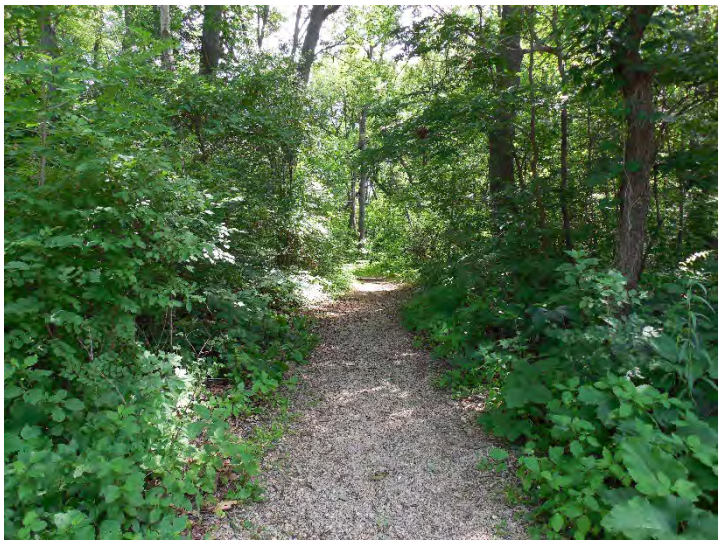
Habitat Management Plan

Elvehjem Sanctuary

October 25, 2023



Site information

Address: 1314 Painted Post Drive

Acreage: 11.62 acres

Acquired: Acquired in 1960s

Watershed: Starkweather Creek (East Branch), Lake Monona

Site summary: This site features sandy loam soils and shallow bedrock on a wooded hillside that faces northwest. Large, old growth bur and white oaks and hickories exist in the southern part of the park, whereas the northern end of the park exhibits a gradient to more mesic species such as cherry, hackberries, and boxelders. A burial mound is located within the park near the southern boundary. Elvehjem also shares a boundary with the grounds of Elvehjem Elementary School (Madison Metropolitan School District). Part of the wooded area south of the park is owned by the school, and there may be opportunity to engage the school district in its management.

Adjacent lands: The northern section of Elvehjem is connected to Heritage Prairie Conservation Park via the Tom George Greenway. Acewood Conservation Park is also within close proximity.

Madison Parks' Land Management Plan (2023) defines land cover categories found in the City's parklands, and provides general parameters for their management. That document provides a foundation upon which more detailed, site-specific work plans can be built. The natural areas of the park include:

Urban forest – *Woodlands*

This land cover category encompasses the entire conservation park.

This habitat management plan addresses the ecological management of the natural areas within the park. It takes into account ecological processes, species lifecycles, and population and community dynamics.

Conservation values

Madison is located in the Southeast Glacial Plains Ecological Landscape as defined by the Wisconsin Department of Natural Resources (WiDNR) in The Ecological Landscapes of Wisconsin (2015). The park itself is located on a northwest facing slope on the east side of the City. Soil types include Miami silt loam and Carrington silt loam. The land cover and habitats at Elvehjem Sanctuary (Elvehjem) can be further described as the following Natural Communities, in part:

Southern Mesic Forest
Southern Dry-Mesic Forest
Oak Woodland

These recognized Natural Communities described by the Wisconsin Natural Heritage Inventory help provide more technical and specific restoration targets based on the ecology of Wisconsin. These reference communities provide benchmarks that help guide ecologically appropriate restoration efforts. Descriptions for Wisconsin's Natural Communities can be accessed at: https://apps.dnr.wi.gov/biodiversity/Home/Index/Communities, and are also included in Appendix D.

Appendix A, Figure 3 is a map delineating these Natural Communities in the park. Appendix B contains lists of plant and bird species that have been documented to date.

This woodland, which had been degraded due to fire suppression and likely some grazing, had become overgrown and invaded with non-native shrubs such as buckthorn and honeysuckle, and non-native herbaceous species such as garlic mustard, dame's rocket, and Japanese hedge parsley. Significant progress has been made in removing the non-native shrubs, but work still needs to focus on herbaceous

species. The land management team is currently reintroducing native plants and will re-establish a regular fire regime in this habitat.

The Greenway offers an interaction point for community members as they spend time walking through the trail. This also presents an opportunity for invasive plants to exist in the fringe of the parks, so restoration efforts could also extend into the Greenway trials.

Wildlife known form the park and surrounding neighborhood include typical urban species such as white-tailed deer, coyote, fox, raccoon, opossum, and common small mammals. Bats are likely present. Only nine bird species have been documented in eBird to date. Further work is needed.

Ecological threats

Fire suppression – Abundant oak leaf litter is suppressing native herbaceous species diversity in the south end of the park, and the dense shrub layer has suppressed native species throughout. Likewise, the dense canopy that has developed in the absence of fire is preventing oak regeneration and establishment.

Leaf litter accumulation and dense canopy cover at Elvehjem.

Invasive species – The recent brush removal project has released many non-native biennial plants, as anticipated. Invasive plant species present at Elvehjem include garlic mustard, dame's rocket, buckthorn, honeysuckle, Japanese hedge parsley, Japanese knotweed, and garden escapes such as Lamium and Pachysandra.

Invasive animal species include jumping worms (*Amynthas* spp.), present in the northern end of the park along the greenway. Jumping worms may also be present on the ridge west of the community gardens.

Conservation goals

Restore and maintain forest and oak woodland habitat by ensuring appropriate fire regimes, controlling invasive species and sustaining and increasing native plant species diversity.

1. *Improve and maintain diverse native plant community*

   The recent initial clearing of the brushy invasive understory has provided an excellent opportunity for continued maintenance including spraying, inter-seeding, and most importantly, burning. The institutionalization of these practices at Elvehjem will help the native plant community re-establish and become balanced.

2. *Monitor the various major taxonomic groups in order to inform management decisions.*

   Increased monitoring is a broader goal of the Conservation Park program. Efforts should focus on surveying reptile, amphibian, and bird populations, as well as quantifying plant species richness and diversity.

3. *Engage the community and foster school and neighborhood involvement in the stewardship of the park.*

   In the past, there had been active volunteers from the neighborhood and relationships between Parks staff and staff at Elvehjem Elementary. Some classes still use a small wooded area in the general park for outdoor gatherings, and occasional unidentified volunteers pull non-native herbaceous species in the conservation park. Opportunities exist to strengthen these connections and increase the level of involvement from the community through environmental education and ecological restoration activities.

Management considerations

Madison Parks' vision is "to provide the ideal system of parks, natural resources and recreational opportunities which will enhance the quality of life for everyone." Ord. 8.40, Preservation of Conservation Parks, includes, "It is important to the residents of Madison that the City preserve Madison's native landscapes, its plant and animal populations for residents' careful use and full enjoyment."

In pursuit of this, we strive to balance ecological management needs with the needs of the community. Ecological management at Elvehjem should pay specific attention to the following:

Smoke management – The adjacent school and surrounding residential development creates challenges for prescribed burning. However, it is imperative to use fire as a management tool in this habitat, and the management team will have to be flexible to take advantage of any concurrence of social patterns and weather conditions that would allow burning with the least impact to the community.

Herbicide management – A community garden exists near the edge of the woodland. Care should be taken during herbicide applications to limit drift and general awareness to proximity to gardening areas.

Encroachment – Special care should be taken to monitor for vegetation encroachment along the park boundaries and private property. Invasive populations have already been identified in localized areas, and care should be taken to reduce spread.

Management history

Initial efforts at this park included removal of honeysuckle and installation of a shady woodland native seed mix in the understory in the south end of the park in 2012. Japanese knotweed has been managed for several years along the west boundary of the park, and is almost eradicated. Neighbors have occasionally volunteered to hand pull garlic mustard and other biennial weeds in the greenway and in the SW portion of the park.

In the winter of 2022-2023, a contractor was hired to cut and treat buckthorn and honeysuckle throughout the South and North units. Slash was burned in brush piles. No follow-up work has yet occurred.

Clearing invasive shrubs in winter 2022-2023.

Management units

Please refer to Appendix A, Figure 4 for a map of management units.

South Unit – Oak Woodland. Largely white and red oaks and hickory are found here. There are also box elders, black cherry, and hackberries growing in the understory of the large oak and hickory canopy. The herbaceous understory has a few established populations of native plants, as well as other nonnative plants that are thriving after the recent brush removal.

North Unit – Southern Dry Mesic Forrest. Largely populated with trees that thrive in fire absent ecosystems (Box elders, hackberries, elms, and maples), as well as a few hickory and oaks on the fringes of the unit. Large amounts of jewelweed inhabit the herbaceous understory, offering little to no space for other species to occupy.

Greenway Unit – Southern Mesic Forest. This area at the bottom of the slope is dominated by silver maple, ash, and box elder, with an understory of jewelweed, clearweed, and nettles. This unit will be addressed in the next management plan cycle. No work is currently planned here due to its location in the greenway corridor.

Objectives

Options for two levels of management are presented in this plan:

> "Basic stewardship" indicates the management required to sustain the current level of habitat quality, given current environmental conditions.
>
> "Habitat improvement" proposes additional actions that are expected to increase native plant and wildlife diversity. These actions would be accomplished through implementation of capital improvement projects, special initiatives directed at a specific goal, or a general, longer-term increase in resources, including labor and materials.

Management will focus on preserving and regenerating oaks, and increasing herbaceous species diversity.

"Basic Stewardship"

- Achieve and maintain 50%-70% overstory canopy cover, measured within individual management units, in areas delineated as Oak Woodland.
- Maintain 70 -100% native overstory canopy cover in areas delineated as Southern Mesic Forest community types
- Establish and maintain oak regeneration throughout the diameter distribution in Oak Woodland and Southern Dry-mesic Forest habitats.
- Follow-up effort to control invasive species on acres previously treated.
- Expand oak woodland and remove tree species competing with oak and hickory canopy.
- Establish and maintain a minimum of 10% native shrub cover, measured in individual management units, in areas delineated as Oak Woodland and Southern Dry-mesic Forest.
- Collect and sow native seed to increase diversity and augment native plant community.
- Burn woodland units approximately every other year, alternating units.
- Treat woody invasive species and limit abundance of raspberries and other brambles.

Specific Management Unit Prescriptions:

Timeline	**Unit**	**Task**
Spring 2024	South Unit North Unit	Spray garlic mustard, dame's rocket and other non-native biennials. (contract)
Summer 2024	South Unit North Unit	Hand-pull any biennials missed in the spring treatment before they seed (contract)
Fall 2024	South Unit North Unit	Spray invasive herbaceous seedlings and woody re-sprouts (contract)
Spring 2025	South Unit	Rx burn
Spring 2025	South Unit North Unit	Spray garlic mustard, dame's rocket and other non-native biennials. (staff)
Summer 2025	South Unit North Unit	Hand-pull any biennials missed in the spring treatment before they seed (volunteers)
Summer 2025	South Unit	Collect and sow native seed (volunteers)
Fall 2025	South Unit North Unit	Spray garlic mustard, dame's rocket, woody re-sprouts, and invasive woody vines (staff)

Timeline	Unit	Task
Spring 2026	North Unit	Rx Burn
Spring 2026	South Unit	Spray garlic mustard, dame's rocket and other non-native biennials. (staff)
Summer 2026	South Unit North Unit	Collect and sow native seed (volunteers) Hand-pull any biennials missed in the spring treatment before they seed (volunteers)
Fall 2026	South Unit North Unit	Spray garlic mustard, dame's rocket, woody re-sprouts, and invasive woody vines (staff)
Spring 2027	South Unit	Rx burn
Spring 2027	South Unit North Unit	Hand pull garlic mustard and dame's rocket (staff and volunteers)
Summer 2027	South Unit North Unit	Collect and sow native seed (volunteers) Hand-pull any biennials missed in the spring before they seed (staff and volunteers)
Fall 2027	South Unit North Unit	Survey for and control garlic mustard, dame's rocket, and invasive woody vines (staff and volunteers)
Spring 2028	North Unit	Rx Burn
Spring 2028	South Unit North Unit	Hand pull garlic mustard and dame's rocket (staff and volunteers)
Summer 2028	South Unit North Unit	Collect and sow native seed (volunteers) Hand-pull any biennials missed in the spring before they seed (staff and volunteers)
Fall 2028	South Unit North Unit	Survey for and control garlic mustard, dame's rocket, and invasive woody vines (staff and volunteers)

Possible burn schedule – average one burn per year:

year	1	2	3	4	5	6	7	8	9	10
South Unit		x		x		x		x		x
North Unit			x		x		x		x	

Year 1 is 2024. Prescribed burns will begin in spring 2025 in the South Unit. See Appendix A, Figure 5 for a map of potential burn units.

"Habitat improvement"
In addition to the actions outlined above for basic stewardship of this natural area, the following initiatives would advance the restoration trajectory of the park, resulting in greater benefit, achieved sooner. These actions could be accomplished as capacity allows:

- Thin overstory and midstory canopy around and under dominant oaks and hickories to reduce competition and stress, and promote tree health and reproduction.
- Collect and sow acorns to assist regeneration of white and bur oaks in Oak Woodland.
- Plant bare root and non-dormant herbaceous plants in North and South units.
- Plant additional native shrub and understory tree species throughout the park to provide structural diversity and maximize species richness.
- Contract out prescribed burns to supplement staff capacity and ensure establishment of desired fire regime.
- Research and implement steps to augment habitat for the Rusty Patched Bumble Bee.

Monitoring and Evaluation

Measuring results is critical to determining success. Refer to Appendix C for an outline of the goals for monitoring natural areas in Madison Parks.

Parks staff currently have very limited capacity to conduct monitoring. However, Parks is supported by a network of volunteers and researchers. Community science programs collect data on sensitive ecological indicators and provide crucial information on which to base management decisions.

Potential community science programs that could be implemented at Elvehjem include:

Program	Coordinator	Website
Wisconsin Bat Program (starting in 2024)	Wisconsin Department of Natural Resources	https://wiatri.net/inventory/bats/
Wisconsin Bumble Bee Brigade (since 2020)	Wisconsin Department of Natural Resources	https://wiatri.net/inventory/bbb/
iNaturalist	iNaturalist	https://www.inaturalist.org/

Staff and volunteers could monitor vegetation along permanent transects, using a protocol where plant species richness and cover is measured in randomized square-meter quadrats. This data would be used by Parks staff to calculate diversity and floristic quality. See Appendix A, Figure 6 for a map of proposed vegetation monitoring transects.

Additional monitoring needs include:

- Tree species recruitment and diameter distribution
- Overstory canopy cover in woodlands
- Update and verify species lists throughout park
- Systematic photo monitoring

Budget

The work outlined in this plan is accomplished through financial and in-kind support from the City's General Operating budget, special Capital Improvement Project funding, and volunteer labor.

Typical Annual Budget Estimate:

Task	Labor required (hours)	Annual cost
Burns (one per year @ $4,000 each)	40	$4,000
Native seed mix and growing stock	-	$1,000
Native plant establishment (@ $20/hr)	100	$2,000
Invasive species control (staff)	100	$3,000
Contract for invasive species control	-	$4,000
Monitoring (@ $25/hr)	40	$1,000
Trail maintenance and repair (@ $20/hr plus materials)	40	$800
Totals		**$15,800**

Hourly rates reflect average staff wages and volunteer "in-kind" rates.

Citations

Madison General Ordinance 8.40, Preservation of Conservation Parks
https://library.municode.com/wi/madison/codes/code_of_ordinances?nodeId=COORMAWIVOICH1--10_CH8PUPR_8.40PRCOPA

Madison Parks. 2023. *City of Madison, Parks Division Land Management Plan*. City of Madison, Parks Division, Madison.

Wisconsin Department of Natural Resources. 2015. *The ecological landscapes of Wisconsin: An assessment of ecological resources and a guide to planning sustainable management.* Chapter 18, Southeast Glacial Plains Ecological Landscape. Wisconsin Department of Natural Resources, PUB-SS-1131T 2015, Madison, WI.

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

Wisconsin Department of Natural Resources. 2023. Wisconsin's Natural Communities. https://apps.dnr.wi.gov/biodiversity/Home/Index/Communities Accessed August 2, 2023.

Document History

This Habitat Management Plan is consistent with Madison Parks' Land Management Plan. This Habitat Management Plan has 5-year lifespan, and should be reviewed yearly. It can be revised whenever new information is discovered. If no changes have been made, it should be updated in its 5th year.

Version	Description
10/23/2023	First draft, presented to Habitat Stewardship Subcommittee

Appendices

A. Maps
   - Figure 1. Park Overview
   - Figure 2. Land Cover Categories (Parks Land Management Plan)
   - Figure 3. Natural Communities (Department of Natural Resources)
   - Figure 4. Management Units
   - Figure 5. Prescribed Burn Units
   - Figure 6. Vegetation Monitoring Transects

B. Species Lists
C. Natural Areas Monitoring Goals
D. Detailed Natural Community Descriptions
E. Burial Mound Management Plan (forthcoming)


Figure 1. Elvehjem Sanctuary: Park Overview
Cottage Grove Road
Tom George Greenway
Painted Post Drive
Managed Meadow
Meadowlark Drive
Elvehjem Elementary School
Academy Drive
N
Map created: 8/30/2023
Aerial photo: 2022
0
250
500 Feet
Legend
Elvehjem Sanctuary
Elvehjem Park
greenway (Engineering)
Trails
Burial Mound
Parking
Restroom


Figure 2. Elvehjem Sanctuary: Parks Vegetation Types
Painted Post Drive
Meadowlark Drive
N
Legend
Parks Vegetation Types
Urban Forest - Woodland
Map created: 8/29/2023
Aerial photo: 2022
0
250
500 Feet

Figure 3. Elvehjem Sanctuary: Natural Communities

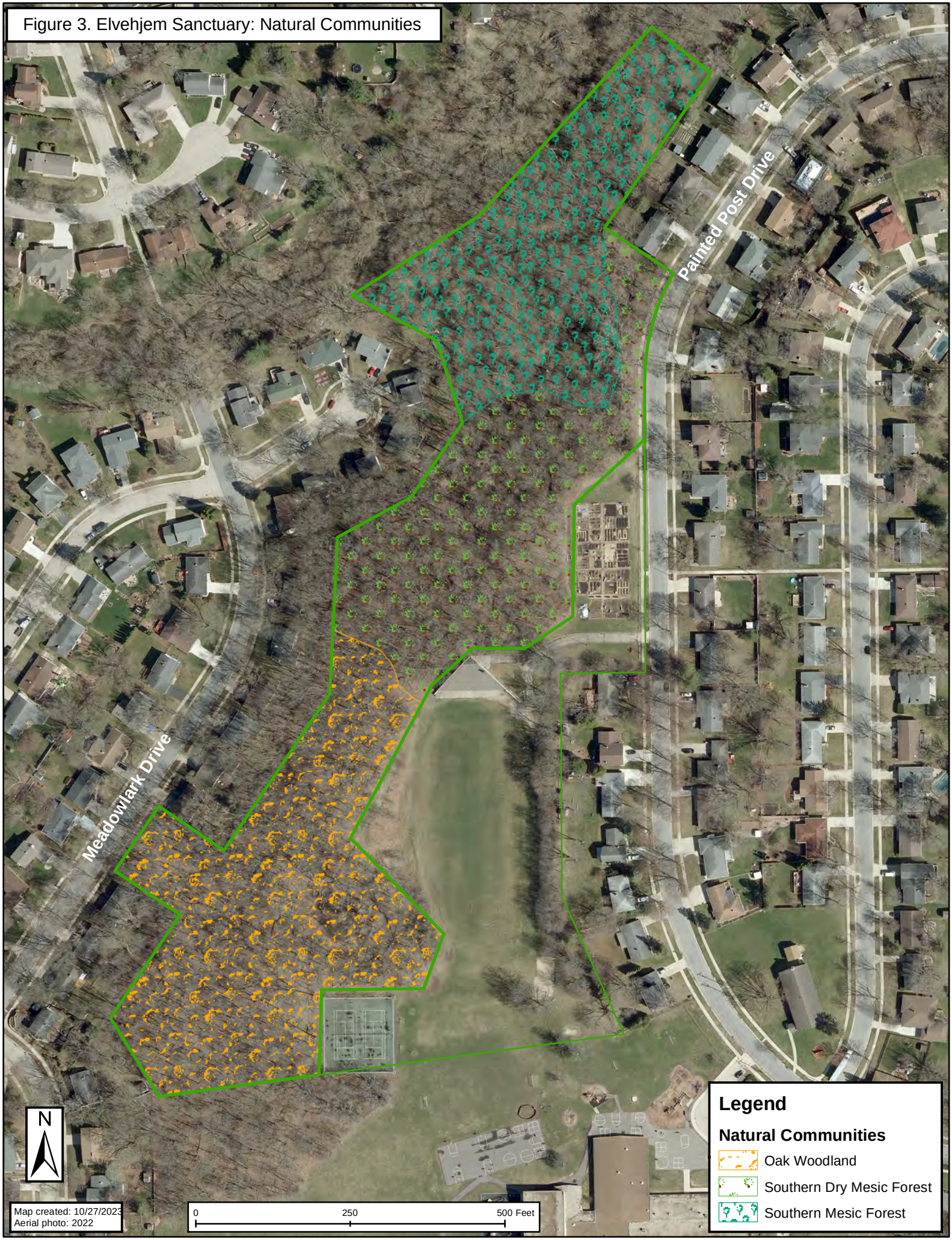


Figure 4. Elvehjem Sanctuary: Management Units

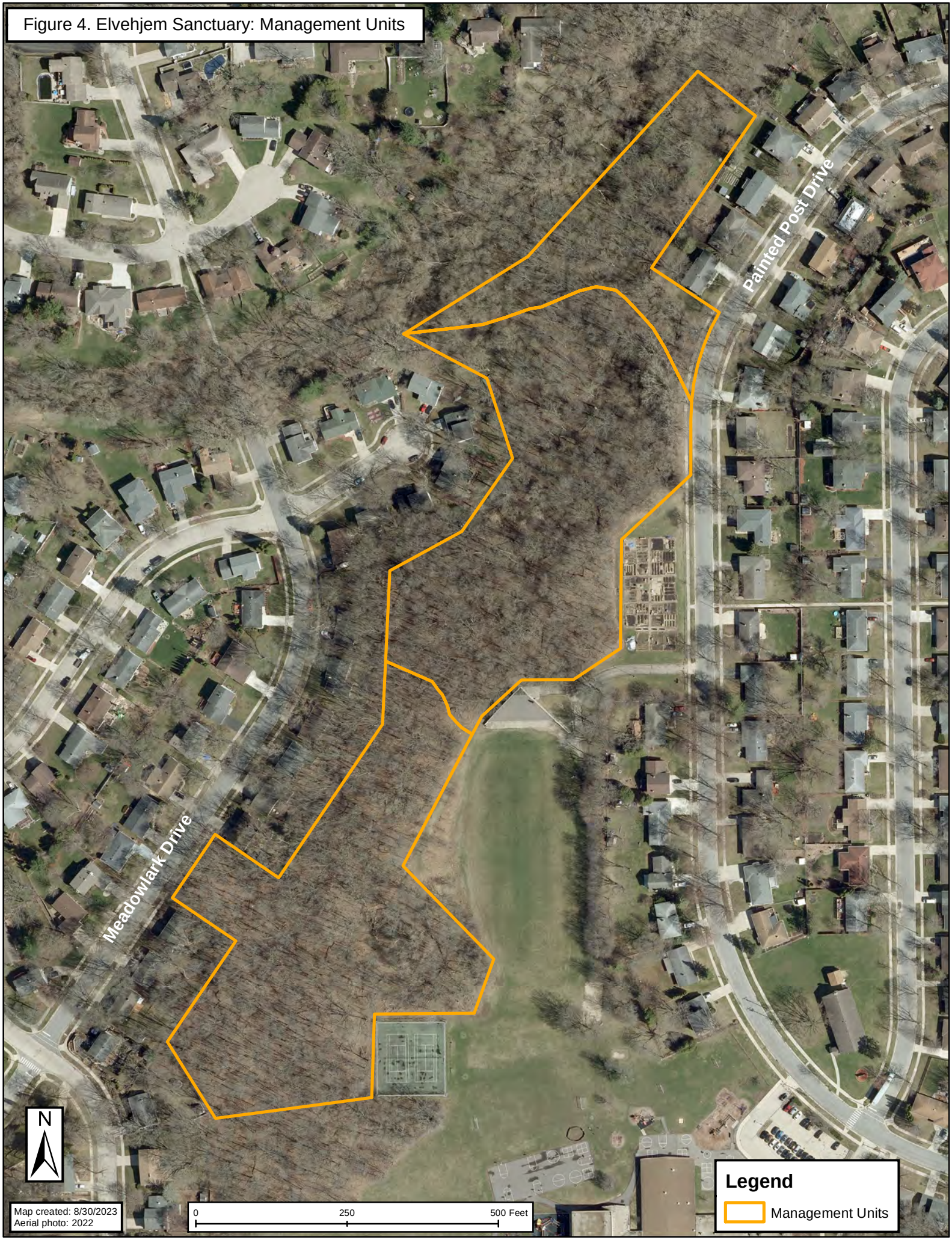


Figure 5. Elvehjem Sanctuary: Potential Prescribed Burn Units

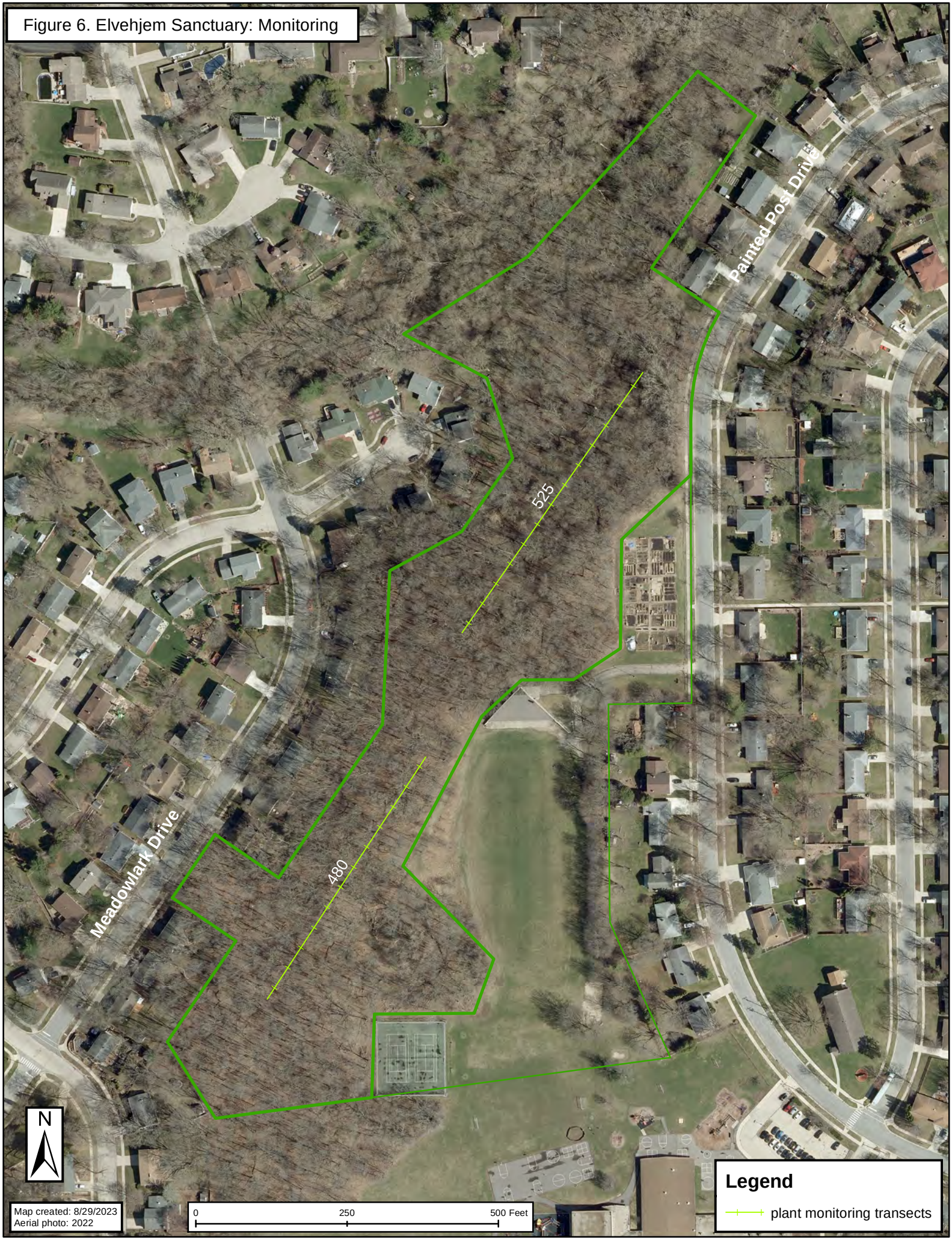


Figure 6. Elvehjem Sanctuary: Monitoring
Painted Post Drive
525
480
Meadowlark Drive
N
Map created: 8/29/2023
Aerial photo: 2022
0
250
500 Feet
Legend
plant monitoring transects

Elvehjem Sanctuary
10/27/2023

Vascular Plants

SCIENTIFIC NAME	COMMON NAME	Native	Introduced
Acer negundo	Box elder	X	
Acer platanoides	Norway maple	X	
Acer saccharinum	Silver maple	X	
Actaea rubra	Red baneberry	X	
Agrimonia gryposepala	Tall agrimony	X	
Alliaria officinalis	Garlic mustard		X
Amphicarpa bracteata	Hog peanut	X	
Anemone quinquefolia interior	Wood anemone	X	
Aquilegia canadensis	Wild columbine	X	
Aralia nudicaulis	Wild sarsaparilla	X	
Arctium minus	Common burdock		X
Arisaema triphyllum	Jack-in-the-pulpit	X	
Aster lateriflorus	Calico aster	X	
Carex pensylvanica	Pennsylvania sedge	X	
Carya cordiformis	Bitternut hickory	X	
Carya ovata	Shagbark hickory	X	
Caulophyllum thalictroides	Blue cohosh	X	
Celtis occidentalis	Hackberry	X	
Circaea quadrisulcata canadensis	Enchanter's nightshade	X	
Cornus alternifolia	Alternate-leaved dogwood	X	
Cornus racemosa	Gray dogwood	X	
Corylus americana	American hazelnut	X	
Cryptotaenia canadensis	Honewort	X	
Desmodium glutinosum	Pointed tick trefoil	X	
Erigeron strigosus	Daisy fleabane	X	
Eupatorium rugosum	White snakeroot	X	
Fraxinus pennsylvanica	Green ash	X	
Geranium maculatum	Wild geranium	X	
Geum canadense	Wood avens, White avens	X	
Helianthus divaricatus	Woodland sunflower	X	
Hesperis matrionalis	Dame's rocket		X
Hydrophyllum virginianum	Virginia waterleaf	X	
Hystrix patula	Bottlebrush grass	X	
Impatiens capensis	Orange jewelweed	X	
Isopyrum biternatum	False rue anemone	X	
Juglans nigra	Black walnut	X	
Lactuca canadensis	Wild lettuce	X	
Leonurus cardiaca	Motherwort		X
Monarda fistulosa	Wild bergamot	X	
Monotropa uniflora	Indian pipe	X	
Morus alba	White mulberry		X

SCIENTIFIC NAME	COMMON NAME	Native	Introduced
Nepeta cataria	Catnip		X
Oenothera biennis	Common evening primrose	X	
Osmorhiza claytoni	Halry sweet cicely	X	
Osmorhiza longistylis	Smooth sweet cicely	X	
Parthenocissus quinquefolia	Virginia creeper	X	
Phryma leptostachya	Lopseed	X	
Podophyllum peltatum	May apple	X	
Polygonatum canaliculatum	Smooth solomon's seal	X	
Polygonum virginianum	Jumpseed	X	
Populus grandidentata	Large-toothed aspen	X	
Populus tremuloides	Quaking aspen	X	
Prenanthes alba	Lion’s foot	X	
Prunus serotina	Wild black cherry	X	
Prunus virginiana	Choke cherry	X	
Quercus alba	White oak	X	
Quercus macrocarpa	Bur oak	X	
Quercus rubra	Red oak	X	
Rhamnus cathartica	Common buckthorn		X
Rhus glabra	Smooth sumac	X	
Rhus radicans	Poison ivy	X	
Ribes missouriense	Wild gooseberry	X	
Rubus occidentalis	Black raspberry	X	
Rudbeckia hirta	Black-eyed susan	X	
Sambucus canadensis	Elderberry	X	
Sanicula marilandica	Black snakeroot	X	
Smilacina racemosa	False solomon's seal	X	
Smilacina stellata	Starry false solomon's seal	X	
Smilax lasioneura	Common carrion flower	X	
Smilax tamnoides hispida	Bristly green brier	X	
Solanum dulcamara	Bittersweet nightshade		X
Thalictrum dioicum	Early meadow rue	X	
Tilia americana	Basswood	X	
Triosteum perfoliatum	Late horse gentian	X	
Ulmus americana	American elm	X	
Ulmus ruba	Slippery elm	X	
Urtica chamaedryoides	Nettle	X	
Urtica procera	Tall nettle	X	
Uvularia grandiflora	Bellwort	X	
Viburnum lentago	Nannyberry	X	
Viola sororia	Hairy wood violet	X	
Vitis riparia	Riverbank grape	X	

total species	**82**
total native	**74**
total exotic	**8**

Animals- Birds

Source: eBird Field Checklist generated by eBird on 6/23/2023. (GBIF.org 2023)

State listings:
END = endangered
THR = threatened
SC/M = special concern, but fully protected by federal and state laws under the Migratory Bird Act

SGCN = Species of Greatest Conservation Need, as identified in the Wisconsin Wildlife Action Plan
SINS-Monitoring = Species has numerical conservation status ranks and sufficient information to be assessed, but does not meet SGCN criteria.
SINS-Ranking = Species for which there is basic information, but not enough to assign a numerical rank

See Wisconsin natural heritage working list website for more information:
https://dnr.wi.gov/topic/NHI/WList.html

COMMON NAME	SCIENTIFIC NAME	state listing	Wi DNR Wisconsin Wildlife Action Plan
American Robin	Turdus migratorius		
Cedar Waxwing	Bombycilla cedrorum		
Dark-eyed Junco	Junco hyemalis		
Downy Woodpecker	Dryobates pubescens		
Eastern Wood-Pewee	Contopus virens		
Northern Flicker	Colaptes auratus		
White-breasted Nuthatch	Sitta carolinensis		
White-throated Sparrow	Zonotrichia albicollis		
Yellow-rumped Warbler	Setophaga coronata		
total species	**9**	**0**	**0**

Madison Parks
Natural Areas Monitoring Goals
August 2023

Monitoring is necessary to track the success of restoration efforts as well as the overall quality of the habitat being managed. Data collected can quantify results, show trends in natural area health, and reveal potential concerns. The following framework identifies some possible monitoring subjects and strategies. Objectives and tasks can be implemented and completed as staff and volunteer capacity allow.

Much information can be gained by engaging and supporting various formal community science programs, and less formal community-populated databases. Data from many of these are accessible from the individual host organizations, as well as through clearing houses such as the Global Biodiversity Information Facility (GBIF) Many volunteers currently conduct monitoring within conservation parks and other natural areas. These programs are recognized below as well.

Taxa: Plants

Objectives:

1. Complete and update species inventories for each park, and each management unit where applicable (Managed Meadow, Woodland, management unit within a conservation park, etc.).

   Tasks:

   a. Conduct meander surveys three times during the growing season to compile and update plant species list.

2. Determine and track floristic quality in managed natural areas

   Tasks:

   a. Establish permanent transects with randomized $1m^2$ plots (quadrats)

   b. Survey quadrats and record percent cover of each species present.

   c. Analyze data to calculate species richness, diversity, and Floristic Quality Index.

Taxa: Insects

Objectives:

1. Complete overall species inventory per park

   Tasks:

   a. Conduct daytime surveys with sweep nets

   b. Conduct nighttime surveys with light traps

   c. Conduct surveys of soil surface insect fauna

2. Monitor pollinator abundance and species composition

   Tasks:

   a. Collect data using Wisconsin Bumble Bee Brigade protocols

   b. Support the Integrated Monarch Monitoring Program

   c. Collect data using Pollard transects to target butterflies

   d. Support the Wisconsin Odonata Survey

Taxa: Herptiles

Objectives:

1. Complete overall species inventory per park

   Tasks:

   a. Conduct surveys with funnel traps
2. Conduct breeding survey

   Tasks:

   a. Establish Wisconsin Frog and Toad Survey phenology survey locations where appropriate

Taxa: Birds

Objectives:

1. Conduct surveys and document species present.
2. Analyze data available from eBird through the Global Biodiversity Information Facility (GBIF)

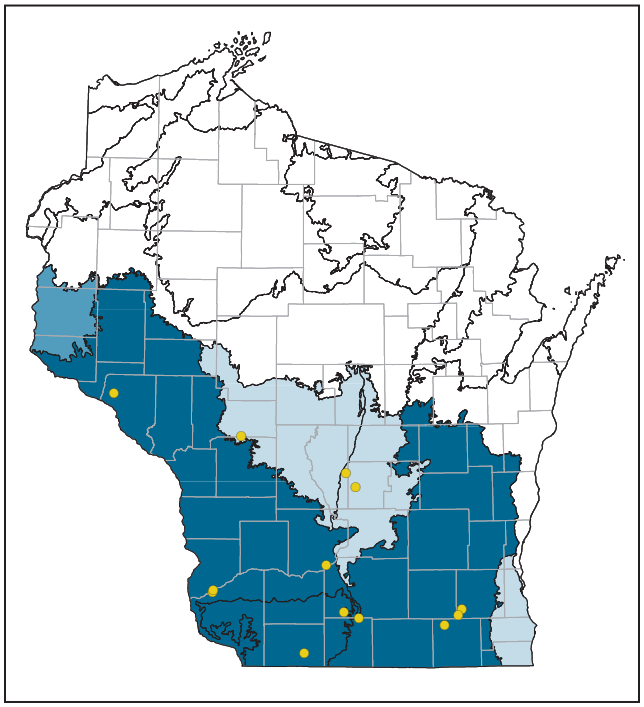
   Tasks:

   a. Download data sets for each park

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

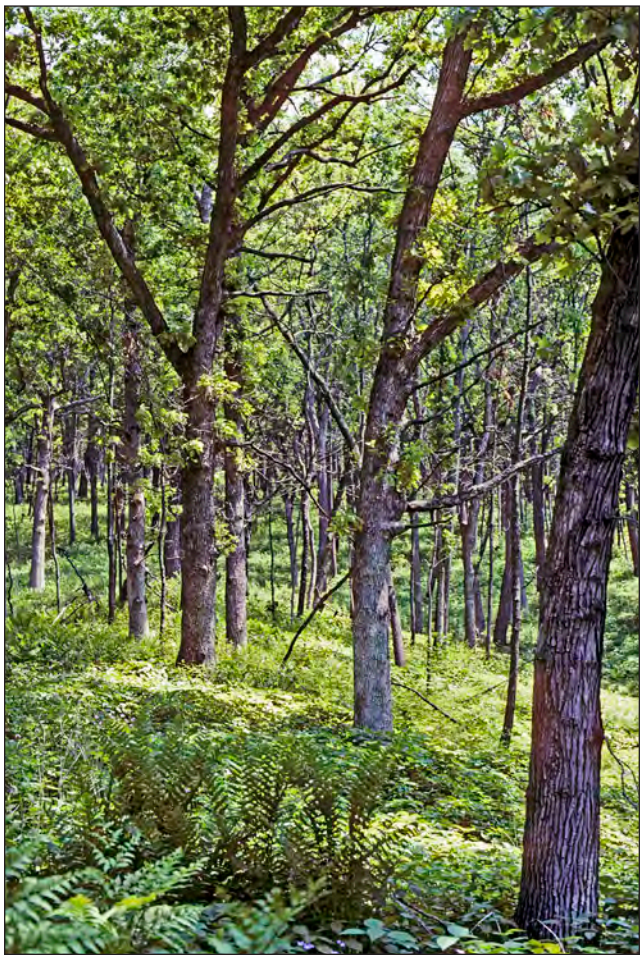
Oak woodland features high canopy closure, but the dominant oaks retain distinctive limb architecture, and the oaks' leaf mosaic allows more light to reach the ground than in stands being invaded by shade tolerant trees such as maples. Such stands are somewhat transitional between more open savannas 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 (*Polioptila 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 CEGL002142 White Oak – Bur Oak – Northern Red Oak / American Hazelnut Woodland (Faber-Langendoen 2001). However, CEGL002134 Central Midwest White Oak – Mixed Oak Woodland, though described for areas south of Wisconsin, and a wet-mesic type CEGL002140 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.

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For a reference list, please see the **Literature Cited.**

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

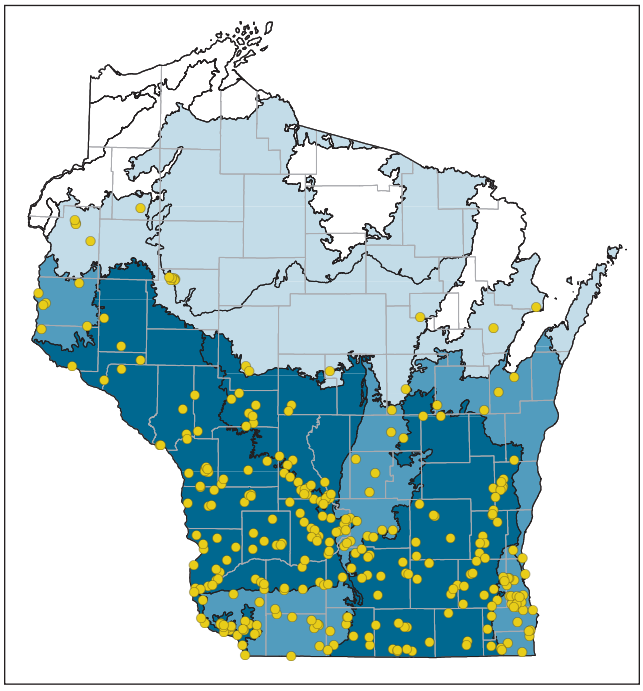
Dominant trees of relatively undisturbed, intact, mature stands are northern red oak (*Quercus rubra*), white oak (*Q. alba*), red maple (*Acer rubrum*), and sometimes American basswood (*Tilia americana*). Associates include shagbark hickory (*Carya ovata*), bitternut-hickory (*C. cordiformis*), black 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 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*).

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.

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 CEGL002068 and Red Oak – Sugar Maple – Elm Forest CEGL005017.

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.

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

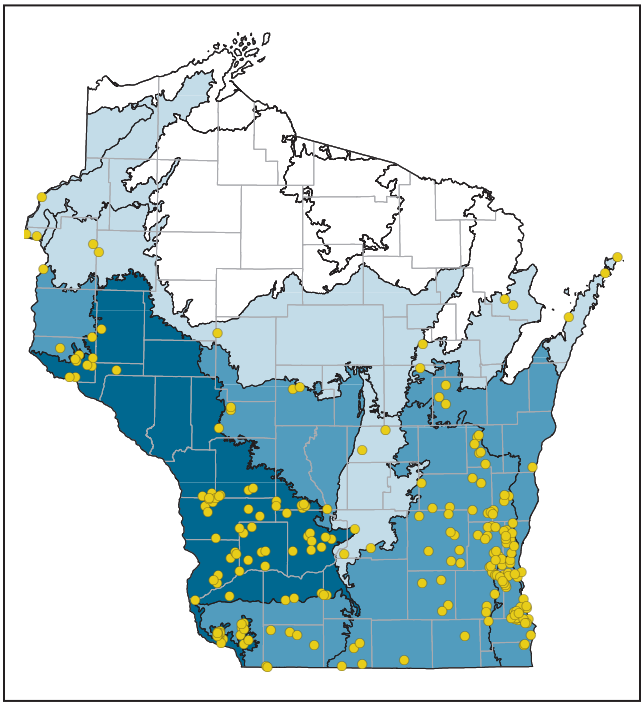
Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

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.



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.

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 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 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 (*Polioptila 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

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.

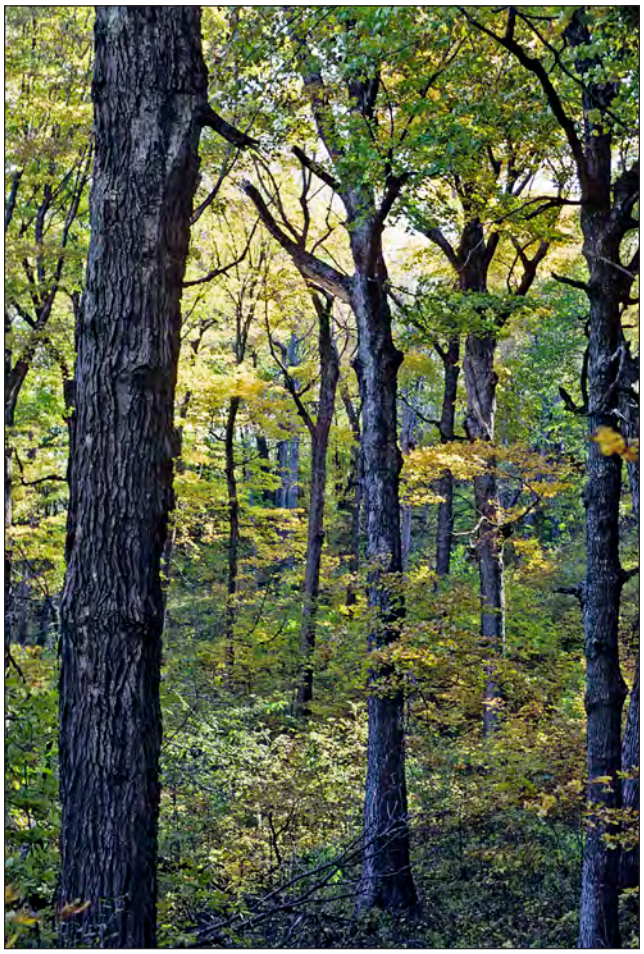
This rich maple-basswood forest on slopes above the Rush River in Pierce County supports a high diversity of herbs, including snow trillium (Wisconsin Threatened), putty-root (Wisconsin Special Concern) and Dutchman's breeches. Western Coulees and Ridges Ecological Landscape. Photo by Eric Epstein, Wisconsin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

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 CEGL002062 North-central Maple – Basswood Forest (Faber-Langendoen 2001). It is likely that CEGL005013 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)

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For a reference list, please see the **Literature Cited.**