

# Oak Opening (Global Rank G1; State Rank S1)

## Overview: Distribution, Abundance, Environmental Setting, Ecological Processes

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

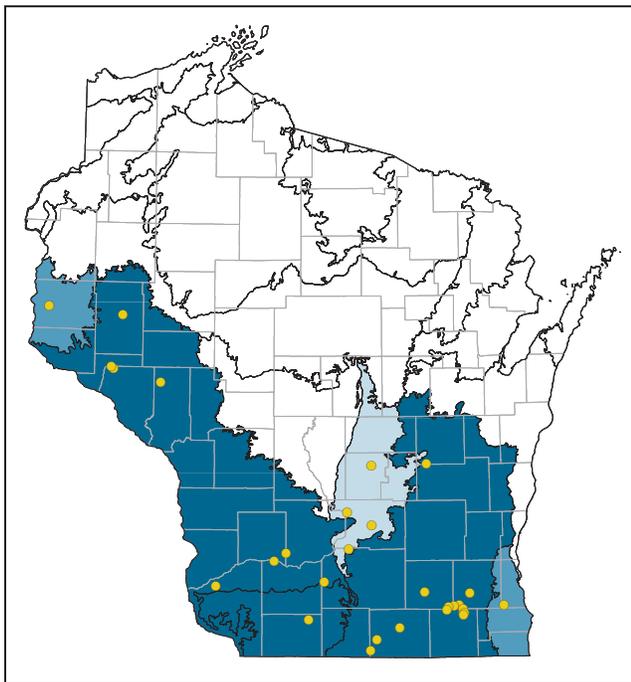
In 1959 Curtis wrote that “an oak savanna with an intact ground layer is the rarest plant community in Wisconsin today.” This statement applies throughout the continental range of the type (Nuzzo 1986) and is even more apt now than it was a half century ago. Virtually all present conservation efforts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

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

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

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

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



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



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

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

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

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

## Community Description: Composition and Structure

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

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

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

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

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



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

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

## Conservation and Management Considerations

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

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

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

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

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



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

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

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

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

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

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

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

### Additional Information

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

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

Michigan and Ontario have described CEGL005120 Lakeplain Wet-mesic Oak Openings. This extremely rare natural community is possible in the southeastern corner of Wisconsin and northeastern Illinois within the 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](#).