

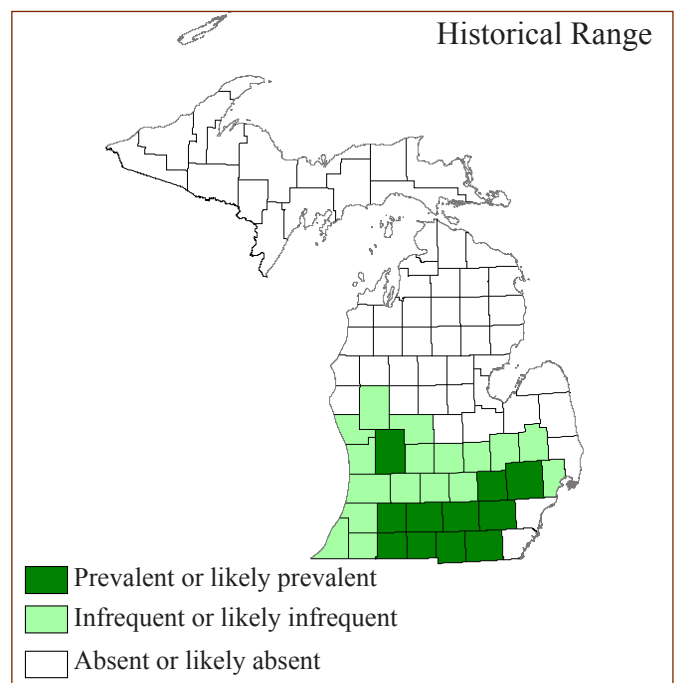


Photo by Susan R. Crispin

Overview: Oak barrens is a fire-dependent, savanna type dominated by oaks, having between 5 and 60 percent canopy, with or without a shrub layer. The predominantly graminoid ground layer is composed of species associated with both prairie and forest communities. Oak barrens are found on droughty soils and occur typically on nearly level to slightly undulating sandy glacial outwash, and less often on sandy moraines or ice contact features.

Global and State Rank: G2?/S1

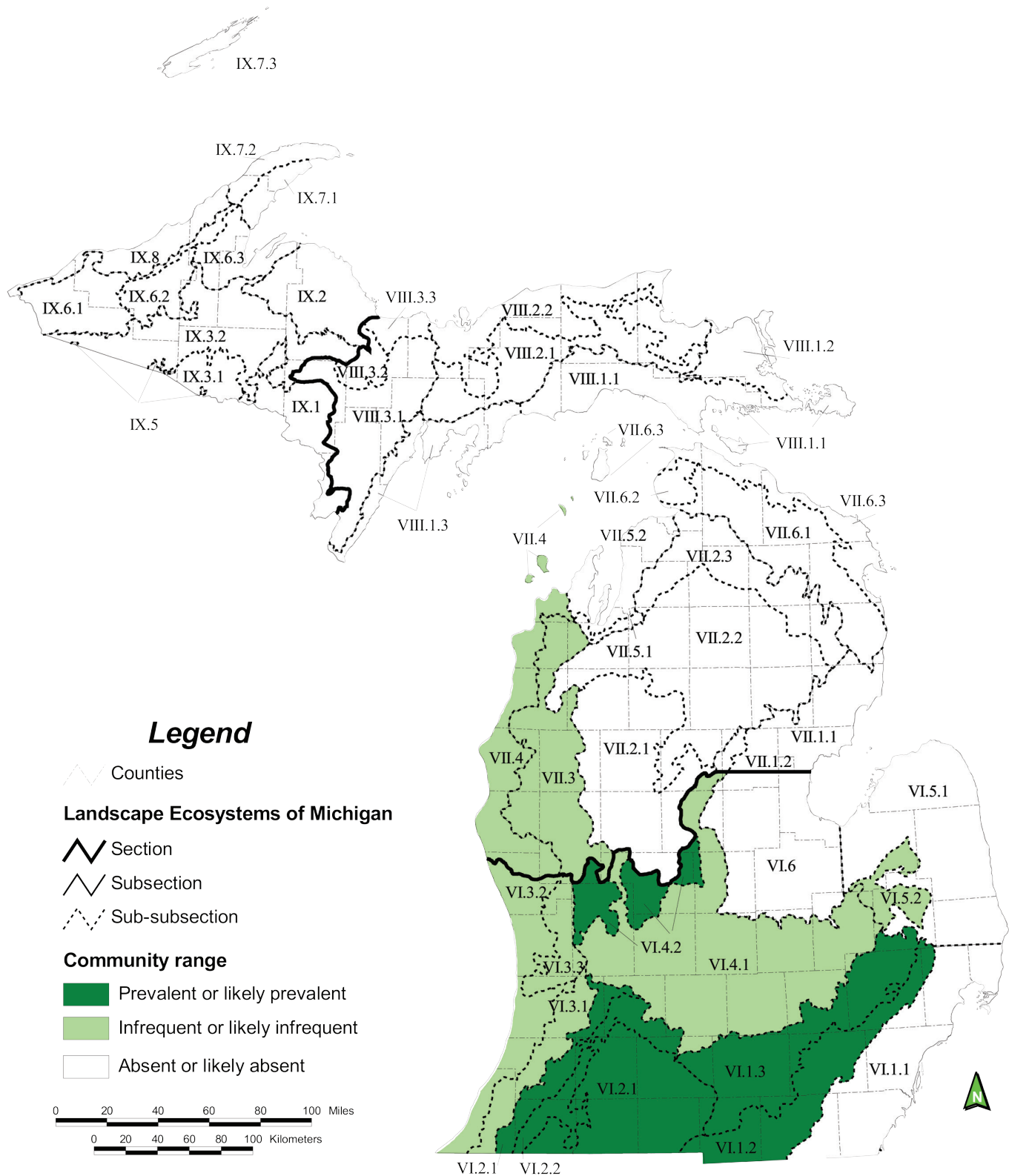
Range: Barrens and prairie communities reached their maximum coverage in Michigan approximately 4,000-6,000 years before present, when postglacial climatic conditions were comparatively warm and dry. During this time, xerothermic conditions allowed for the invasion of fire-dependent, xeric vegetation types into a large portion of the Lower Peninsula and into sections of the Upper Peninsula. With the subsequent shift of more mesic climatic conditions southward, there has been a recolonization of mesic vegetation throughout Michigan. The distribution of fire-dominated communities, such as oak barrens, has been reduced typically to isolated patches concentrated along the climatic tension zone. In the 1800s, oak barrens were located in the interior of the southeastern Lower Peninsula on sandy glacial outwash and coarse-textured moraines (Comer et al. 1995). Presently the distribution of this community has been reduced to degraded remnants throughout its original range. In addition to southern Michigan, oak barrens remnants occur south of the tension



zone through Wisconsin and southeastern Minnesota, and in the glaciated portions of Ohio, Indiana, Illinois, Iowa, Missouri, Kansas, and Nebraska (Chapman et al. 1995, NatureServe 2001).

Rank Justification: At the time of European settlement, oak savanna communities covered some 11-13 million hectares of the Midwest. Presently oak savanna remnants occur on just 0.02% of their presettlement extent (Nuzzo 1986). The notes of the original land surveyors of





Ecoregional map of Michigan (Albert 1995) depicting historical distribution of oak barrens (Albert et al. 2008)



Michigan reveal that in the 1800s, oak barrens covered approximately 719,042 acres or 1.9% of the state, distributed patchily across the four lower tiers of counties. In Allegan and Ottawa Counties, savanna communities were typically oak-pine barrens, while lakeplain oak openings were prevalent in the thumb region (Huron, Bay, and Tuscola Counties). Oak openings shared the same range as oak barrens but occurred on dry-mesic to mesic soils as opposed to droughty sites. Surveyors' notes indicate that high concentrations of oak barrens occurred in the following counties: Oakland County (28% or 200,557 acres), Jackson County (12% or 84,204 acres), Livingston County (11% or 81,176), and Washtenaw County (9% or 62,966 acres). Today merely a few hundred acres of oak barrens remain in Michigan with small, restorable remnants occurring in Cass, Branch, Livingston, Jackson, Washtenaw, and Van Buren Counties. This rare community constitutes less than 0.0005% of the present vegetation of Michigan.

Oak barrens have been cleared for sand mining, agriculture, and residential and urban development (Chapman et al. 1995). Alteration of historic fire regimes has shifted most barrens types into woodlands and forest (Curtis 1959, Faber-Langendoen 1993). Wildfire suppression policies instituted in the 1920s in concert with road construction, expansion of towns, and increased agriculture caused a dramatic decrease in fire frequency and intensity (Abrams 1992). The reduction of fire in the landscape resulted in the succession of open oak barrens to closed-canopy forests dominated by black and white oaks with little advanced regeneration of oaks and a vanishing graminoid component (Chapman et al. 1995). In addition, timber exploitation of oaks in the 1920s destroyed or degraded oak barrens across Michigan (Michigan Natural Features Inventory 1995). Many oak barrens fragments are currently completely dominated by black oak as the result of selective harvest of canopy white oak (Minc and Albert 1990). In addition to simplified overstory structure, these communities are often depauperate in floristic diversity as the result of fire suppression and subsequent woody encroachment, livestock grazing, off-road vehicle activity, and the invasion of exotic species (Michigan Natural Features Inventory 1995).

Landscape and Abiotic Context: Oak barrens occur on well-drained, nearly level to slightly undulating sandy glacial outwash, and less often on sandy moraines or ice contact features. Oak barrens typically occur in the driest landscape positions, such as ridge tops, steep slopes, south

and west facing slopes, and flat sand plains. This xeric, fire-prone community is characterized by soils that are infertile, coarse-textured, well-drained sand or loamy sand with medium to slightly acid pH and low water retaining capacity. Soils contain low organic matter and lack the fine-textured illuvial horizon associated with soils of the oak openings and are thus droughtier. Oak barrens and oak-pine barrens typically occur in bands surrounding prairie (Chapman et al. 1995, Kost et al. 2007).

Oak barrens are distributed in Michigan's Region I, Southern Lower Michigan (Albert et al. 1986). This region has a warm, temperate, rainy to cool, snow-forest climate with hot summers and no dry season. The daily maximum temperature in July ranges from 29° to 32° C (85° to 90° F) and the daily minimum temperature in January ranges from -9° to -4° C (15° to 25° F). The number of freeze-free days is between 120 and 220, and the average number of days per year with snow cover of 2.5 cm or more is between 10 and 60. The mean annual total precipitation for Region I is 820 mm (Albert et al. 1986, Barnes 1991).

Natural Processes: Curtis (1959) suggested that oak barrens originated when prairie fires spread into surrounding closed oak forest with enough intensity to create open barrens. Repeated low intensity fires working in concert with drought then maintain these barrens (Curtis 1959, Faber-Langendoen and Tester 1993). Oak barrens persist when fire disturbance and/or drought prevents canopy closure and the dominance of woody vegetation. Presently, the prevalent catalyst of fires is lightning strike but historically, Native Americans played an integral role in the fire regime, accidentally and/or intentionally setting fire to prairie ecosystems (Day 1953, Chapman 1984). Where large-scale herbivores are abundant, grazing may help inhibit the succession of grass-dominated oak barrens to woodland (Ritchie et al. 1998).

The character of oak barrens can differ dramatically, primarily as the result of varying fire intensity and frequency, which are influenced by climatic conditions, soil texture, topography, and landscape context (i.e., proximity to water bodies and fire-resistant and fire-conducting plant communities) (Bowles et al. 1994, Chapman et al. 1995). Infrequent, high-intensity fires kill mature oaks and produce barrens covered by abundant scrubby oak sprouts. Park-like barrens with widely spaced trees and an open grass understory are maintained by frequent low-intensity fires, which occur often enough to restrict maturation of oak seedlings (Chapman et al.



1995, Faber-Langendoen and Davis 1995, Peterson and Reich 2001). Canopy oaks within these barrens rarely burn because of low fuel loads beneath their crowns, which shade out light-demanding vegetation (Anderson and Brown 1983). Frequent low-intensity fires also maintain high levels of grass and forb diversity by deterring the encroachment of woody vegetation and limiting single species dominance. Absence of fire in oak barrens causes increased litter layer and fuel loads, decreased herb layer diversity, increased canopy and subcanopy cover, invasion of fire-intolerant species, and ultimately the formation of a closed-canopy oak community, often within 20-40 years (Curtis 1959, Chapman et al. 1995, Faber-Langendoen and Davis 1995).



Photo by Gary Reese

Canopy closure and woody encroachment in a fire suppressed oak barrens.

Vegetation Description: The oak barrens community is a heterogeneous savanna vegetation type with variable physiognomy in time and space. Structurally, oak barrens range from dense thickets of brush and understory scrub oak within a matrix of grassland to park-like open woods of widely spaced mature oak with virtually no shrub or sub-canopy layer above the open forb and graminoid understory (Bowles and McBride 1994, Chapman et al. 1995, Kost et al. 2007). The physiognomic variations, which occur along a continuum, are the function of the complex interplay between fire frequency and intensity (Chapman et al. 1995). Typically, oak barrens grade into prairie on one edge and dry forest on the other. As noted by Bray (1958) and Curtis (1959), the flora of this community is a mixture of prairie and forest species, with prairie forbs and grasses more abundant in high light areas and forest forbs and woody species in the areas of low light.

The canopy layer generally varies from 5 to 60 percent cover (Chapman et al. 1989) and is dominated or co-dominated by *Quercus velutina* (black oak) and *Quercus*

alba (white oak). These species of oak are also prevalent in the sub-canopy in shrubby clumps, especially where fire intensity is high. In addition, *Acer rubrum* (red maple), *Prunus serotina* (black cherry), *Populus grandidentata* (bigtooth aspen), *Populus tremuloides* (trembling aspen), and *Quercus ellipsoidalis* (pin oak) are often found in the overstory and sub-canopy of this community. Pin oak is especially common on excessively well-drained sites. Prevalent species of the subcanopy layer include: *Carya* spp. (hickory species), *Cornus* spp. (dogwood species), *Corylus americana* (American hazelnut), *Prunus* spp. (cherry species), and *Sassafras albidum* (sassafras).

Characteristic shrubs include: *Amelanchier* spp. (serviceberry), *Arctostaphylos uva-ursi* (bearberry), *Ceanothus americanus* (New Jersey tea), *Comptonia peregrina* (sweetfern), *Corylus americana*, *Cornus* spp., *Corylus cornuta* (beaked hazelnut), *Crataegus* spp. (hawthorn species), *Gaultheria procumbens* (wintergreen), *Gaylussacia baccata* (huckleberry), *Prunus americana* (wild plum), *Prunus virginiana* (choke cherry), *Prunus pumila* (sand cherry), *Quercus prinoides* (dwarf chestnut or dwarf chinkapin oak), *Rhus copallina* (shining sumac), *Rosa carolina* (pasture rose), *Rubus flagellaris* (northern dewberry), *Salix humilis* (prairie or upland willow), and *Vaccinium angustifolium* (low sweet blueberry).

The ground layer is dominated by graminoids and forbs. Common species include: *Schizachyrium scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), and *Carex pensylvanica* (Pennsylvania sedge), with Pennsylvania sedge often replacing the bluestems in shaded areas and fire-suppressed communities. Other prevalent herbs of the oak barrens include: *Aster oolentangiensis* (sky-blue aster), *Aureolaria* spp. (false foxglove), *Coreopsis lanceolata* (tickseed), *Cyperus filiculmis* (nut grass), *Danthonia spicata* (poverty oats), *Deschampsia flexuosa* (hair grass), *Euphorbia corollata* (flowering spurge), *Helianthus divaricatus* (tall sunflower), *Koeleria macrantha* (June grass), *Krigia biflora* (dwarf dandelion), *Lathyrus ochroleucus* (white pea), *Lespedeza hirta* (hairy lespedeza), *Liatris aspera* (blazing star), *Liatris cylindracea* (dwarf blazing star), *Lupinus perennis* (wild lupine), *Monarda fistulosa* (wild bergamot), *Panicum implicatum* (panic grass), *Pedicularis canadensis* (wood betony), *Stipa avenacea* (needle grass), *Stipa spartea* (needle grass), *Tephrosia virginiana* (goats-rue), and *Viola pedata* (birdfoot violet) (Kost et al. 2007).



In the absence of fire and with the prevalence of anthropogenic disturbance such as logging, off-road vehicle recreation, and livestock grazing, the following exotic species may be dominant components of the herbaceous layer of oak barrens: *Agropyron repens* (quack grass), *Agrostis stolonifera* (creeping bent), *Asparagus officinalis* (wild asparagus), *Centaurea maculosa* (spotted knapweed), *Hieracium* spp. (hawkweeds), *Hypericum perforatum* (St. John's-wort), *Poa compressa* (Canada bluegrass), *Poa pratensis* (Kentucky bluegrass), *Rumex acetosella* (sheep sorrel), and *Tragopogon dubius* (goat's beard).

Michigan indicator species:

Spring/Early Summer

Comandra umbellata (bastard toadflax), *Coreopsis lanceolata* (lanceolate coreopsis), *Geum triflorum* (prairie smoke, state threatened), *Lithospermum canescens* (hoary puccoon), *Lupinus perennis*, *Krigia biflora*, *Pedicularis canadensis*, *Potentilla simplex* (common cinquefoil), *Senecio plattensis* (prairie ragwort), *Stipa spartea*, and *Viola pedata*.

Summer

Anemone cylindrica (thimbleweed), *Asclepias tuberosa* (butterfly weed), *Asclepias verticillata* (whorled milkweed), *Ceanothus americanus*, *Helianthus occidentalis* (woodland sunflower), *Helianthus divaricatus*, *Linum sulcatum* (furrowed flax, state special concern), *Monarda punctata* (horsemint), *Monarda fistulosa*, *Opuntia humifusa* (prickly pear), and *Trichostema dichotomum* (bastard pennyroyal, state threatened).

Fall

Andropogon gerardii, *Aristida purpurascens* (three awn grass), *Aster oolentangiensis*, *Aster ericoides* (many flowered aster), *Aster sericeus* (silky aster, state threatened), *Aureolaria flava* (false foxglove), *Aureolaria pedicularia* (false foxglove), *Aureolaria virginica* (false foxglove), *Bouteloua curtipendula* (side oats grama, state endangered), *Liatris aspera* (rough blazing star), *Liatris cylindracea* (dwarf blazing star), *Schizachyrium scoparium*, *Silphium terebinthinaceum* (prairie dock), *Solidago speciosa* (showy goldenrod), *Solidago rigida* (stiff goldenrod), and *Stipa avenacea*.

Other noteworthy species: Rare plants associated with oak barrens include: *Aristida tuberculosa* (beach three-awned grass, state endangered), *Aster drummondii* (Drummond's

aster, state threatened), *Aster sericeus* (western silvery aster, state threatened), *Astragalus canadensis* (Canadian milk-vetch, state threatened), *Baptisia leucophaea* (cream wild indigo, state endangered), *Bouteloua curtipendula* (side-oats grama grass, state endangered), *Carex inops* ssp. *heliophila* (sun sedge, state special concern), *C. richardsonii* (Richardson's sedge, state special concern), *C. tinctoria* (tinged sedge, state threatened), *Celtis tenuifolia* (dwarf hackberry, state special concern), *Cerastium velutinum* (fled chickweed, presumed extirpated from Michigan), *Cirsium hillii* (Hill's thistle, state special concern), *Dasistoma macrophylla* (mullein-foxglove, state endangered), *Eupatorium sessilifolium* (upland boneset, state threatened), *Euphorbia commutata* (tinted spurge, state threatened), *Gentiana puberulenta* (downy gentian, state endangered), *Geum triflorum* (prairie-smoke, state threatened), *Gillenia trifoliata* (Bowman's root, state endangered), *Helianthus hirsutus* (whiskered sunflower, state special concern), *Helianthus mollis* (downy sunflower, state threatened), *Hieracium paniculatum* (panicled hawkweed, state threatened), *Houstonia caerulea* (azure bluet, presumed extirpated from Michigan), *Kuhnia eupatorioides* (false boneset, state special concern), *Lechea minor* (least pinweed, presumed extirpated from Michigan), *Lechea stricta* (erect pinweed, state special concern), *Linum sulcatum* (furrowed flax, state special concern), *Paronychia fastigiata* (low-forked chickweed, presumed extirpated from Michigan), *Phlox bifida* (cleft phlox, presumed extirpated from Michigan), *Prunus alleghaniensis* var. *davisii* (Alleghany or sloe plum, state special concern), *Silene stellata* (starry campion, state threatened), *Silene virginica* (fire pink, state endangered), *Sisyrinchium strictum* (blue-eyed grass, state special concern), *Solidago bicolor* (white goldenrod, state endangered), *Sporobolus clandestinus* (dropseed, state endangered), and *Trichostema dichotomum* (bastard pennyroyal, state threatened).

Oak barrens frequently support numerous lichens and mosses. Oak trunks provide substrate for foliose lichens (e.g., *Punctelia rudecta*, *Physcia millegrana*, and *Candelaria concolor*) and crustose lichens (e.g., *Candelariella xanthostigma* and *Rinodina papillata*). In addition to the cryptogamous communities thriving on tree boles, oak barrens often contain patches of microbiotic soil crust composed of lichens, mosses, and cyanobacteria (Will-Wolf and Stearns 1999).

The oak barrens and surrounding prairie habitat share a rich diversity of invertebrates including numerous



butterflies, skippers, grasshoppers, and locusts. However, the fragmented and degraded status of midwestern oak barrens/savannas and prairies has resulted in the drastic decline of numerous insect species associated with dry, open habitats or obligates of barrens and prairie host plants (Chapman et al. 1995). Rare butterflies, skippers, and moths include: *Atrytonopsis hianna* (dusted skipper, state special concern), *Catocala amestris* (three-staff underwing, state endangered), *Erynnis p. persius* (persius dusky wing, state threatened), *Hesperia ottoe* (ottoe skipper, state threatened), *Incisalia henrici* (Henry's elfin, state threatened), *Incisalia irus* (frosted elfin, state threatened), *Lycaeides melissa samuelis* (Karner blue, state threatened/federal endangered), *Papaipema sciata* (Culver's root borer, state special concern), *Pygarcia spraguei* (Sprague's pygarcia, state special concern), *Pyrgus centaureae wyandot* (grizzled skipper, state special concern), *Schinia indiana* (phlox moth, state endangered), *Schinia lucens* (leadplant moth, state endangered), *Spartiniphaga inops* (Spartina moth, state special concern), and *Speyeria idalia* (regal fritillary, state endangered).

Other rare invertebrates include *Lepyronia gibbosa* (Great Plains spittlebug, state special concern), *Oecanthus pini* (pinetree cricket, state special concern), *Orphulella pelidna* (green desert grasshopper, state special concern), *Prosapia ignipectus* (red-legged spittlebug, state special concern), and *Scudderella fasciata* (pine katydid, state special concern).

Numerous songbirds utilize oak barrens. Rare species include *Ammodramus savannarum* (grasshopper sparrow, state special concern) and *Dendroica discolor* (prairie warbler, state endangered). Typical songbirds include: *Melospiza lincolni* (Lincoln's sparrow), *Passerina cyanea* (indigo bunting), *Pooecetes gramineus* (vesper sparrow), *Sial sialis* (eastern bluebird), *Spizella passerina* (chipping sparrow), *Spizella pusilla* (field sparrow), *Toxostoma rufum* (brown thrasher), *Vermivora pinus* (blue-winged warbler) and *Vermivora ruficapilla* (Nashville warbler). Additional avian species that utilize this habitat include: *Accipiter striatus* (sharp-shinned hawk), *Bartamia longicauda* (upland sandpiper), *Bonasa umbellus* (ruffed grouse), *Buteo jamaicensis* (red-tailed hawk), *Carduelis tristis* (American goldfinch), *Charadrius vociferus* (killdeer), *Chondestes grammacus* (lark sparrow), *Falco sparverius* (American kestrel), *Icterus galbula* (Baltimore oriole), *Melanerpes erythrocephalus* (red-headed woodpecker), *Meleagris gallopavo* (wild turkey), *Otus asio* (Eastern

screech-owl), *Tyrannus tyrannus* (eastern kingbird), and *Zenaida macroura* (mourning dove). Savanna restoration with prescribed fire in Minnesota resulted in the increase in the abundance of open-country bird species, including many species that have been declining in central and eastern North America (Davis et al. 2000).

Cryptotis parva (least shrew, state threatened) and *Microtus ochrogaster* (prairie vole, state endangered) are rare mammals that may be found in oak-pine barrens. Additional mammals commonly associated with the oak barrens community include: *Canis latrans* (coyote), *Microtus pennsylvanicus* (meadow vole), *Odocoileus virginianus* (white-tailed deer), *Sciurus niger* (fox squirrel), *Spermophilus tridecemlineatus* (thirteen-lined ground squirrel), *Taxidea taxus* (badger), *Vulpes vulpes* (red fox), and *Zapus hudsonia* (jumping meadow mouse).

Several rare reptiles are known from this community type. They include: *Pantherophis spiloides* (gray ratsnake, state special concern), *Sistrurus c. catenatus* (eastern massasauga, state special concern, federal candidate species), and *Terrapene c. carolina* (eastern box turtle, state special concern). Some of the more common amphibians and reptiles that frequent the oak barrens include: *Bufo a. americanus* (eastern American toad), *Bufo fowleri* (Fowler's toad), *Heterodon platirhinos* (eastern hog-nosed snake), and *Opheodrys vernalis* (smooth green snake).

Conservation/management: Fire is the single most significant factor in preserving the oak barrens landscapes. Where remnants of oak barrens persist, the use of prescribed fire is an imperative management tool for maintaining an open canopy, promoting high levels of grass and forb diversity, deterring the encroachment of woody vegetation and invasive exotics, and limiting the success of dominants. Numerous studies have indicated that fire intervals of 1-3 years bolster graminoid dominance, increase overall grass and forb diversity, and remove woody cover of saplings and shrubs (White 1983, Tester 1989). Burning at longer time intervals will allow for seedling establishment and the persistence of woody plants. Where rare invertebrates are a management concern, burning strategies should allow for ample refugia to facilitate effective postburn recolonization (Michigan Natural Features Inventory 1995, Siemann et al. 1997).

Though most of the historical oak barrens have been degraded by selective logging, livestock grazing, and fire



suppression or destroyed by development, agricultural clearing, sand mining, and extensive timber harvest, there is much opportunity for restoration of this community type. Plant species of oak barrens can persist through cycles of canopy closure and removal (Chapman et al. 1995). The occurrence of oak barrens indicator species in closed-canopy forests reveals the presence of a native seedbank and highlights that area as a target for restorative management. Also indicative of a site's potential for restoration is the prevalence of oak "wolf trees." "Wolf trees" are large open-grown trees with wide-spreading limbs that are often associated with oak barrens' plants or seedbank (Michigan Natural Features Inventory 1995).



Photo by Joshua G. Cohen

Prescribed fire in remnant oak barrens maintains open canopy conditions, promotes high levels of grass and forb diversity and deters the encroachment of woody vegetation and non-native species.

Where canopy closure has degraded the savanna character, one can restore the oak barrens community by selectively cutting the majority of trees (White 1986), leaving an average of 4 trees/acre. Degraded barrens that have been long deprived of fire often contain a heavy overstory component of shade tolerant species, which can be removed by mechanical thinning (Peterson and Reich 2001). Reconstructed sites will need to be maintained by periodic prescribed fire and may require investment in native plant seeding where seed and plant banks are inadequate (Packard 1988). Depending on the physiognomic target of the management, one can manipulate the intensity, seasonality, and frequency of the prescribed burns: low-intensity and high-frequency burns for the park-like end of the barrens continuum and low-frequency and high-intensity burns for shrubby oak barrens. Fall burns typically are slow moving, low-intensity fires due to high relative humidity and slow wind speed, while late spring and summer burns are often more intense due to higher wind speeds and lower relative humidity (King 2000). Summer burning can be employed

to simulate naturally occurring lightning season burns. Early spring burns often carry irregularly through barrens influenced by high spring water tables. Such patchy burns can be useful tool for establishing refugia for fire-sensitive species and may permit oak seedling establishment (Chapman et al. 1995). Patchy burns are often the result of frequent low-intensity fires, which carry sporadically through areas with low fuel loads. In contrast, infrequent fires are often more uniform in coverage, spreading evenly through areas of high fuel accumulation (Ladd 1991).

In many circumstances the effective use of prescribed fire is precluded due to monetary constraints or safety concerns. In areas where fire is undesirable or unfeasible, mowing or selective cutting can be utilized and should be carried forth in late fall or winter to minimize detrimental impact to herbaceous species and rare invertebrates (Chapman et al. 1995, Michigan Natural Features Inventory 1995, King 2000). Management of oak barrens communities should be orchestrated in conjunction with the management of adjacent communities such as dry sand prairie, dry southern forest, and coastal plain marsh.

Research needs: As noted by Nuzzo (1986), Minc and Albert (1990), Faber-Langendoen (1993), and Bowles and McBride (1994), no single definition of Midwest oak savanna or oak barrens is universally accepted, and numerous distinct community types have been lumped under the phrase "Midwest oak savanna." Misunderstanding and misuse of the term can be alleviated by the continued refinement of regional classifications that correlate species composition, site productivity, ecological process, and landscape context. Understanding spatial and temporal variability of oak barrens is also crucial for determining the direction of management.

Management of oak barrens remnants can be determined by site-specific research of site characteristics and presettlement composition and structure (Minc and Albert 1990, Bowles et al. 1994, Bowles and McBride 1998). Investigation into the frequency, periodicity (seasonality), and intensity of fires in oak barrens is needed to guide restoration and management activities. In addition, because limitations imposed by safety concerns can hamper the effectiveness of prescribed fire as a management tool, maintaining the ecological integrity of oak barrens requires experimentation with different disturbance combinations (King 2000). Effects of management need to be monitored to allow for assessment and refinement.



Since all of Michigan's oak barrens are degraded, it is essential to determine what role seedbanks, vegetative reproduction, and external seed sources play in restoration of remnant barrens. Numerous rare Lepidoptera have host plants occurring on oak barrens. The effects of fire and alternative management techniques on rare faunal populations and their host vegetation need to be studied (Chapman et al. 1995, Siemann et al. 1997). In addition, because of the daunting problem of exotic species encroachment, research needs to examine management strategies that minimize invasive species introduction and dominance.

Similar communities: Bur oak plains, dry sand prairie, dry southern forest, dry-mesic prairie, lakeplain oak openings, oak openings, oak-pine barrens, and pine barrens.

Other Classifications:

Michigan Natural Features Inventory Presettlement Vegetation (MNFI):

Black Oak Barren and Mixed Oak Savanna

Michigan Department of Natural Resources (MDNR): G-grass and O0(zero)-oak with <100 trees per acre.

Michigan Resource Information Systems (MIRIS): 33 (Pine or Oak Opening), 412 (Central Hardwood), 4122 (White Oak), 4123 (Black Oak), 4129 (Other Oak).

The Nature Conservancy National Classification:

CODE; ALLIANCE; ASSOCIATION; COMMON NAME

II.B.2.N.a.12; *Quercus alba* - (*Quercus velutina*) Woodland Alliance; *Quercus velutina* - (*Quercus ellipsoidalis*) - *Quercus alba*/Deschampsia flexuosa Woodland; Black Oak- Northern Pin Oak / Common Hairgrass Woodland

V.A.6.N.c.3; *Quercus velutina* - (*Quercus ellipsoidalis*) Wooded Herbaceous Alliance; *Quercus velutina* - (*Quercus alba*) - *Quercus ellipsoidalis*/Schizachyrium scoparium - Lupinus perennis Wooded Herbaceous Vegetation; Black Oak/Lupine Barrens

Related Abstracts: Alleghany plum, bur oak plains, Culver's root borer, dry sand prairie, dry-mesic prairie, Hill's thistle, karner blue butterfly, lakeplain oak openings, oak barrens, oak openings, oak-pine barrens, pine barrens, prairie smoke, and red-legged spittlebug.

Selected References:

- Abrams, M.D. 1992. Fire and the development of oak forests. *BioScience* 42(5): 346-353.
- Albert, D.A. 1995. Regional landscape ecosystems of Michigan, Minnesota, and Wisconsin: A working map and classification. Gen. Tech. Rep. NC-178. St. Paul, MN: USDA, Forest Service, North Central Forest Experiment Station, St. Paul, MN. <http://nrs.fs.fed.us/pubs/242> (Version 03JUN1998). 250 pp.
- Albert, D.A., J.G. Cohen, M.A. Kost, B.S. Slaughter, and H.D. Enander. 2008. Distribution Maps of Michigan's Natural Communities. Michigan Natural Features Inventory, Report No. 2008-01, Lansing, MI. 174 pp.
- Albert, D.A., S.R. Denton, and B.V. Barnes. 1986. Regional landscape ecosystems of Michigan. Ann Arbor, MI: University of Michigan, School of Natural Resources. 32pp & map.
- Anderson, M.D., and L.E. Brown. 1983. Comparative effects of fire on trees in a midwestern savannah and an adjacent forest. *Bulletin of the Torrey Botanical Club* 119(1): 19-28.
- Barnes, B.V. 1991. Deciduous forests of North America. Pp 219-344 in E. Röhrig and B. Ulrich (eds.) *Ecosystems of the World 7: Temperate Deciduous Forests*. Elsevier, Amsterdam.
- Botts, P., A. Haney, K. Holland, S. Packard. 1994. Midwest oak ecosystems recovery plan. Technical report for the 1993 Midwest Oak Savanna Conference, Chicago, 112 pp.
- Bowles, M.L., M.D. Hutchinson, and J.L. McBride. 1994. Landscape pattern and structure of oak savanna, woodland and barrens in northeastern Illinois at the time of European settlement. Pp. 65-74 in J.S. Fralish, R.C. Anderson, J.E. Ebinger, and R. Szafoni (eds.) *Proceedings of the North American Conference on Barrens and Savannas*, October 15-16, 1994, Illinois State University, Normal, IL.



- Bowles, M.L., and J.L. McBride. 1994. Presettlement barrens in the glaciated prairie region of Illinois. Pp. 75-85 in J.S. Fralish, R.C. Anderson, J.E. Ebinger, and R. Szafoni (eds.) *Proceedings of the North American Conference on Barrens and Savannas*, October 15-16, 1994, Illinois State University, Normal, IL.
- Bowles, M.L., and J.L. McBride. 1998. Vegetation composition, structure, and chronological change in a decadent midwestern North American savanna remnant. *Natural Areas Journal* 18(1): 14-27
- Bray, J.R. 1958. The distribution of savanna species in relation to light intensity. *Canadian Journal of Botany* 36: 671-681.
- Chapman, K.A. 1984. An ecological investigation of native grassland in Southern Lower Michigan. M.A. thesis, Western Michigan University. 235 pp.
- Chapman, K.A., M.A. White, and M.R. Huffman. 1989. Draft: Oak barrens stewardship abstract. Midwest Heritage Task Force, The Nature Conservancy, Minneapolis, MN.
- Chapman, K.A., M.A. White, M.R. Huffman, and D. Faber-Langendoen. 1995. Ecology and stewardship guidelines for oak barrens landscapes in the upper Midwest. Pp. 1-29 in F. Stearns and K. Holland, eds., *Proceedings of the Midwest Oak Savanna Conference*, 1993. U.S. Environmental Protection Agency, Internet Publications. Available: <http://www.epa.gov/glnpo/oak/oak93/chapman.html> (Accessed: September 21, 2000).
- Comer, P.J., D.A. Albert, H.A. Wells, B.L. Hart, J.B. Raab, D.L. Price, D.M. Kashian, R.A. Corner, and D.W. Schuen. 1995. Michigan's presettlement vegetation, as interpreted from the General Land Office Surveys 1816-1856. Michigan Natural Features Inventory, Lansing MI. Digital map.
- Corner, R.A. 1996. Natural community abstract for pine barrens. Michigan Natural Features Inventory, Lansing, MI 3 pp.
- Curtis, J.T. 1959. *Vegetation of Wisconsin: An Ordination of Plant Communities*. University of Wisconsin Press, Madison, WI. 657 pp.
- Davis, A.M., W.D. Peterson, B.P. Reich, M. Crozier, T. Query, E. Mitchell, J. Huntington, and P. Bazakas. 2000. Restoring savanna using fire: impact on the breeding bird community. *Restoration Ecology* 8(1): 30-40.
- Day, G.M. 1953. The Indian as an ecological factor in the Northeastern forest. *Ecology* 34(2): 329-346.
- Faber-Langendoen, D. 1993. A proposed classification for savannas in the Midwest. Background paper for the Midwest oak savanna conference. 18 pp.
- Faber-Langendoen, D. (editor). 1999. International classification of ecological communities: Terrestrial vegetation of the Midwestern United States. The Nature Conservancy, Midwest Conservation Science Department, Minneapolis MN.
- Faber-Langendoen, D. (editor). 2001. Plant communities of the Midwest: Classification in an ecological context. Association for Biodiversity Information, Arlington, VA. 61 pp + appendix (705 pp.).
- Faber-Langendoen, D., and M.A. Davis. 1995. Effects of fire frequency on tree canopy cover at Allison Savanna, eastcentral Minnesota, USA. *Natural Areas Journal* 15(4): 319-328.
- Faber-Langendoen, D., and J.R. Tester. 1993. Oak mortality in sand savannas following drought in east-central Minnesota. *Bulletin of the Torrey Botanical Club* 120 (3): 248-256.
- Heikens, A.L., and P.A. Robertson. 1994. Barrens of the Midwest: a review of the literature. *Castanea* 59(3): 184-194.
- King, R. 2000. Effects of single burn events on degraded oak savanna. *Ecological Restoration* 18:4 Winter. 228-233.
- Kost, M.A., D.A. Albert, J.G. Cohen, B.S. Slaughter, R.K. Schillo, C.R. Weber, and K.A. Chapman. 2007. Natural communities of Michigan: Classification and description. Michigan Natural Features Inventory, Report Number 2007-21, Lansing, MI. 314 pp.
- Ladd, D. 1991. Reexamination of the role of fire in Missouri oak woodlands. Pp 67-80 In Burger G.V., J.E. Ebinger, and G.S. Wilhelm, eds., *Proceedings of the oak woods management workshop*. Eastern Illinois University, Charleston, IL.
- Michigan Natural Features Inventory. 1995. Forest stewardship training materials for oak-pine barrens ecosystem. (Unpublished manuscript.) Michigan Natural Features Inventory, Lansing, MI.
- Minc, L.D., and D.A. Albert. 1990. Oak-dominated communities of Southern Lower Michigan: floristic and abiotic comparisons. Michigan Natural Features Inventory, Lansing MI (Unpublished manuscript). 103 pp.



- NatureServe: An online encyclopedia of life [web application]. 2001. Version 1.4 . Arlington (VA): Association for Biodiversity Information. Available: <http://www.natureserve.org/>. (Accessed: August 10, 2001.)
- Nuzzo, V. 1986. Extent and status of Midwest oak savanna: presettlement and 1985. *Natural Areas Journal* 6: 6-36.
- Packard, S. 1988. Just a few oddball species: restoration and the rediscovery of the tallgrass savanna. *Restoration and Management Notes* 6(1): 13-20.
- Peterson, D.W., and P.B. Reich. 2001. Prescribed fire in oak savanna: fire frequency effects on stand structure and dynamics. *Ecological Applications* 11(3): 914-927.
- Ritchie, M.E., D. Tilman, and J.M.H Knops. 1998. Herbivore effects on plant and nitrogen dynamics in oak savanna. *Ecology* 79(1), 165-177.
- Siemann, E., J. Haarstad, and D. Tilman. 1997. Short-term and long-term effects of burning on oak savanna arthropods. *American Midland Naturalist* 137(2): 349-361.
- Tester, J.R. 1989. Effects of fire frequency on oak savanna in east-central Minnesota. *Bulletin of the Torrey Botanical Club* 116(2): 134-144.
- White, A.S. 1983. The effects of thirteen years of annual prescribed burning on a *Quercus ellipsoidalis* community in Minnesota. *Ecology* 64(5): 1081-108.
- White, A.S. 1986. Prescribed burning for oak savanna restoration in central Minnesota. Research Paper NC-266, U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station, St. Paul, Minn. 12 pp.
- Will-Wolf, S., and F. Stearns. 1999. Dry soil oak savanna in the Great Lakes region. Pp. 135-154 in R.C. Anderson, J.S. Fralish, and J.M. Baskin (eds.) Savannas, Barrens, and Rock Outcrop Plant Communities of North America. Cambridge, United Kingdom.
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Recently burned oak barrens remnant, Fort Custer, Calhoun County. Photo by Joshua G. Cohen.

