

PROPERTY PLANNING COMMON ELEMENTS

COMPONENTS OF MASTER PLANS

HABITATS AND THEIR MANAGEMENT

Oak and Oak-dominated Mixed Forest

Description

This page describes management of oak forests in southern and central Wisconsin and oak-dominated mixed forests in northern Wisconsin. Oak forests are those in which oak species comprise 50% or more of the basal area. Dominant species are red oak, white oak, black oak, bur oak, or Northern pin oak (also called scrub oak), with shagbark hickory, red maple, aspens, basswood, paper birch, white pine, and black cherry as common associates. Oak can occur on a wide variety of dry to mesic sites, with species composition and successional pathways influenced by site conditions, disturbance regimes, and land use history. Oak-dominated forests are more common south of the Tension Zone.

On sandy sites, stands typically are dominated by black, northern pin, and white oaks, while white oak and bur oak tend to dominate those on thin soils or dry slopes. These droughty (though not nutrient-poor) hillsides may have semi-open canopies where light can penetrate to the ground and stimulate growth of relatively dense understory layers, particularly where surface fires are absent. Canopy associates on dry sites can include trembling aspen, white pine, red pine, jack pine, and white birch; dry-mesic associates commonly include bigtooth aspen, black cherry, and red maple. Common understory species on these dry and dry-mesic sites include hazelnut, gray dogwood, blueberries, wintergreen, partridge-berry, cow-wheat, wild sarsaparilla, Canada mayflower, bracken fern, starflower, barren-strawberry, trailing arbutus, hog-peanut, false Solomon's seal, lopseek, wild geranium, tick-trefoils, and enchanter's nightshade.

On mesic sites or dry sites that are succeeding to more mesophytic species, red oak often dominates, producing moderate canopy closure. Common canopy associates on more mesic sites are white oak, black oak, bur oak, hickories, elms, black cherry, black walnut, and bigtooth aspen. Sugar maple and red maple often succeed oaks on these sites if a nearby seed source is present, along with other shade-tolerant or mid-tolerant species such as white ash, bitternut hickory, and basswood. The understory flora can be diverse, with many of the same species as in drier sites but also including such species as jack-in-the-pulpit, large-flowered bellwort, interrupted fern, and lady fern.

For oaks in wet and wet-mesic situations, please see the "Bottomland Hardwoods" and "Swamp Hardwoods" Common Elements.

Historically, oak forests were common and widespread throughout much of the state. In southern Wisconsin, oak-dominated communities (including oak forest, oak woodland, and oak opening) are part of a vast and diverse array of fire-adapted plant communities that once covered much of the eastern United States. Disturbance events such as wind and especially fire (both naturally occurring and of Native American origin) were critical factors in the historic distribution and dominance of oak. Periodic fires played a key role in the development and maintenance of oak cover types, with variations in fire intensity and frequency as well as site characteristics determining structural conditions and species composition. With Euro-American settlement, oak forests and woodlands in central and southern Wisconsin were subjected to widespread clearing for agriculture and



development. The cutting and burning used to clear the land, subsequent farming and pasturing, and then abandonment of land that was marginal for agriculture created conditions favoring oaks over more shade-tolerant, less fire-adapted species. Today’s oak forests are a result of these post-cutover land management practices, as well as more recent management practices and threats.

In northern Wisconsin, oaks historically were an important component of the white pine, red pine, and jack pine forests that were once widely distributed across the north. Most of these forests were cut and burned during the widespread heavy logging of the late 19th and early 20th centuries. The forests that grew back from this cutover have a much lower proportion of conifers and tend to be dominated by early-successional deciduous species such as trembling aspen and white birch. Much of the current oak in northern Wisconsin developed following the cutover. Red oak is the most common species on dry-mesic to mesic sites and can sometimes be dominant in stands formerly dominated by white or red pine. White oak can be locally important. Mixed stands often contain aspen, white birch, white pine, and northern hardwoods. Northern pin oak (also called scrub oak) and red oak are the dominant oak species on dry sites, sometimes with bur oak and white oak. Common associates include aspen, white pine, red pine, jack pine, red maple, and white birch.

Oaks have very high wildlife value, providing resources through mast production, nesting, denning, and roosting habitat, and cover for a wide variety of game and nongame species. Oaks also host a high diversity and abundance of insect populations, particularly lepidopterans (butterflies and moths), making them a critical food resource for migrating landbirds in the spring.

Oak-dominated forests in southern Wisconsin are most prevalent in the Western Coulee and Ridges Ecological Landscape (EL) and also common in the Central Sand Hills, Central Sand Plains, and the southern Kettle Moraine region of the Southeast Glacial Plains. Other southern ELs with important oak-dominated sites are Central Lake Michigan Coastal, Southern Lake Michigan Coastal, Southwest Savanna, and Western Prairie. Oaks are widely distributed across northern Wisconsin but are most prevalent in the Northern Highland, Northeast Sands, and Northwest Sands, and also common in the Forest Transition and North Central Forest.

Ecological Landscape Opportunities

Ecological Landscape	Opportunity*	
	Southern Oak Types	Northern Oak Types
Central Lake Michigan Coastal	I	P
Central Sand Hills	M	P
Central Sand Plains	M	P
Forest Transition	P	I
North Central Forest		I
Northeast Sands		M
Northern Highland		M
Northern Lake Michigan Coastal		I
Northwest Lowlands		I
Northwest Sands		M
Southeast Glacial Plains	M	P
Southern Lake Michigan Coastal	I	
Southwest Savanna	M	
Superior Coastal Plain		I



Ecological Landscape	Opportunity*	
	Southern Oak Types	Northern Oak Types
Western Coulee and Ridges	M	P
Western Prairie	I	P

M = Major; major opportunity exists in this Landscape; many significant occurrences are recorded, or restorations likely to be successful.

I = Important; several occurrences important to maintaining the community in the state occur in this Landscape.

P = Present; community is present in the Landscape but better opportunity exists elsewhere.

Rare Species

Many Species of Greatest Conservation Need (SGCN) are associated with oak-dominated forests throughout Wisconsin based on the findings in [Wisconsin’s 2015 Wildlife Action Plan](#). To learn more, visit the [Southern Forest communities page](#) and click on ‘Central Sands Pine-Oak’, ‘Southern Dry Forest’ and ‘Southern Dry-mesic Forest’; or the [Northern Forest communities page](#) and click on ‘Northern Dry Forest’ and ‘Northern Dry-mesic Forest’.

Threats

- Past and current land use changes, fire suppression, unsustainable management practices (e.g., high-grading), excessive herbivory, and competition from both native and non-native species have contributed to the loss of mature oaks from, and lack of oak regeneration in, many currently and formerly oak-dominated stands, a change which is likely to be detrimental to wildlife.
- Presettlement oak-dominated forests were maintained by relatively high-frequency, low-intensity fires which consumed leaf litter and small woody debris, while higher-intensity fires at longer intervals killed overstory trees and allowed more light to reach the ground, giving oaks a competitive advantage as a new stand developed. Fire suppression has allowed shrubs and saplings of shade-tolerant, fire-sensitive species to become much more prevalent, while inhibiting oak regeneration and causing a decline in numerous light-demanding herbaceous understory plants. The replacement of fire-adapted species with mesophytic species may represent a change that is self-reinforcing, as microenvironmental conditions are altered in a way that continually improves them for mesophytes (cooler, damper, more shaded conditions; less flammable leaf litter) and deteriorates them for shade-intolerant, fire-adapted species. This could make reintroduction of fire very challenging.
- Fragmentation threatens oak forests, particularly in southern Wisconsin but also in many parts of the north. Much of southern Wisconsin is characterized by “permanent” fragmentation, or the long-term conversion of native habitats to agricultural, residential, or urban uses. This isolates and degrades forest tracts, limits management options, and reduces habitat for species that require large forest blocks.
- Many oak stands suffer from ecological simplification – a lack of species and structural diversity needed to support a robust community of plants and animals – due to past and current management practices, invasion by non-native species, and excessive deer herbivory. The very young and very old age-classes are underrepresented in many oak stands. This reduces habitat for a variety of species and makes forests more vulnerable to pests, diseases, and other environmental stresses.



- Non-native invasive species are a significant threat to oak forests. Problematic species currently include non-native honeysuckles and buckthorns, garlic mustard, Japanese barberry, multiflora rose, autumn olive, and gypsy moth. Some aggressive native species such as prickly ash can also be problematic.
- Predicted changes in climate may affect some species associated with oak forests. Warmer, drier conditions in southern Wisconsin may be more favorable for some species of oaks and hickories. However, warmer temperatures may also allow invasive plants, insect pests, and pathogens to increase.

Management Techniques

- [Coppice](#)
- [Overstory removal](#)
- [Shelterwood](#)
- [Clearcut](#)
- [Patch selection](#)
- [Direct seeding and planting](#)
- [Prescribed fire](#)
- [Site preparation](#)
- [Intermediate treatments](#)
- [Pesticide treatments](#)

Management Considerations

- Consider landscape composition and structure (species composition; successional stage; age structure; stand/patch size; degree of fragmentation, etc.) when deciding on a management technique. A variety of management techniques may be applied depending on the management objectives.
- Limit permanent fragmentation caused by development (roads, landings, etc.).
- Where possible, manage for larger stands, larger blocks, to increase connectivity with surrounding forest, and to soften sharp transitions between habitat types.
- Where appropriate and feasible, manage oak forests as part of a natural gradient from forest to woodland to savanna/barrens.
- Coppice or shelterwood methods are often used to regenerate oak in conjunction with site preparation techniques and intermediate treatments. Patch selection and clearcutting or shelterwood with planting may have application in some sites. Given the current challenges in managing oak, a commitment to long-term management is required to successfully regenerate and establish new oaks.
- Strongly consider using prescribed fire in combination with silvicultural prescriptions (e.g., shelterwood, group selection, thinning) to regenerate oak. These techniques have shown substantial benefits for oak regeneration in other parts of the U.S. and Midwest, including in Wisconsin and on productive sites.
- Promote a diversity of oak species.



- Wherever feasible, convert central or northern hardwoods to oak or maintain/increase the oak component in these stands.
- In stands containing mature oaks where management to regenerate oak is not feasible, consider deferring management, or apply extended rotation or old-growth management to retain oaks as long as possible.
- In mixed stands, manage for an increased oak component where feasible, and for tree species diversity, favoring longer-lived species. On dry northern sites, favor oaks, pines, and white birch over aspen and red maple.
- Manage stands for composition and structural diversity by: retaining some large-diameter trees, living and dead cavity trees, snags, and coarse woody debris; creating canopy gaps of varying sizes; maintaining or increasing tree species diversity; creating and maintaining a diversity of age and size classes; and applying extended rotation or managed old-growth management to some stands.
- Increase representation of older trees and older stands.
- Protect special features such as ephemeral ponds, seeps, riparian areas, cliff faces, glades, and rock outcrops, and savanna, barrens, and prairie remnants.
- Control and limit deer herbivory.
- Retain openings created by oak wilt where beneficial.

