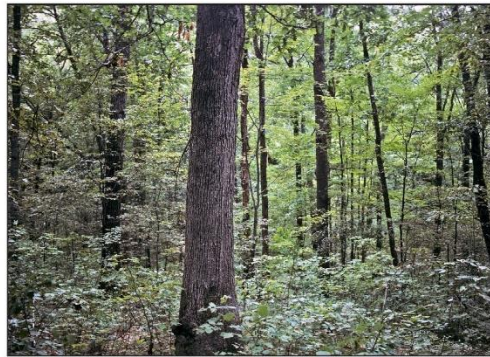
Locations of Southern Dry-mesic Forest in Wisconsin. The deeper hues shading the ecological landscape polygons indicate geographic areas of greatest abundance. An absence of color indicates that the community has not (yet) been documented in that ecological landscape. The dots indicate locations where a significant occurrence of this community is present, has been documented, and the data incorporated into the Natural Heritage Inventory database.

(*Phryma leptostachya*), large-flowered bellwort (*Uvularia grandiflora*), lady fern (*Athyrium filix-femina*), interrupted fern (*Osmunda claytoniana*), fragrant bedstraw (*Galium triflorum*), jack-in-the-pulpit (*Arisaema triphyllum*), downy yellow violet (*Viola pubescens*), and black snakeroot (*Sanicula* spp.).

Stands occupying sites that are variable in slope, aspect, soil depth, soil type, and moisture availability are likely to support some herbs characteristic of other forest communities, including such well-known spring wildflowers as spring-beauty (*Claytonia virginica*), Virginia water-leaf (*Hydrophyllum virginianum*), and blue cohosh (*Caulophyllum thalictroides*). Adjoining dry forests may contribute an additional complement of understory species. Examples might include rough-leaved sunflower (*Helianthus strumosus*) and starry false Solomon's-seal (*Maianthemum stellatum*). In the more extensive forests of southwestern Wisconsin, stands often include features such as springs, seepages, and bedrock outcrops. This adds to the number and kinds of niches available and increases the potential to support additional species and functions.

Among the rare and uncommon plants associated with Southern Dry-mesic Forest are forked aster (*Eurybia furcata*), heart-leaved skullcap (*Scutellaria ovata*), autumn coralroot (*Corallorhiza odontorhiza*), woodland boneset (*Eupatorium sessilifolium* var. *brittonianum*), Short's rock-cress (*Arabis shortii*), and nodding pogonia (*Triphora trianthophora*).

Characteristic birds inhabiting this forest community include Scarlet Tanager (*Piranga olivacea*), Eastern Wood-Pewee (*Contopus virens*), Great Crested Flycatcher (*Myiarchus crinitus*), Red-bellied Woodpecker (*Melanerpes carolinus*), Barred Owl (*Strix varia*), White-breasted Nuthatch (*Sitta carolinensis*), Red-eyed Vireo (*Vireo olivaceus*), Yellow-throated Vireo (*Vireo flavifrons*), and Ovenbird (*Seiurus aurocapilla*). Large stands are of especially critical



Mature stand of southern dry-mesic forest composed of large red oak, white oak, red maple, and other hardwoods features an intact ground layer and supports several rare forest interior birds. Norwalk Hardwoods, Monroe County, Western Coulees and Ridges Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

importance to area-sensitive species, such as the Cerulean Warbler (*Setophaga cerulean*), Hooded Warbler (*Setophaga citrina*), Worm-eating Warbler (*Helminthos vermivorum*), Acadian Flycatcher (*Empidonax vireescens*), and Wood Thrush (*Hylocichla mustelina*).

The extensive oak forests of southwestern Wisconsin have proven to be of high importance to migrating passerines as the peak spring migration periods for many of these birds is somewhat synchronized with the flowering of the oaks, opening of the oak leaf buds, and the appearance of a major hatch of caterpillars—an important food source for insectivores such as the wood warblers, vireos, gnatcatchers, and others needing to replenish their energy reserves after their long journeys.

At locations in southern Wisconsin where conifers play a significant role in the overall forest composition, the diversity of resident birds can be exceptionally high. Among the locations featuring such mixed deciduous-coniferous forests are the stream gorges of the Baraboo Hills (Sauk County) and the Upper Kickapoo River Valley (Vernon and southern Monroe counties).

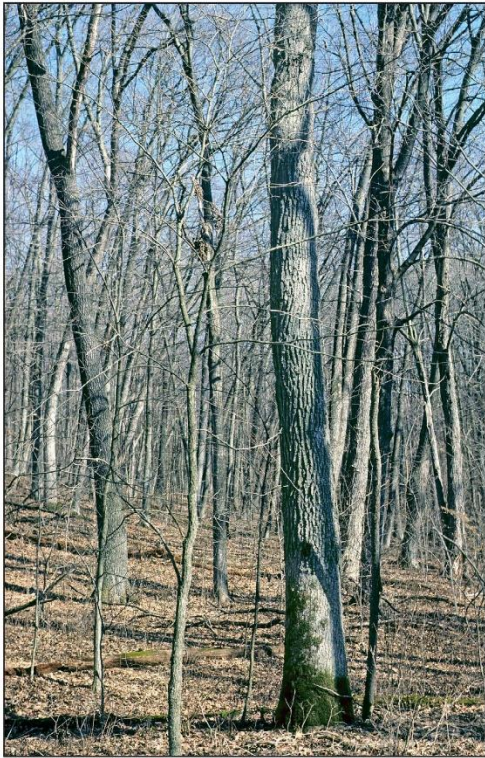
Other animals for which Southern Dry-mesic Forest provides important habitat include gray fox (*Urocyon cinereoargenteus*), woodland vole (*Microtus pinetorum*), eastern red bat (*Lasiurus borealis*), northern long-eared bat (*Myotis septentrionalis*), and gray rat snake (*Pantherophis spiloides*).

Conservation and Management Considerations

Along with habitat fragmentation and decreasing patch size, the composition of oak-dominated southern dry-mesic forests is changing (Nowacki and Abrams 2008). In the absence of periodic fire and under current harvest regimes, mesophytic (and sometimes rather weedy) tree species are becoming increasingly common and may eventually dominate the canopy. The primary factor responsible for this is the long-term policy of fire suppression, which has now been in place for a century or more in much of southern Wisconsin. In the absence of appropriate periodic disturbance, especially by fire, the oaks are eventually replaced by other hardwoods, and these species are often of significantly lower ecological value to forest wildlife. Red and white oak timber is also a significant source of economic value to local landowners and communities.

Prolonged periods of fire suppression, repeated episodes of high-grading (an unsustainable but all too common logging practice), infestations of gypsy moth (*Lymantria dispar*) and other invasive species, excessive browse pressure due to high white-tailed deer (*Odocoileus virginiana*) populations, and heavy pasturage by livestock have all been recent contributors to the decline of oak in southern Wisconsin forests.

The understories of stands heavily disturbed by severe windstorms, logging, or prolonged grazing may be choked by dense thickets of blackberries (*Rubus* spp.), gooseberries (*Ribes* spp.), common prickly-ash (*Xanthoxylum americanum*), or other shrubs partially protected by spines or thorns. They



Mature forest dominated by large northern red and white oaks. Note the general absence of mesophytic competitors such as red maple, black cherry, and ironwood in the stand pictured. Maintaining oaks on mesic and dry-mesic sites in the absence of fire and in the presence of dense growths of shade-tolerant shrubs and saplings has been problematic, and current logging practices used by some can aggravate this issue and speed cover type conversion. Baraboo Hills, Sauk County, Western Coulees and Ridges Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

may also be heavily invaded by nonnative invasive shrubs, such as the Eurasian honeysuckles (*Lonicera tatarica*, *L. morrowii*, and the hybrid *L. x bella*), buckthorns (*Rhamnus cathartica* and *R. frangula*), and Japanese barberry (*Berberis thunbergii*). Invasive herbs are now serious problems in many of southern Wisconsin's hardwood forests. Problematic weedy herbs in Southern Dry-mesic Forest include garlic mustard (*Alliaria petiolata*) and dame's rocket (*Hesperis matronalis*).

Given the ongoing major threats to the dry-mesic oak forests, as well as to other communities usually considered as parts of the fire-dependent oak ecosystem, the managers' toolkit to perpetuate oaks needs expansion. To have any hope of being effective, this will need to include measures such as prescribed fire, herbicide use, manual removal of competing shrubs and

saplings, underplanting of seedling oaks of local genotypes, and fencing. This is especially important on dry-mesic sites where conditions border on mesic. Some of these practices may be well beyond the means of many private woodlot owners, but an investment must be made in developing more reliable and cost-effective means of maintaining our oak forests.

Opportunities to manage for oak-dominated dry-mesic forests at large scales are best in the Driftless Area, especially in the Western Coulees and Ridges Ecological Landscape. The Baraboo Hills and some of the blufflands along southwestern Wisconsin's larger rivers (e.g., the Mississippi, Wisconsin, Chippewa, and Black) offer especially good opportunities to manage for a broad suite of southern forest, savanna, and grassland communities. In southeastern Wisconsin, the northern portion of the Kettle Moraine region, including parts of the Northern Unit of the Kettle Moraine State Forest, also offer excellent opportunities to manage for this forest type, although at somewhat reduced scales and in a portion of the ecological landscape in which savanna and prairie representation is greatly reduced or absent compared to areas farther south and west.

As habitat fragmentation is also a serious problem for Southern Dry-mesic Forest and all other upland forest communities in southern Wisconsin, where feasible Southern Dry-mesic Forest should be conserved and managed in large patches that include other forest communities as well as bedrock outcrops, spring seeps, rivers, and streams. This will maximize ecosystem diversity and viability as conditions change over time and will provide habitat for populations of species that cannot or are unlikely to be maintained in small, isolated patches.

The Southern Dry-mesic Forests support a wealth of native plants and animals, including many that do not occur in the much more extensive and less fragmented forests of northern Wisconsin. In addition to the ecological values provided by the southern oak forests, the dominant trees are notable for their longevity and the great size they may attain and for their aesthetic appeal and high economic value. Private-public partnerships and the development of appropriate incentives will be among the key factors necessary to achieve success in conserving this forest community.

Efforts to perpetuate oaks as components of forests on dry-mesic sites may include areas that are presently treeless or with very low tree cover (e.g. fallowed or abandoned agricultural fields or pastures, ensuring that the openings do not represent a remnant natural community, such as a bedrock glade, savanna, or prairie), especially if they occur as small but hard-edged openings within areas of extensive hardwood forest. When both historical and present conditions indicate that forest vegetation is appropriate cover for such small openings, reforestation may be a better, and far more practical, choice than maintaining a non-natural opening. In addition to potentially increasing the amount of oak on the landscape, such activities could reduce the negative impacts of hard edge while increasing the area of effective

forest for many wildlife species. This could also ameliorate the practice of entering the older, more intact stands first, which can further decrease the number of large patches and already scarce developmental stages needed by some species. This is a consideration that should become a part of the oak ecosystem managers' toolkit.

Additional Information

For additional information, see the natural community descriptions for Southern Dry Forest, Southern Mesic Forest, Central Sands Pine-Oak Forest, and Northern Dry-mesic Forest. The U.S. National Vegetation Classification associations corresponding most closely to Wisconsin's Southern Dry-mesic Forest are Midwestern White Oak – Red Oak Forest CEG002068 and Red Oak – Sugar Maple – Elm Forest CEG005017.

Also see:

Abrams (1992)
Abrams (1998)
Abrams (2003)
Abrams (2005)
Bowles et al. (2007)
Dey et al. (2010)
Fralish 2004)
Johnson et al. (2009)
Knoot et al. (2010)
Leach and Ross (1995)
Lorimer (1984)
Nowacki and Abrams (2008)
Rodewald (2003)
Rogers et al. (2008)
Steele (2012)
WDNR (2011a)
Wood et al. (2012)

FROM: Epstein, E.E. Natural communities, aquatic features, and selected habitats of Wisconsin. Chapter 7 in *The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management*. Wisconsin Department of Natural Resources, PUB-55-1131H 2017, Madison.

For a list of terms used, please visit the [Glossary](#).

For a reference list, please see the [Literature Cited](#).

Appendix 4. Southern Mesic Forest Community Description (WDNR Ecological Landscapes of Wisconsin, 2015)

Southern Mesic Forest (Global Rank G3?; State Rank S3)

Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

Southern Mesic Forest occurs south of the Tension Zone on moist, well-drained, medium, or fine-textured soils with high nutrient availability. In the glaciated areas of Wisconsin, this community occurs on well-drained ground moraine, fine-textured end moraine, rich alluvial terraces above river floodplains, and lakeplain margins. In southwestern Wisconsin's Driftless Area, Southern Mesic Forest occupies sites that are well drained but not droughty, which were protected from fire by rivers, wetlands, bedrock escarpments, and slopes with cool, humid northern or eastern aspects. While the distribution of Southern Mesic Forest is primarily south of the Tension Zone, outliers that might be classified here do occur to the north and east.

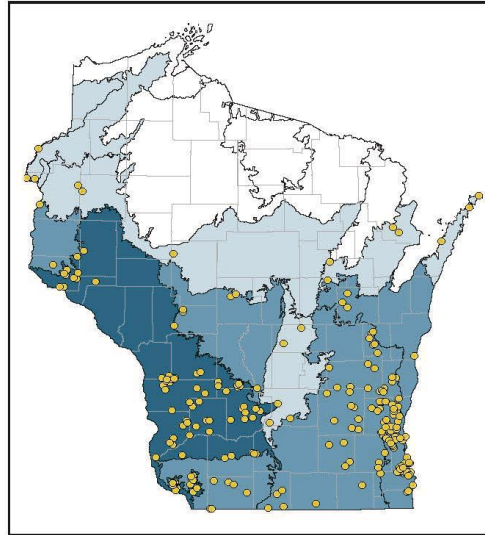
Historically this community was extensive in parts of glaciated southeastern Wisconsin (Finley 1976). It was also common, as were drier oak-dominated forests, in portions of southwestern Wisconsin's Driftless Area, especially in the heavily forested triangle formed by the Baraboo, Kickapoo, and Wisconsin rivers.

In glaciated and heavily developed southeastern Wisconsin, this community has been severely affected by outright destruction and habitat fragmentation. Much of the forest in the nearly level, fertile parts of Wisconsin was cleared to make way for farms, cities, and industries, leaving only scattered, small remnants. In the Western Coulees and Ridges Ecological Landscape of southwestern Wisconsin's unglaciated Driftless Area, the mesic hardwood forests are more common, less isolated, and may occur in a complex vegetation mosaic of drier oak-dominated forests on the rugged upland bluffs, conifer "relicts," and the lowland forests associated with large river floodplains.

Windstorms are the most important natural disturbance and may affect areas limited to the loss of single trees to much more extensive areas caused by tornadic storms or downbursts. Ice storms may also have extensive impacts. Gaps caused by these natural disturbances may set succession back, or when they occur at small scales of less than one to several acres, provide the conditions necessary for some of the less shade tolerant members of the community to persist or flourish.

Community Description: Composition and Structure

Southern Mesic Forest is dominated by hardwood trees, especially sugar maple (*Acer saccharum*) and American basswood (*Tilia americana*). In eastern Wisconsin near Lake Michigan, American beech (*Fagus grandifolia*) becomes an important canopy associate and may assume co-dominant status along with sugar maple and American basswood. The potential canopy associates comprise a diverse group and may include



Locations of Southern Mesic Forest in Wisconsin. The deeper hues shading the ecological landscape polygons indicate geographic areas of greatest abundance. An absence of color indicates that the community has not (yet) been documented in that ecological landscape. The dots indicate locations where a significant occurrence of this community is present, has been documented, and the data incorporated into the Natural Heritage Inventory database.

northern red oak (*Quercus rubra*), white oak (*Q. alba*), white ash (*Fraxinus americana*), red elm (*Ulmus rubra*), American elm (*U. americana*), red maple (*Acer rubrum*), black walnut (*Juglans nigra*), butternut (*J. cinerea*), bitternut-hickory (*Carya cordiformis*), and in the southwestern corner of the state, honey locust (*Gleditsia triacanthos*). Conifers are absent, although in a few areas, such as parts of the Driftless Area in the Western Coulees and Ridges Ecological Landscape, eastern white pine (*Pinus strobus*) and an occasional eastern hemlock (*Tsuga canadensis*) may occur.

In the parlance of many foresters, all forests dominated by sugar maple tend to be classified and managed as "northern hardwoods." There are some differences in understory composition and in the proportional representation of some of the canopy associates. Also, in the vast forests of northern Wisconsin, hemlock was dominant or co-dominant in many stands from which it is now absent, and these are all considered northern hardwoods.

The deep shade created by the canopy trees in undisturbed stands of sugar maple, American beech, and American basswood typically suppresses the shrub/sapling stratum until a gap opens up. Cover values of shrubs and saplings are typically low, and by mid-summer, mature stands appear quite

open beneath the canopy. Gap-phase replacement, caused by windthrow, ice accumulation damage, pest infestation, or disease, is the characteristic natural disturbance regime of Southern Mesic Forest. Gaps may quickly fill with thickets of sapling trees or shrubs such as American hazelnut (*Corylus americana*), American witch-hazel (*Hamamelis virginiana*), and muscle-wood (*Carpinus caroliniana*).

Nutrient-rich stands support striking displays of spring wildflowers such as wild leek (*Allium tricoccum*), blue cohosh (*Caulophyllum thalictroides*), woodland phlox (*Phlox divaricata*), spreading Jacob's-ladder (*Polemonium reptans*), bloodroot (*Sanguinaria canadensis*), large-flowered trillium (*Trillium grandiflorum*), May-apple (*Podophyllum peltatum*), downy yellow violet (*Viola pubescens*), and Virginia water-leaf (*Hydrophyllum virginianum*). The spring ephemerals deserve special mention. This group is well known and widely appreciated for the vibrant colors it adds to the drab and seemingly lifeless post-winter woodland landscape. The spring ephemerals complete the above-ground portion of their life cycles early in the growing season in just a few weeks before the trees leaf out. Common members of this group are spring-beauty (*Claytonia virginica*), Dutchman's breeches (*Dicentra cucullaria*), false mermaid-weed (*Floerkea proserpinacoides*), false rue anemone (*Enemion biternatum*), cut-leaved toothwort (*Cardamine concatenata*), and the trout-lilies: white (*Erythronium albidum*) and yellow (*E. americanum*). By late spring, dense stands of Canadian wood-nettle (*Laportea canadensis*), maidenhair fern (*Adiantum pedatum*), and other ferns (e.g., *Osmunda* spp., *Athyrium* spp.) have become dominant, and evidence of the vibrant ephemerals is gone.

Plants strongly associated with, and in some cases restricted to, the mesic hardwood forests of southern Wisconsin include showy orchis (*Orchis spectabilis*), heart-leaved skullcap (*Scutellaria ovata*), putty-root (*Aplectrum hyemale*), rue-anemone (*Thalictrum thalictroides*), glade fern (*Diplazium pycnocarpon*), broad beech fern (*Phegopteris hexagonoptera*), ebony spleenwort (*Asplenium platyneuron*), and silvery spleenwort (*Deparia acrostichoides*).

Among the rare herbs associated with Southern Mesic Forest—and some of these are also limited to southern Wisconsin—include bluestem goldenrod (*Solidago caesia*), snow trillium (*Trillium nivale*), goldenseal (*Hydrastis canadensis*), Carey's sedge (*Carex careyana*), great water-leaf (*Hydrophyllum appendiculatum*), nodding pogonia (*Triphora trianthophora*), twinleaf (*Jeffersonia diphylla*), and reflexed trillium (*Trillium recurvatum*). Several rare woody plants also occur in Southern Mesic Forest; the shrub, smooth black-haw (*Viburnum prunifolium*), the Wisconsin Special Concern Kentucky coffee-tree (*Gymnocladus dioica*), and the Wisconsin Threatened blue ash (*Fraxinus quadrangulata*).

The rare animals found in southern Wisconsin hardwood forests include a number of area-sensitive species that are either absent from or of very limited distribution in the far more extensive forests of northern Wisconsin. This group includes Cerulean Warbler (*Setophaga cerulean*), Hooded



Remnant mesic hardwood forest in Milwaukee County is dominated by large oaks, maples, American basswood, and American beech. Few such remnants persist in the southeastern corner of the state, all are small and isolated, and most are fragments of formerly much more extensive forested areas. Southern Lake Michigan Coastal Ecological Landscape. Photo by Emmet Judziewicz.



This rich maple-basswood forest on slopes above the Rush River in Pierce County supports a high diversity of herbs, including snow trillium (Wisconsin Threatened), putty-root (Wisconsin Special Concern) and Dutchman's breeches. Western Coulees and Ridges Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

Warbler (*Setophaga citrina*), Kentucky Warbler (*Geothlypis formosa*), Yellow-throated Warbler (*Setophaga dominica*), Worm-eating Warbler (*Helmitheros vermivorum*), Louisiana Waterthrush (*Parkesia motacilla*), and Acadian Flycatcher (*Empidonax virescens*). Other birds breeding in southern Wisconsin's mesic hardwood forests are Wood Thrush (*Hylocichla mustelina*), Scarlet Tanager (*Piranga olivacea*), Pileated Woodpecker (*Dryocopus pileatus*), Blue-gray Gnatcatcher (*Poliopitila caerulea*), Barred Owl (*Strix varia*), and Red-shouldered Hawk (*Buteo lineatus*).

When other habitats, such as ephemeral ponds, seeps and spring runs, streams, cliffs, or talus slopes, are embedded within Southern Mesic Forest, additional species (amphibians, aquatic invertebrates, wetland plants), which may include rare or sensitive habitat specialists, will find suitable

living conditions. Older stands, for example, those with deep humus and abundant coarse woody debris, are important for frogs and salamanders and some invertebrates.

Conservation and Management Considerations

Critical management issues include severe fragmentation (especially in the southeast), infestations of invasive plants, which can be overwhelming in the case of garlic mustard (*Alliaria petiolata*), exotic earthworms (the issue of soil and understory damage due to the activities of exotic earthworms is well documented and very serious in mesic hardwood forests of northern Wisconsin; the situation in the south is less clear), and negative grazing and browsing impacts due to the activities of domestic livestock and white-tailed deer (*Odocoileus virginianus*). Dutch elm disease, caused by several species of fungi but especially *Ophiostoma ulmi*, has devastated mesic forests in which red or American elm were important components. Beech bark disease (beech scale), caused by interactions of a scale insect (*Cryptococcus fagisuga*) and fungi (several

species in the genus *Neonectria*) has been documented in Door County and seems likely to spread throughout the Wisconsin range of American beech. Infested stands may include resistant individuals, so there is some hope that these can be propagated and used to repopulate infested stands. An exotic beetle, the emerald ash borer (*Agrilus planipennis*), has been spreading rapidly, especially in southern Wisconsin, and will alter the composition and structure of infested stands in which ash occurs by killing most of them.

Conservation and management of Southern Mesic Forest will be most effective, especially for associated vertebrates, where this type occurs in a mosaic of other, more extensive hardwood forest communities. Public ownership of mesic hardwood forests is limited and unlikely to increase appreciably; partnerships involving NGOs and other private entities are essential if the best remaining examples are to be maintained, restored, and managed. Additional incentives, focused on the conservation of whole forest communities rather than on exploitation or resource extraction, are needed



Floristically rich southern mesic forest dominated by sugar maple, American basswood, and red oak occupies this moist cove opening to the Kickapoo River in south central Monroe County. Wilton Hemlock-Hardwoods, Western Coulees and Ridges Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.



Diverse old stands of sugar maple-basswood forest on an alluvial terrace just above the floodplain of the Black River. This stand supports not only a diverse herbaceous layer but several rare animals as well. Black River State Forest, Jackson County, Central Sand Plains Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

for private landowners if the loss of diversity in southern forests is to be reversed or even abated (Rogers et al. 2008, Waller and Rooney 2008).

Some of the best and most extensive conservation opportunities are within the Driftless Area (e.g., in the Baraboo Hills and along the lower Wisconsin River), but there are important stands elsewhere, especially in the southeastern quadrant of the state (the most intact of these are in the northern part of the Kettle Moraine region) and in west central Wisconsin, near the Mississippi and St. Croix rivers. Mesic forests in these areas differ from one another in their post-Pleistocene histories, soils, landforms, and to some degree, in their composition. In most of southern Wisconsin, but especially in the east, this type has been greatly reduced because of outright destruction and the conversion of forested land on fertile, well-drained ground moraine with gentle topography to agricultural or residential uses. Fragmentation pressures are very high, and many remnants are in poor condition because of past grazing, overabundant white-tailed deer, the explosive spread of invasive plants, high-grading, and the influence of activities in the surrounding landscape. Intact mesic hardwood forests are scarce now and becoming increasingly more so.

The classification of forest communities has sometimes been an issue that has presented additional challenges to conservation as resource management agencies do not always differentiate the mesic hardwood forests of southern Wisconsin from the much broader and widely used category of “northern hardwoods.” The latter type is still represented by millions of acres in northern Wisconsin and the Upper Peninsula of Michigan and has been considered by some as not worthy of conservation attention because of its abundance. We would emphasize that many of the unique attributes of Southern Mesic Forest, including a high percentage of the

rare species mentioned in the “Community Description” section above, are not duplicated or even present in the northern hardwood forests. In addition, there are climatic, geological, and hydrological differences between the mesic hardwood forest of the north and south. The vegetation mosaic and context of the southern hardwood forests is very different from those of the north.

It has become increasingly difficult to find intact examples of Southern Mesic Forest in good condition. The acreage of this community occurring on public lands is limited, and it is important to avoid taking the type for granted. Better incentives are needed for private landowners if they are to focus on the conservation of southern Wisconsin's forest communities to ensure that they can be better protected from the negative impacts of incompatible or short-sighted land uses.

Additional Information

For related information, see the natural community descriptions for Northern Mesic Forest, Southern Dry-mesic Forest, and Southern Hardwood Swamp. The U.S. National Vegetation Classification type most closely corresponding to Southern Mesic Forest is CEG002062 North-central Maple – Basswood Forest (Faber-Langendoen 2001). It is likely that CEG005013 Beech - Maple Glaciated Forest would apply to a limited acreage of mesic hardwood forests in southeastern Wisconsin. It would also apply to beech-maple hardwood forests north of the Tension Zone in close proximity to Lake Michigan though at least a few of these stands also support coniferous tree species such as eastern white pine, eastern hemlock, and northern white-cedar (*Thuja occidentalis*).

Also see:

Grimm (1984)

FROM: Epstein, E.E. Natural communities, aquatic features, and selected habitats of Wisconsin. Chapter 7 in *The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management*. Wisconsin Department of Natural Resources, PUB-SS-1131H 2017, Madison.

For a list of terms used, please visit the [Glossary](#).

For a reference list, please see the [Literature Cited](#).

Appendix 5. Mesic Prairie Community Description (WDNR Ecological Landscapes of Wisconsin, 2015)

Mesic Prairie (Global Rank G1G2; State Rank S1)

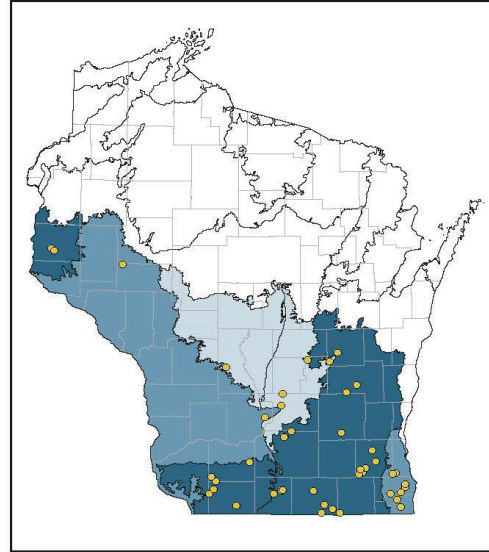
Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

Mesic Prairie was historically the most abundant of the tall-grass prairie communities in southern Wisconsin, where it was estimated to have covered approximately 840,000 acres (Curtis 1959, Finley 1976). Sites supporting Mesic Prairie featured nutrient-rich loamy soils, level to gently rolling topography, adequate moisture, and good drainage. Frequent wildfire was the primary disturbance factor responsible for maintaining Mesic Prairie, though periodic drought and at times grazing by wild ungulates were sometimes important factors. The most extensive tallgrass prairies occurred in areas lacking natural firebreaks, where there were few lakes, streams, or wetlands to obstruct fires ignited by lightning strikes or native Americans. Major landforms supporting extensive areas of Mesic Prairie included well-drained ground moraine and silt-capped ridgetops in the Driftless Area.

Today Mesic Prairie is one of the rarest native grassland communities in Wisconsin and across continental North America. The few remnants are small, isolated, often weedy, and tend to occur in narrow strips along roads, railroad tracks, or in utility corridors and are highly vulnerable to further degradation and decline. A few stands are known from cemeteries established in the late 19th or early 20th centuries. The landscape mosaic within which tallgrass prairie remnants are embedded today is typically composed of intensively cropped agricultural lands, some of which are rapidly urbanizing. This is especially acute in southeastern and west central Wisconsin.

Community Description: Composition and Structure

The dominant plants are grasses and a diverse and showy assemblage of forbs. Important tall grasses, which grew to heights of 2–3 meters or more, were big blue-stem (*Andropogon gerardii*), yellow Indian grass (*Sorghastrum nutans*), needle grass (*Stipa spartea*), and switch grass (*Panicum virgatum*). Shorter grasses, such as prairie dropseed (*Sporobolus heterolepis*), little blue-stem (*Schizachyrium scoparium*), and several of the panic grasses (e.g., Leiberger's panic grass, *Dichanthelium leibergerii*) are often present and may be common in some stands. The diverse forb layer is vibrant as it typically includes good representation from groups such as the asters, goldenrods, sunflowers, blazing stars, and legumes. Representative forbs of Mesic Prairie include compass-plant (*Silphium laciniatum*), prairie rosinweed (*S. integrifolium*), rough blazing-star (*Liatris aspera*), thick-spike blazing-star (*L. pycnostachya*), heath aster (*Symphotrichum ericoides*), smooth aster (*S. laeve*), stiff sunflower (*Helianthus pauciflorus*), showy tick-trefoil (*Desmodium canadense*), Illinois tick-trefoil (*D. illinoense*), purple prairie-clover (*Dalea purpurea*), rattlesnake-master (*Eryngium yuccifolium*), flowering spurge



Locations of Mesic Prairie in Wisconsin. The deeper hues shading the ecological landscape polygons indicate geographic areas of greatest abundance. An absence of color indicates that the community has not (yet) been documented in that ecological landscape. The dots indicate locations where a significant occurrence of this community is present, has been documented, and the data incorporated into the Natural Heritage Inventory database.

(*Euphorbia corollata*), prairie thistle (*Cirsium discolor*), northern bedstraw (*Galium boreale*), wild bergamot (*Monarda fistulosa*), yellow coneflower (*Ratibida pinnata*), heart-leaved golden alexanders (*Zizia aptera*), common spiderwort (*Tradescantia ohioensis*), and violet wood-sorrel (*Oxalis violacea*).

Cover values for woody plants would have been low under the disturbance regime of frequent fire that typically maintained the community but increased rapidly as fire suppression policies were implemented across southern Wisconsin by Euro-American immigrants. Shrubs associated with Mesic Prairie included New Jersey tea (*Ceanothus americanus*), prairie willow (*Salix humilis*), lead-plant (*Amorpha canescens*), American hazelnut (*Corylus americana*), and Carolina rose (*Rosa carolina*). Stands from which fire had been excluded for long periods were quickly overrun by shrubs and sapling trees. Problematic plant species for land managers trying to maintain or restore Mesic Prairie are some of the native sumacs such as smooth sumac (*Rhus glabra*) or staghorn sumac (*R. typhina*) and dogwoods like gray dogwood (*Cornus racemosa*) and red osier dogwood (*C. stolonifera*) and nonnative highly invasive shrubs such as the Eurasian buckthorns such as common buckthorn (*Rhamnus cathartica*) and glossy buckthorn

(*R. frangula*), honeysuckles (especially Tartarian (*Lonicera tatarica*), Asian fly (*L. morrowii*), and hybrid Bell's (*Lonicera x bella*) honeysuckle), and multiflora rose (*Rosa multiflora*).

Some rare plants associated with mesic prairie are pale green orchid (*Platanthera flava*), the U.S. Threatened and Wisconsin Endangered prairie white-fringed orchid (*P. leucophaea*), Wisconsin Endangered wild hyacinth (*Camassia scilloides*), Wisconsin Threatened pale purple coneflower (*Echinacea pallida*), American feverfew (*Parthenium integrifolium*), prairie-turnip (*Pediomelum esculentum*), and hairy fimbriistylis (*Fimbristylis puberula*). Mead's milkweed (*Asclepias meadii*) formerly grew in the mesic prairies of southwestern Wisconsin but is now considered extirpated as a wild plant in Wisconsin.

Remnants that have retained high cover values for native grasses and forbs continue to provide habitat for many prairie insects (Panzer et al. 1995) dependent on native prairie vegetation, but some of the vertebrates, especially those that are somewhat area-dependent such as the Great Prairie-Chicken (*Tympanuchus cupido*), Northern Harrier (*Circus cyaneus*), Short-eared Owl (*Asio flammeus*), and American badger (*Taxidea taxus*) are present and persist only if the surrounding area offers extensive areas of open grassland, including core areas that are not cultivated annually. Other noteworthy animals associated with Mesic Prairie are Franklin's ground squirrel (*Spermophilus franklinii*), Henslow's Sparrow (*Ammodramus henslowii*), Bobolink (*Dolichonyx oryzivorus*), and Dickcissel (*Spiza americana*). Rare invertebrates inhabiting mesic prairies include the regal fritillary (*Speyeria idalia*), liatris borer moth (*Papaipema beeriana*), silphium borer (*P. silphii*), phlox moth (*Schinia indiana*), and red-tailed prairie leathopper (*Aflexia rubranura*).

Conservation and Management Considerations

The attributes of high soil fertility, gentle topography, the absence of trees, John Deere's invention of the first commercially successful steel moldboard plow in 1837, and a large influx of Euro-American settlers (many of them farmers) led to the rapid loss of virtually all of our mesic prairies in less than half a century. Once an implement capable of breaking and turning over the tough prairie sod was available, outright destruction was the overriding factor in the precipitous decline of North America's tallgrass prairies. Because of favorable growing conditions and high productivity for crops, the mesic prairies were among the first of our natural communities to disappear. Today, no more than a few hundredths of one percent of this community's former acreage in Wisconsin persists, a situation which is unfortunately paralleled throughout the continental range of these native grasslands.

Because so many of the persisting remnants are small, isolated, and bordered by intensively cultivated agricultural lands, developed residential areas, roads, or railroad tracks, they are exceptionally vulnerable to damage from herbicide spray, salt residue, nutrient-enriched runoff, and infestations of invasive plants. Where rights-of-way are managed with



Good examples of mesic prairie vegetation are now virtually non-existent. Rich silt loam soils and level topography led to the almost total destruction of the deep-soil, tallgrass prairies and their conversion to crop land. Extant remnants are all small, isolated, and vulnerable to disturbance and degradation by further species loss, the spread of invasive plants, herbicide drift, and neglect. Ipswich Prairie occupies an abandoned railroad right-of-way in the cornscape that now covers much of Grant and Lafayette counties. Southwest Savanna Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.



Only small fragments of mesic tallgrass prairie persist today. Most of them are in transportation rights-of-way where they are highly vulnerable to inadvertent damage or outright destruction. Hammond Cemetery Prairie, St. Croix County, Western Prairie Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

herbicides or road-grading equipment, the remnants are quickly degraded, and the diversity within them is quickly lost. Grazing, mowing, fire suppression, and tree planting are also disturbances that pose serious threats to mesic prairies. Grazed stands eventually become dominated by nonnative cool season grasses, including smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), Canada bluegrass (*P. compressa*), timothy (*Phleum pratense*), orchard grass (*Dactylis glomerata*), and reed canary grass (*Phalaris arundinacea*).

Long term, the best conservation opportunities occur where small remnants can be embedded within extensive

areas of open vegetation composed of other prairie types, sedge meadows, and “surrogate” grasslands. This may be especially effective where “prairie pastures” (lands that have a history of livestock grazing but that have never been plowed) are relatively abundant, though these are most often found in areas of steep topography or where bedrock is close to the surface. Occasionally a (narrow) zone of mesic prairie occurs at or near the base of a slope, on the margins of a wetland, or on a narrow ridgetop with a deep loess cap. Meanwhile, it is imperative that the prairie biota, especially plants and invertebrates, are thoroughly surveyed and that the data are analyzed and applied to restoration efforts wherever viable grassland management opportunities at large scales occur.

Sites where it may be feasible to consider the restoration and maintenance of Mesic Prairies at larger scales include Military Ridge and some of the historic prairie areas just to the south, mostly in southwestern Wisconsin’s Driftless Area, the Scuppernong Basin in the Southern Kettle Moraine Region in the southeastern part of the state, the Western Prairie Habitat Restoration Area near the Minnesota border in Pierce and St. Croix counties, and, straddling the Wisconsin-

Illinois border along Lake Michigan, the Chiwaukee Prairie-Illinois Beach State Park complex.

We also encourage state and local governments, other institutions engaged in land management and protection, NGOs, and private individuals to take on the task of preserving and properly managing as many of the small remnants scattered across southern Wisconsin as is possible.

Additional Information

For additional information on somewhat similar natural communities, see the descriptions for Dry-mesic Prairie, Wet-mesic Prairie, Wet Prairie, Calcareous Fen, Southern Sedge Meadow, and Oak Opening. In the U.S. National Vegetation Classification, the community corresponding most closely to Mesic Prairie is CEG1002203 Big Bluestem – Yellow Indiangrass – (Prairie Dropseed) – Blazingstar Species – Gray-head Prairie Coneflower Herbaceous Vegetation (Faber-Langendoen 2001).

Also see:

Henderson and Krause (1995)
Sample and Mossman (1997)

FROM: Epstein, E.E. Natural communities, aquatic features, and selected habitats of Wisconsin. Chapter 7 in *The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management*. Wisconsin Department of Natural Resources, PUB-55-1131H 2017, Madison.

For a list of terms used, please visit the [Glossary](#).

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Appendix 6. Southern Sedge Meadow Community Description (WDNR Ecological Landscapes of Wisconsin, 2015)

Southern Sedge Meadow (Global Rank G4?; State Rank S3)

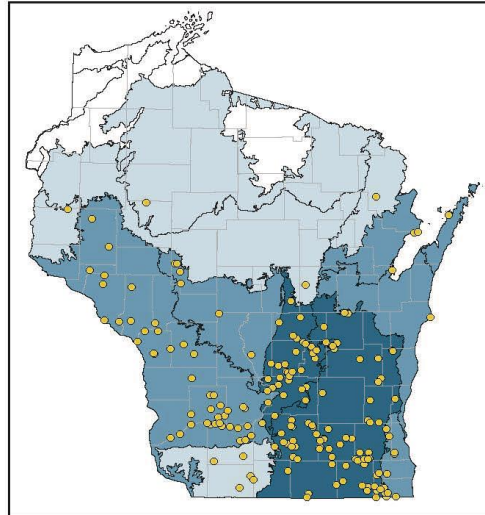
Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

Southern Sedge Meadow is an herb-dominated, minerotrophic wetland community that is most abundant south of the Tension Zone. Outliers are scattered across northern Wisconsin, but there the community is uncommon and of limited extent and supports fewer plant species of mostly southern distribution. Wisconsin's larger occurrences are situated in poorly drained glaciated terrain, especially on landforms such as till plain, lake plain, and outwash. Sedge Meadows are often associated with lake and stream margins. In southwestern Wisconsin's unglaciated Driftless Area, sedge meadows occur mostly along larger low gradient rivers and streams. Stands of Southern Sedge Meadow are also present along the upper reaches of some smaller Driftless Area streams, including headwaters areas, where groundwater seepage can be an important water source.

Soils are peats and mucks, which are usually alkaline, especially in regions of the state such as the southeast where the underlying glacial materials are calcareous, in contrast to the more acid peats and tills associated with the boggy habitats found throughout the north and within parts of central Wisconsin. Layers of marl or clay are sometimes present, and in some areas these help maintain saturated conditions throughout the growing season. In some locations sedge meadows have developed on mineral substrates, such as sands or clays, where the water table has remained high. Because they occupy some of the lowest elevations in a landscape, sites supporting sedge meadows may experience cold air drainage and fogs during the growing season and early fall frosts. The wet soils are slow to warm in the spring, retarding vegetation development.

The mosaic of wetland communities within which Southern Sedge Meadow occurred historically included marsh, fen, low prairie, shrub swamp, and lowland forest. Uplands adjoining Southern Sedge Meadow were vegetated with a mixture of prairie, savanna, woodland, and hardwood or mixed forest. Site hydrology, especially under the saturated or partially inundated water levels typically present in spring, is among the major factors that formerly maintained sedge meadow and prevented them from succeeding to communities dominated by woody vegetation. Another key disturbance factor was wildfire, which periodically burned the meadows along with nearby fire-adapted vegetation types such as prairies and savannas. Uplands bordering sedge meadows often supported fire-dependent vegetation such as mesic (tallgrass) prairie, oak savanna, oak woodland, and oak forest, and the fires that formerly maintained those communities sometimes burned the adjacent sedge meadows as well. Severe droughts, especially when prolonged for a period of years, also impacted sedge meadow by allowing for the establishment of shrubs and trees.

Much of the natural vegetation that historically bordered wetlands of all types in densely populated, heavily developed southeastern Wisconsin has been cleared and replaced



Locations of Southern Sedge Meadow in Wisconsin. The deeper hues shading the ecological landscape polygons indicate geographic areas of greatest abundance. An absence of color indicates that the community has not (yet) been documented in that ecological landscape. The dots indicate locations where a significant occurrence of this community is present, has been documented, and the data incorporated into the Natural Heritage Inventory database.

by cropland, pasture, and residential or industrial areas. In parts of central Wisconsin, however, extensive areas of oak forest (much of it formerly savanna) are still prevalent on the uplands bordering wetlands. Where appropriate, and when not conflicting with other land management needs and goals, the reintroduction of fire would help to partially restore and maintain the mosaic of native communities formerly present in the region.

Many sedge meadows have been ditched or tilled in order to make them more suitable for agricultural uses; others have been inundated by dam and dike construction to enhance certain recreational activities or facilitate the passage of ships. In some areas, wetlands, including sedge meadows, were routinely filled or used as dumps.

Community Description: Composition and Structure

The dominant graminoid is most often tussock sedge (*Carex stricta*), a species that has tremendous influence on the structure and composition of Southern Sedge Meadow by providing microsites upon which other members of the community find suitable growing conditions. Other sedges common in or characteristic of this community are common lake sedge (*Carex lacustris*), water sedge (*C. aquatilis*),

Sartwell's sedge (*Carex sartwellii*), lesser panicled sedge (*C. diandra*), bristly sedge (*C. comosa*), and bottlebrush sedge (*C. hystericina*). Blue-joint grass (*Calamagrostis canadensis*) is a frequent associate and a co-dominant in some sedge meadows. Other grasses occurring in Southern Sedge Meadow are fringed brome (*Bromus ciliatus*), prairie cordgrass (*Spartina pectinata*), marsh muhly (*Muhlenbergia glomerata*), and fowl manna grass (*Glyceria striata*).

A diverse group of forbs is associated with Southern Sedge Meadow, including marsh bellflower (*Campanula aparinoides*), marsh fern (*Thelypteris palustris*), tall meadow-rue (*Thalictrum dasycarpum*), sensitive fern (*Onoclea sensibilis*), northern water-horehound (*Lycopus uniflorus*), panicled aster (*Symphotrichum lanceolatum*), shining-leaved aster (*S. firmum*), southern blue flag (*Iris virginica*), giant goldenrod (*Solidago gigantea*), spotted Joe-Pye-weed (*Eupatorium maculatum*), boneset (*E. perfoliatum*), great water dock (*Rumex orbiculatus*), marsh skullcap (*Scutellaria galericulata*), tufted loosestrife (*Lysimachia thyrsiflora*), purple-stem angelica (*Angelica atropurpurea*), meadow anemone (*Anemone canadensis*), turtlehead (*Chelone glabra*), swamp milkweed (*Asclepias incarnata*), swamp thistle (*Cirsium muticum*), brook lobelia (*Lobelia kalmii*), lesser purple fringed orchid (*Platanthera psychodes*), and Michigan lily (*Lilium michiganense*).

The complement of woody plants found in sedge meadows includes many shrubs that dominate or are common in Shrub-carr communities, such as red osier dogwood (*Cornus stolonifera*), silky dogwood (*C. amomum*), beaked willow (*Salix bebbiana*), pussy willow (*S. discolor*), sandbar willow (*S. exigua*), meadow willow (*S. petiolaris*), ninebark (*Physocarpus opulifolius*), nannyberry (*Viburnum lentago*), and white meadowsweet (*Spiraea alba*). Tree cover is low but may include seedlings and saplings of American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*), and others deciduous species. The needle-leaved deciduous conifer tamarack (*Larix laricina*) is sometimes present.

Among the rare plants associated with Southern Sedge Meadow are snowy campion (*Silene nivea*), glade mallow (*Napaea dioica*), nodding rattlesnake-root (*Prenanthes crepidinea*), adder's tongue (*Ophioglossum pusillum*), and smooth-sheath sedge (*Carex laevivaginata*). Some of the more alkaline meadows, especially those that grade into or share groundwater sources with limy springs and/or rich (calcareous) fen vegetation, support specialists associated with open, high pH plant communities.

Animals of conservation concern inhabiting sedge meadows include American Bittern (*Botaurus lentiginosus*), Sandhill Crane (*Antigone canadensis*), Whooping Crane (*Grus americana*), Sedge Wren (*Cistothorus platensis*), Northern Harrier (*Circus cyaneus*), northern cricket frog (*Acris crepitans*), Blanding's turtle (*Emydoidea blandingii*), queensnake (*Regina septemvittata*), eastern massasauga (*Sistrurus catenatus catenatus*), western ribbon snake (*Thamnophis proximus*), Butler's garter snake (*T. butleri*), Baltimore checkerspot (*Euphydryas phaeton*), and Poweshiek skipperling (*Oarisma*

poweshiek). Notable among the rare invertebrates that have been documented in Southern Sedge Meadow is the globally rare and U.S. Endangered Hines emerald dragonfly (*Somatochlora hineana*).

Conservation and Management Considerations

As with all wetland communities, protection of site hydrology and function are the paramount conservation concerns. Sedge meadows statewide, but especially in southern Wisconsin, have been ditched, drained, tilled, and grazed to expand areas of cropland and pasture or to create more suitable sites upon which to build homes, businesses, rights-of-way, and other infrastructure. In some areas, periodic wildfire historically played a key role in maintaining herb dominance and the open aspect of sedge meadows. Ditched or tilled stands in which the water table has been significantly lowered are either quickly converted to croplands or are invaded by woody plants, hastening succession to shrub swamp (usually Shrub-carr) or lowland hardwood forest.

Impoundments created by American beaver (*Castor canadensis*) activity can be problematic. While beaver dams may temporarily increase the local abundance of graminoid-dominated wetlands, they may take the place of riparian forests or shrub swamps, especially swamps composed of speckled alder (*Alnus incana*), bottomland hardwoods, or lowland conifers. It is desirable to have better basic information on the number, extent, and ecological impacts of these altered riparian areas. Where timber management is geared toward aspen production in or adjacent to stream corridors, beaver populations may quickly grow to levels that will affect wetlands by altering hydrology as flowing waters are converted to series of ponds and lakes.

Sedge meadows that have been subjected to prolonged periods of grazing by domestic livestock may be dominated by monotypic stands of reed canary grass (*Phalaris arundinacea*), a pernicious invasive that can also increase when sedge meadows receive excess sediment and nutrient runoff from surrounding



Tussock sedge and Canada bluejoint grass are the dominant graminoid plants in this sedge meadow bordering the White River in Green Lake County, Southeast Glacial Plains Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.



Intact meadow of tussock sedge and Canada bluejoint grass borders this stretch of the White River in Green Lake County, Southeast Glacial Plains Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

uplands. The hooves of livestock can physically break down the sedge tussocks, reducing the availability of key microsites for other native plants and thereby diminishing overall floristic diversity (Werner and Zedler 2002). Grazing compacts soil in the hollows between sedge hummocks, altering drainage patterns and sometimes introducing weed propagules. This type of damage also makes it easier for shrubs to become established, eventually altering stand structure and shading out the more light-demanding native herbs. The absence of periodic wildfire, especially in situations where sedge meadows were integral parts of a vegetation mosaic of fire-dependent natural communities such as prairie, fen, and oak savanna, has also led to increases in woody cover. However, in stands damaged by past grazing, fire alone may not be sufficient to control invasive shrubs once they are established (Middleton 2002a, 2002b, 2004). In such cases, mechanical removal, chemical treatment, or other methods will warrant consideration.

In addition to reed canary grass, invasive plants that can alter, dominate, simplify, or otherwise degrade sedge meadows include common reed (*Phalaris australis*), narrow-leaved cat-tail (*Typha angustifolia*), hybrid cat-tail (*Typha x glauca*), and purple loosestrife (*Lythrum salicaria*). Exotic shrubs may also be problematic, especially common (*Rhamnus cathartica*) and glossy (*R. frangula*) buckthorns and Tartarian (*Lonicera tatarica*), Asian fly (*L. morrowii*), and hybrid Bell's (*Lonicera x bella*) honeysuckles. Native shrubs such as dogwoods (*Cornus* spp.), ninebark (*Physocarpus opulifolius*), and white meadow-sweet may also be serious problems in sedge meadows where the hydrology has been altered or fire has been excluded. Prolonged droughts can also accelerate the spread of woody species. Tree species capable of invading sedge meadows are American elm, box elder (*Acer negundo*), eastern cottonwood (*Populus deltoides*), quaking aspen (*P. tremuloides*), willows, (*Salix* spp.), and several ashes (*Fraxinus* spp.).

Protecting and, where needed, restoring wetland hydrology is the key to managing and maintaining diverse, functional sedge meadows. Appropriate management actions may include ditch filling, tile breakage, restoration of stream meanders, use of prescribed fire, cutting, and herbicides to limit the abundance of encroaching woody vegetation, modifying or eliminating dams that maintain artificially elevated water tables, and controlling the quantity and quality of runoff. Runoff carrying excessive amounts of silt, nutrients, herbicides, and pesticides is problematic and ultimately needs to be addressed at the source when possible, but the establishment of buffer areas between wetlands and adjacent croplands, heavily grazed pastures, construction sites, and residential developments can help lessen adverse impacts from these land uses.

Southern Sedge Meadow may grade into Emergent Marsh, Calcareous Fen, Wet-mesic Prairie, Wet Prairie, Tamarack (Rich) Swamp, or Shrub-carr. At some sites, individual wetland components of the vegetation mosaic around sedge meadows can be difficult to tease apart or delineate with precision. From a conservation perspective, the more important considerations are to identify those factors that are affecting and impacting the community, determining the habitat patch size and context needed by the plants and animals inhabiting the meadow and then incorporating that knowledge into development and implementation of a management and monitoring plan that is designed to effectively maintain the sedge meadow and the other communities occupying a given wetland—and the local watershed—over time. It would be useful to perform analyses designed to better assess the economic values provided to society by functional sedge meadows and other wetlands.

Additional Information and References

For related information, see the natural community descriptions for Northern Sedge Meadow, Emergent Marsh, Calcareous Fen, Wet Prairie, Wet-mesic Prairie, Shrub-carr, Alder Thicket, and Southern Hardwood Swamp. Southern Sedge Meadow corresponds most closely to the U.S. National Vegetation Classification type CEG002258 Tussock Sedge - Sedge Species Herbaceous Vegetation (Faber-Langendoen 2001). Also, see "Beaver Meadow" in the "Other Selected Habitats" section of this document.

Also see:

Costello (1936)
Hipp (2008)
Kost and De Steven (2000)
Middleton (2002a)
Middleton (2002b)
Middleton (2004)
Peach and Zedler (2006)
Reuter (1986)
Van der Valk et al. (1999)
Werner and Zedler (2002)

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For a list of terms used, please visit the [Glossary](#).

For a reference list, please see the [Literature Cited](#).

Appendix 7. High Priority Species of Greatest Conservation Need (SGCN) for Oak Opening in the South East Glacial Plains (Wisconsin Wildlife Action Plan 2015)

Birds (7)	Herptiles (3)	Mammals (5)	Insects (12)
Common nighthawk Eastern meadowlark Eastern whip-poor-will Henslow's sparrow Northern bobwhite Red-headed woodpecker Versper's sparrow	Blanding's turtle North American racer Ornate box turtle	Big brown bat Eastern pipistrelle Franklin's ground squirrel Little brown bat Woodland vole	<i>Aeshna clepsydra</i> <i>Bruchomorpha extensa</i> <i>Cryptocephalus cuneatus</i> <i>Cuerna sayi</i> <i>Dichromorpha viridis</i> <i>Erythroneura carbonate</i> <i>Pachybrachis atomarius</i> <i>Papaipema silphii</i> <i>Prairiana angustens</i> <i>Prairiana kansana</i> <i>Speyeria idalia</i> <i>Syrbula admirabilis</i>

Appendix 8. High Priority Species of Greatest Conservation Need (SGCN) for Oak Woodland in the South East Glacial Plains (Wisconsin Wildlife Action Plan 2015)

Birds (3)	Herptiles (2)	Mammals (5)
Cerulean warbler Eastern whip-poor-will Red-headed woodpecker	Blanding's turtle Ornate box turtle	Big brown bat Eastern pipistrelle Franklin's ground squirrel Northern long-eared bat Woodland vole

Appendix 9. High Priority Species of Greatest Conservation Need (SGCN) for Southern Dry-Mesic Forest in the South East Glacial Plains (Wisconsin Wildlife Action Plan 2015)

Birds (3)	Herptiles (2)	Mammals (4)
Acadian flycatcher Cerulean warbler Eastern whip-poor-will Hooded warbler Red-headed woodpecker	Blanding's turtle North American racer Ornate box turtle	Big brown bat Eastern pipistrelle Northern long-eared bat Woodland vole

Appendix 10. High Priority Species of Greatest Conservation Need (SGCN) for Mesic Prairie in the South East Glacial Plains (Wisconsin Wildlife Action Plan 2015)

Birds (8)	Herptiles (5)	Mammals (2)	Insects (15)
Bobolink Common nighthawk Dickcissel Eastern meadowlark Henslow's sparrow Northern bobwhite Short-eared owl Upland sandpiper	Blanding's turtle Butler's gartersnake Eastern massasagua Ornate box turtle Plains gartersnake	Franklin's ground squirrel Little brown bat	Aflexia rubranura Antistrophus silphii Aphelonema simplex Bombus pennsylvanicus Bruchomorpha extensa Dichromorpha viridis Erythroneura carbonate Memnonia panzer Myndus ovatus Pachybrachis atomarius Papaipema beeriana Papaipema silphii Paraphlepsius nebulosus Prairiana kansana Speyeria idalia

Appendix 11. High Priority Species of Greatest Conservation Need (SGCN) for Southern Sedge Meadow in the South East Glacial Plains (Wisconsin Wildlife Action Plan 2015)

Birds (8)	Herptiles (7)	Mammals (4)	Insects (4)
American bittern Bobolink Common nighthawk Eastern meadowlark Henslow's sparrow King rail Short-eared owl Whooping crane	Blanding's turtle Butler's gartersnake Eastern massasagua Four-toed salamander Northern cricket frog Plains gartersnake Queensnake	Big brown bat Little brown bat Northern long-eared bat Silver-haired bat	<i>Colymbetes exaratus</i> Calephelis muticum Orchelium delicatum Orphulella pelidna