



Silverwood County Park Natural Communities Vegetation Management Plan February 2, 2022

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.

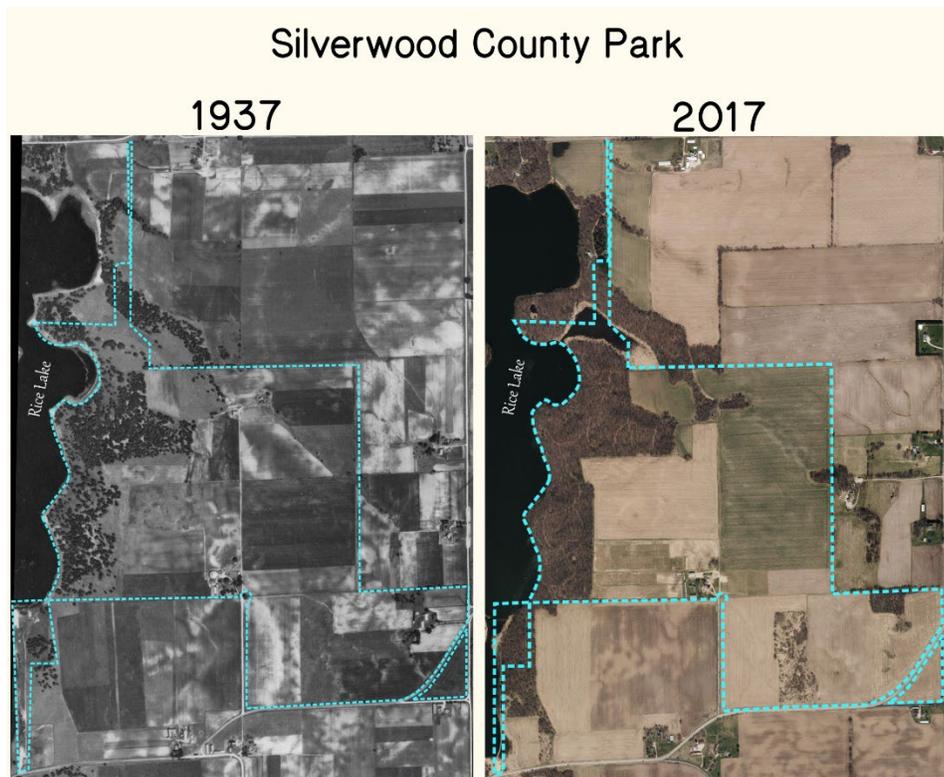


Figure 1. Change in vegetation at Silverwood County Park between 1937 and 2017.

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

The park contains two primary use areas: an agriculture education and innovation area and a natural area that is being restored to various natural communities of southern Wisconsin including oak savanna/opening, oak woodland, and southern dry-mesic forest. Both use areas have a network of trails for recreation and property access. Ultimately, the two use areas will merge seamlessly and provide a wide diversity of flora, fauna, habitats and a range of visitor experiences.

The agriculture areas serve to educate the public on the broad and diverse aspects of Wisconsin agriculture – past, present and future. The park celebrates the rich cultural history of agriculture in Dane County as well as demonstrating innovative agricultural practices and land stewardship that sustains the land for future generations. The area provides educational facilities, job training, and resources for the public, farmers, and youth to learn how food, fuel and fiber are grown processed and distributed. The area also provides access to a demonstration farm which offers opportunities for agriculture research.

Natural areas are used primarily for recreation including hiking, snowshoeing, picnicking, wildlife viewing, horseback riding, and enjoying views of the surrounding landscape. Ecological restoration activities are conducted by volunteers and staff which includes such tasks as tree and brush removal, brush pile burning, invasive weed control, prescribed burning, and seeding/planting. Natural areas within the park adjoin Rice and Sweet Lakes, providing trail users access to the water and a welcome variation in scenery during their park visit.

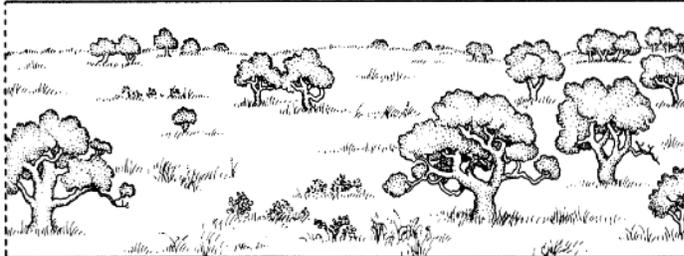
3. Broad vegetation goals, describing the desired physical/biological appearance of the site upon completion.

- Park will include three primary natural communities (Oak Savanna/Opening, Oak Woodland, and Southern Dry-Mesic Forest). Communities will transition naturally into each other providing a seamless landscape that is biologically diverse and offers a varied experience for the park user. The following resources have been included to describe the composition, structure, and associated processes that occur in each community type:
 - Figure 2: Sketches of natural communities included in plan.
 - Figure 3: Map of the desired natural community types.
 - Table 2: Summary of characteristic plants and birds within each community.
 - Table 3: Desired species of trees for each community type and their relative dominance.
 - Appendices 1-3: Detailed descriptions of each community type
- Exotic/invasive species will be controlled through various methods. Table 1 lists common exotic/invasive species that occur at Silverwood County Park.
- Vegetation will allow views of geologic features, underlying terrain, and water bodies and include designated scenic vistas occurring regularly throughout the 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 that have been declining regionally. Appendices 4-6 list high priority SGCN within each community.

Prairie



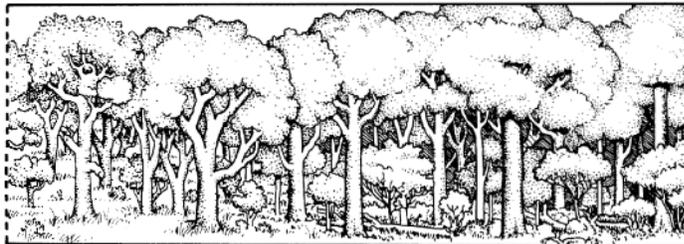
Oak Opening/Savanna



Oak Woodland



Forest



From *The Tallgrass 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.

Silverwood County Park
Desired Natural Communities

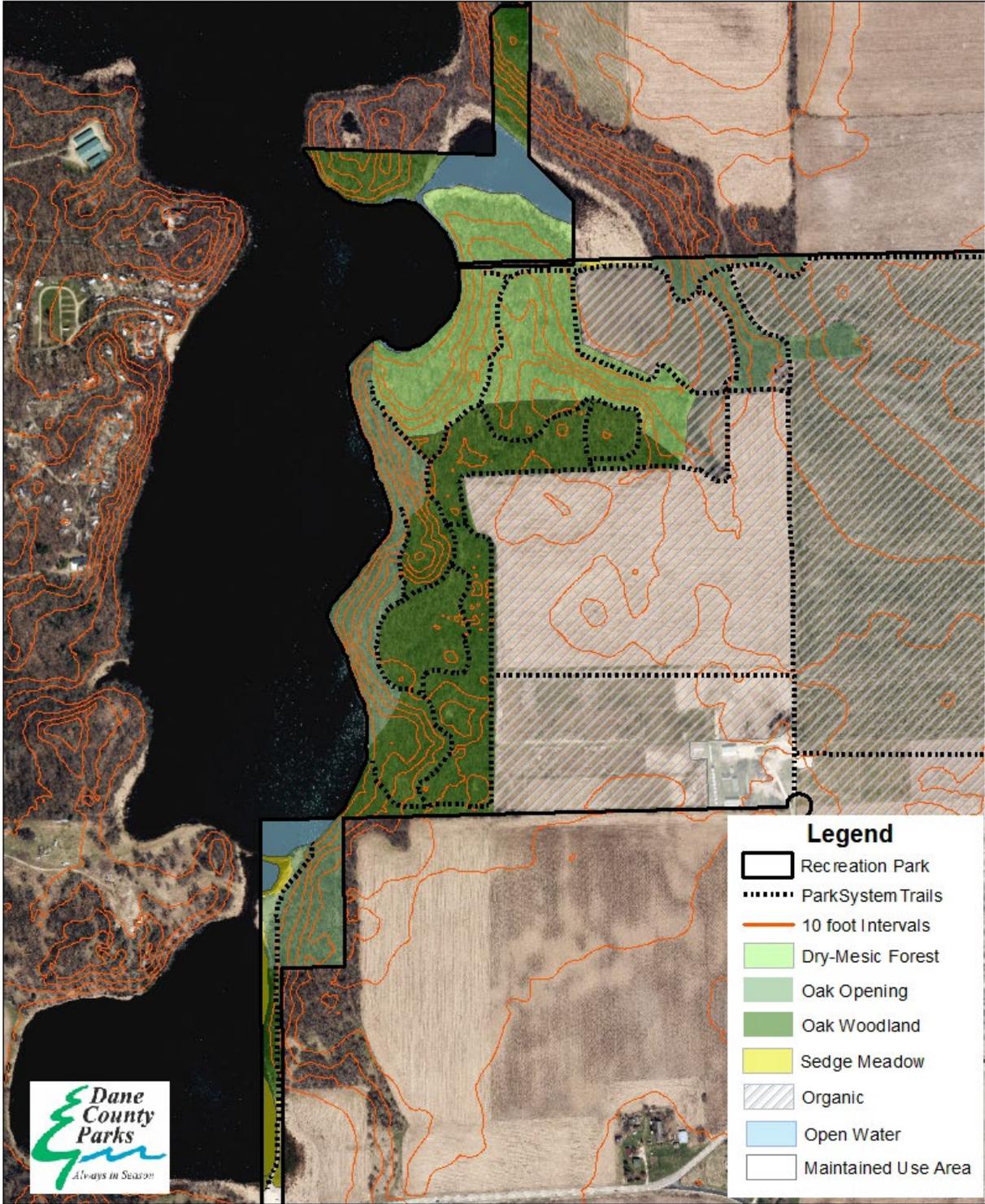
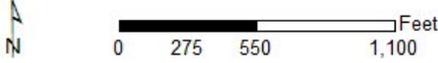


Figure 3. Desired natural community locations at Silverwood County Park

4. Identify and describe noteworthy resources and unique opportunities.

- Dry oak savanna/opening remnants along shoreline slopes containing plant species that have declined significantly in the region.
- Mature oak-dominated canopy across the site.
- Southeast Glacial Plains ecological landscape with geologic features including rolling glacial till plains, steep ridges, dry kettles, kettle lakes, and moraines composed mostly of material deposited from the Wisconsin glaciation.
- Multiple scenic vistas and views of geologic features and Rice and Sweet Lakes.
- Excellent wildlife viewing opportunities including woodland birds, mammals, and waterfowl.
- Unique opportunity to blend restored natural communities with adjacent agricultural initiatives.

5. Identify threats/concerns that are likely to be impediments to success.

- Encroachment of persistent woody vegetation and invasive shrubs in all communities.
- Obstruction of scenic vistas by tall woody vegetation and invasive shrubs.
- Invasion of aggressive exotic herbaceous weeds in all communities including new and emerging invasives such as leafy spurge and garden valerian.
- 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 Silverwood County Park requiring management. (E=Eradicate; R=Reduce)

Herbaceous plants:	Shrubs:	Trees
<ul style="list-style-type: none"> • Bidens (R) • Bird’s foot trefoil (E) • Burdock (E) • Canada thistle (E) • Exotic biennial thistles (E) • Garden valerian (E) • Garlic mustard (E) • Japanese hedge parsley (E) • Leafy spurge (E) • Reed Canary Grass (E) • Stickseed (R) • Wild Parsnip (E) • Yellow and white sweet clover (E) 	<ul style="list-style-type: none"> • Aspen sprouts (E)—retain mature trees • Autumn and Russian Olives (E) • Burning Bush (E) • Bush Honeysuckles (E) • Common Buckthorn (E) • Gray dogwood (R) • Multiflora Rose (E) • Staghorn and smooth sumac (R) 	<ul style="list-style-type: none"> • Bitternut hickory (R) • Black cherry (R) • Boxelder (R) • Elms (R) • Green or white ash (R) • Red Cedar (R) • Shagbark hickory (R) • White Mulberry (E)

6. Priority management recommendations

Management of oak savanna/opening, 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 3 summarizes the desirable tree species and their relative dominance for each community and Table 1 lists common weeds and shrubs that should be eradicated or reduced.
- Timber harvesting should be considered as a method to reduce the abundance of non-compatible 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.
- 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, sweet clover, wild parsnip, garden valerian, and birds-foot trefoil. Care should be taken that control methods do not damage sensitive and rare vegetation. Special efforts should be made to ensure garden valerian, an emerging invader in the area, is surveyed for and treated annually. Any new species and infestations should be documented with the Great Lakes Early Detection app (GLEDN) or EDDmaps.
- 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.
- Scatter native seeds and plant community appropriate trees or shrubs 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.

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

<i>Oak Savanna/Opening</i>	<i>Oak Woodland</i>	<i>Southern Dry-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>
Characteristic Native Plants: <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 Characteristic Native Birds <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 	Characteristic Native Plants: <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 Characteristic Native Birds <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 	Characteristic Native Plants: <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 Characteristic Native Birds <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

Table 3. Summary of desired tree species and relative dominance in each natural community in Silverwood County Park.

Oak Opening/Savanna:	Oak Woodland:	Southern Dry-Mesic Forest
<p>Dominant</p> <ul style="list-style-type: none"> Bur oak White oak <p>Sub-dominant</p> <ul style="list-style-type: none"> Blackoak Red oak Shagbark hickory 	<p>Dominant</p> <ul style="list-style-type: none"> Bur oak White oak Red oak Shagbark hickory <p>Sub-dominant</p> <ul style="list-style-type: none"> Black oak 	<p>Dominant</p> <ul style="list-style-type: none"> Red oak White oak <p>Subdominant</p> <ul style="list-style-type: none"> American basswood Shagbark hickory <p>Occasional</p> <ul style="list-style-type: none"> Bitternut hickory Black cherry Elms White ash

Scenic vistas and geology

- Maintain scenic vistas by removing species that are not core components of the desired natural community, especially invasive shrubs.
- 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.
- Limit use of heavy equipment within 75ft of the shoreline when soil is not frozen.
- 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 4-6 summarize high priority Species of Greatest Conservation Need (SGCN) for Oak Opening, Oak Woodland, and Southern Dry-Mesic Forest in the South East Glacial Plains.

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.

Cultural Resources

- Avoid disturbance to archeological resources following Wisconsin Historical Society recommendations which includes limiting ground disturbance and leaving artifacts in place.

7. Coordination and approval of volunteer activities

- Volunteer activities should be consistent with the Silverwood County Park Master Plan and the 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

Activity	Timeframe	Entity	Method
Tree and shrub removal	October-March	Volunteers and/or staff	Volunteers and staff: chainsaw, brushcutter (spot treating stumps w/ herbicide); Staff: mowers, skid loader
Prescribed burning	March-May; August-November	Staff led, volunteer supported	Burn crew with fire-fighting equipment (hand tools, water cans, UTVs, trucks)
Weed control	April-July	Volunteers and/or staff	Volunteers: Shovels, brushcutters, small mowers, herbicides Staff: mowers, herbicides
Native Seed collection	August-October	Staff led, volunteer supported	Hand collect seed from several parks in the system during regular county parks hosted workdays
Seed processing and packaging	September-December	Staff led, volunteer supported	Clean, weigh, and package seed for planting in parks throughout the county
Planting seeds	November-March	Volunteers	Hand scatter seeds in project areas
Plant trees and shrubs	October-November; April-June	Volunteers	Plant county-grown or nursery purchased container plants
Water and maintain plants	May-September	Volunteers	Provide water to container plants, maintain caging, remove weeds

References:

Dane County Parks. 2016. Silverwood 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.

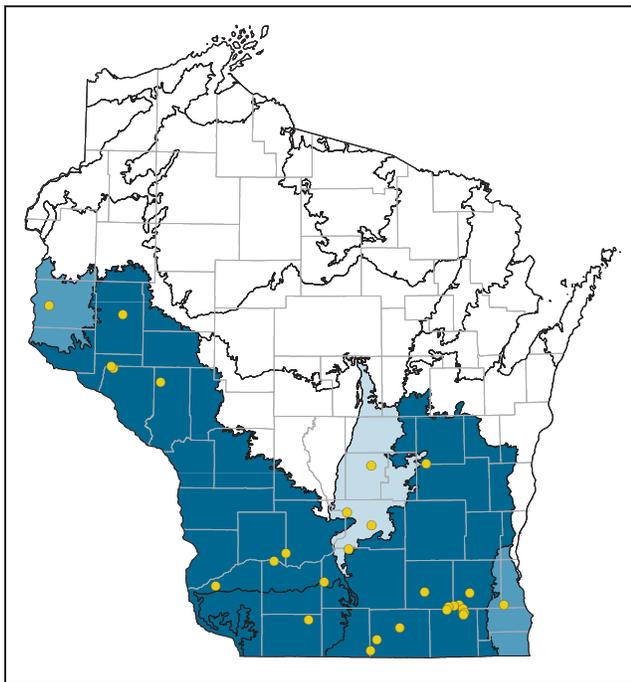
In 1959 Curtis wrote that “an oak savanna with an intact ground layer is the rarest plant community in Wisconsin today.” This statement applies throughout the continental range of the type (Nuzzo 1986) and is even more apt now than it was a half century ago. Virtually all present conservation efforts 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.

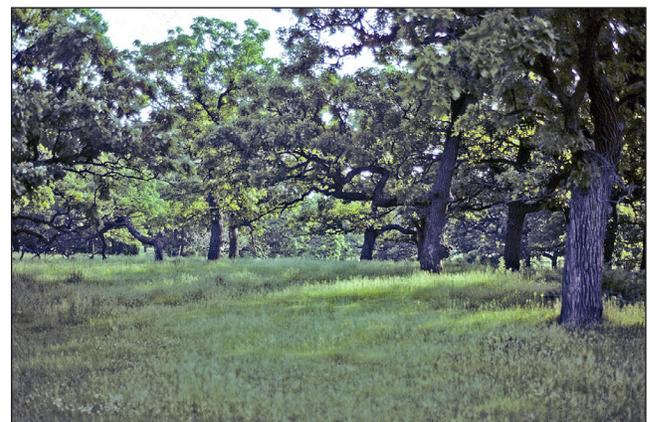
As defined by Curtis (1959), Oak Openings are oak-dominated savanna communities in which there was at least one tree per acre but where total tree cover was less than 50%. However, he also noted that the “density (of trees) per acre was the most variable of all characteristics,” a key point for managers 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 cansescens*), 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 Chiwaukee 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](#).

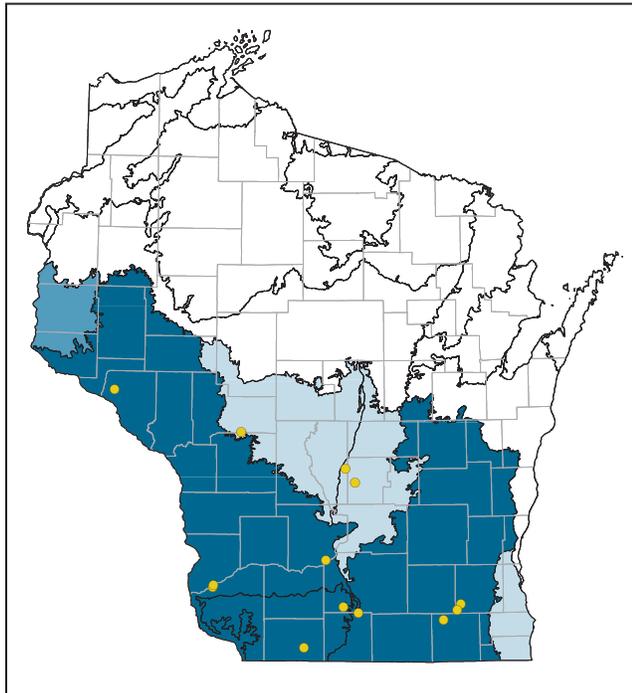
For a reference list, please see the [Literature Cited](#).

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

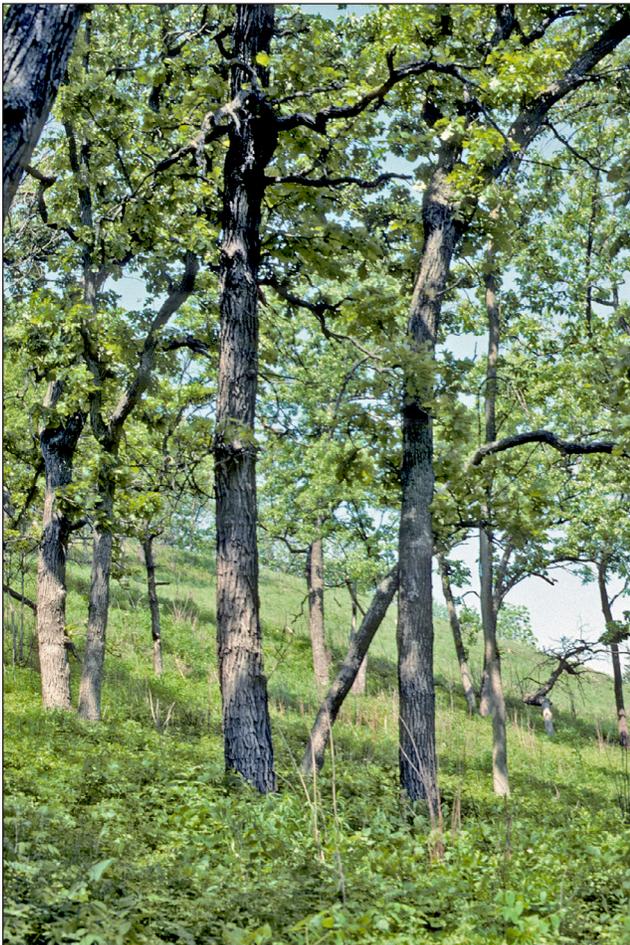


Oak woodland features high canopy closure, but the dominant oaks retain distinctive limb architecture, and the oaks' leaf mosaic allows more light to reach the ground than in stands being invaded by shade tolerant trees such as maples. Such stands are somewhat transitional between more open savannas 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.

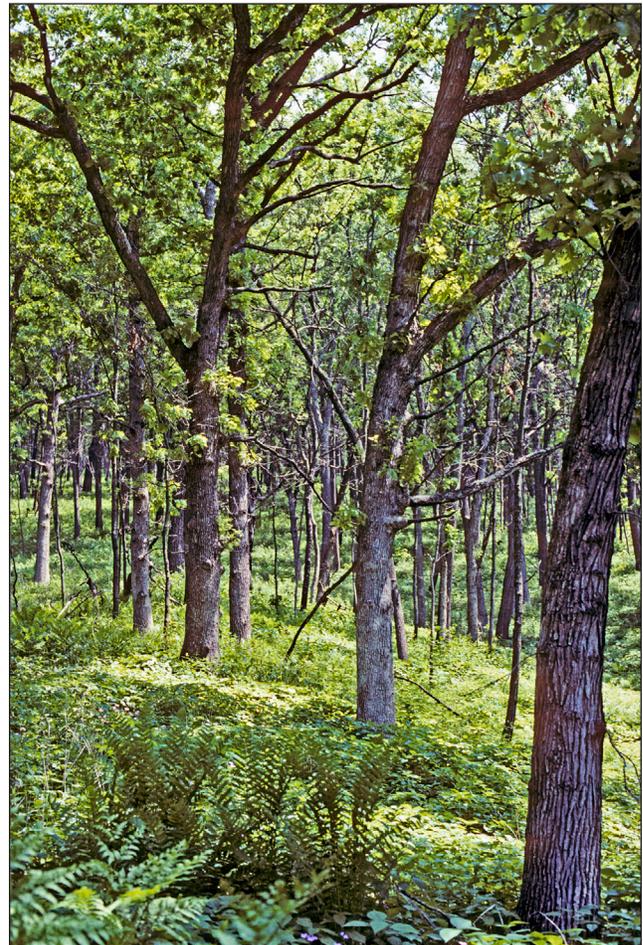
(*Q. ellipsoidalis*) would have been less common, and perhaps absent, on more mesic sites due to their shade intolerance and the competitive advantages some of the other oaks would have had in these environments.

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-parnsnip (*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 (*Poliophtila 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 CEG002142 White Oak – Bur Oak – Northern Red Oak / American Hazelnut Woodland (Faber-Langendoen 2001). However, CEG002134 Central Midwest White Oak – Mixed Oak Woodland, though described for areas south of Wisconsin, and a wet-mesic type CEG002140 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)

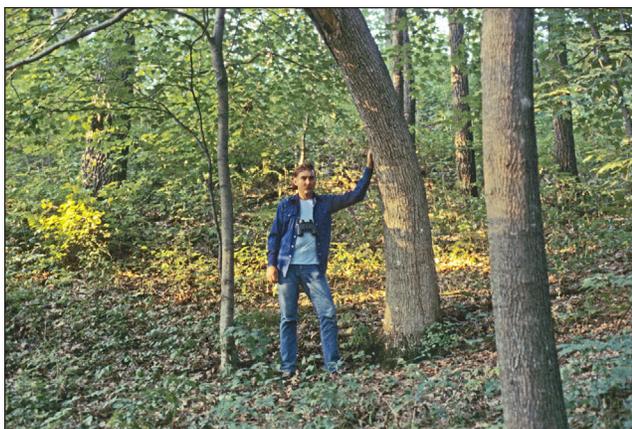
Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

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.

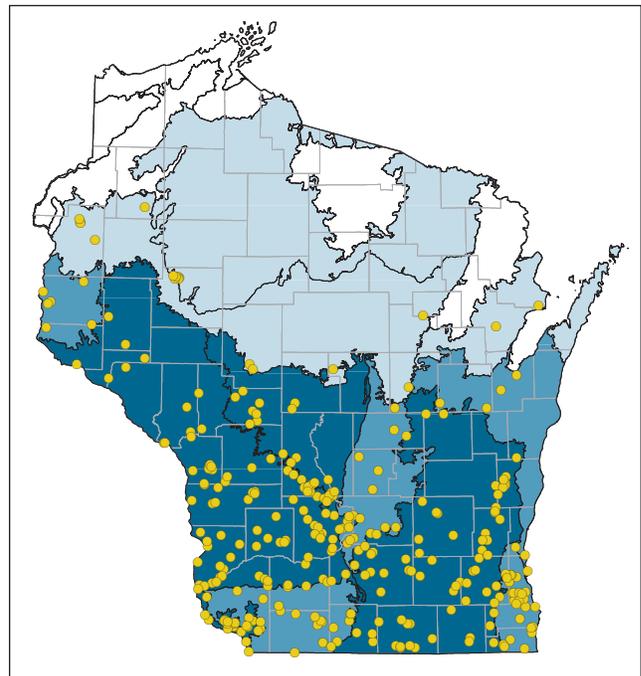


Mature dry-mesic hardwood forest of red oak, white oak, and red maple. Monroe County, Western Coulees and Ridges Ecological Landscape. Photo by Eric Epstein, Wisconsin DNR.

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



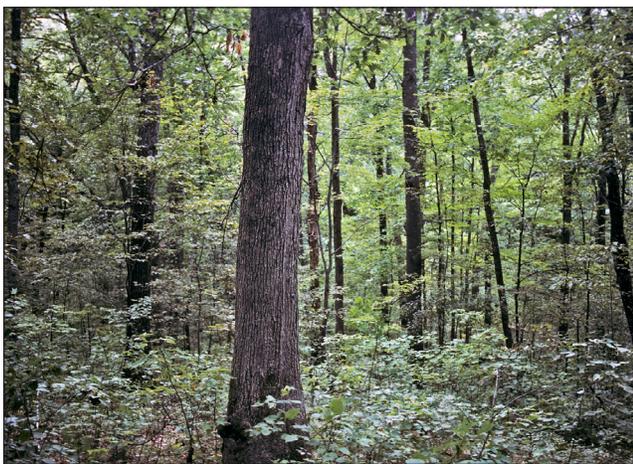
Locations of Southern Dry-mesic Forest in Wisconsin. The deeper hues shading the ecological landscape polygons indicate geographic areas of greatest abundance. An absence of color indicates that the community has not (yet) been documented in that ecological landscape. The dots indicate locations where 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 (*Helmitheros vermivorum*), Acadian Flycatcher (*Empidonax virescens*), 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 CEGLO02068 and Red Oak – Sugar Maple – Elm Forest CEGLO05017.

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-SS-1131H 2017, Madison.

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

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

Appendix 4. 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 5. 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 6. 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