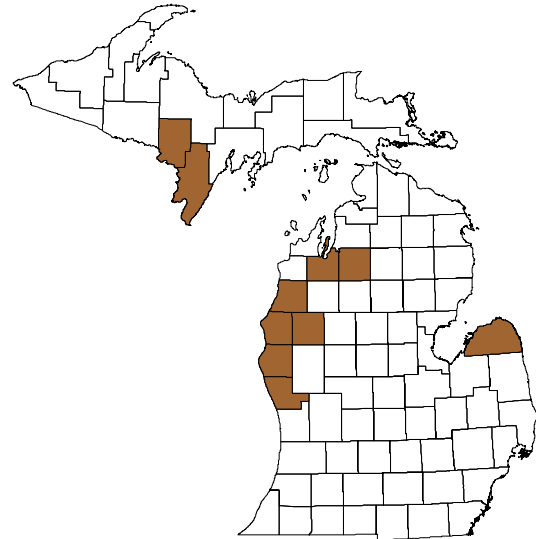




Photo by Patrick J. Comer

State Distribution



Global and State Rank: G3/S2

Range: Barrens and prairie communities reached their maximum extent in Michigan approximately 4,000-6,000 years before present, when post-glacial 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-pine barrens, has been reduced to isolated patches typically along the climatic tension zone (Hauser 1953 in Lohrentz and Mattei 1995). In the 1800s, oak-pine barrens were located on sandy outwash plains radiating from the tension zone, in the Sandusky lakeplain and in several counties of the Upper Peninsula, including Menominee, Dickinson and Chippewa counties (Comer et al. 1995). Presently the distribution of this community is concentrated in the Newaygo Outwash Plain with additional remnants in the sandy outwash plains of Menominee and Dickinson counties and the sandy lakeplains of Huron and Allegan Counties. In addition to Michigan, oak-pine barrens remnants occur in Manitoba, Ontario, Minnesota, and Wisconsin (NatureServe 2000).

Rank Justification: Prior to European settlement of Michigan in the 1800s, just over 112,000 acres of oak-pine barrens were present in Michigan, covering 0.3%

of the state's surface area (Comer et al. 1995). Most of this acreage was concentrated in Newaygo County (17% or 19,000 acres), Crawford County (15% or 17,000 acres) and Allegan County (14% or 15,000 acres). Today merely a few hundred acres of high quality oak-pine barrens remain in Michigan. This rare community constitutes less than 0.005% of the present vegetation, a sixty-fold reduction from the amount of oak-pine barrens originally present.

Currently a few small remnants of oak-pine barrens persist. Destructive timber exploitation of pines (1890s) and oaks (1920s) combined with post-logging slash fires destroyed or degraded oak-pine barrens across Michigan (Michigan Natural Features Inventory 1995). In addition, alteration of the historical fire regime has shifted much of the vegetation types with barrens physiognomy into woodlands and forest (Faber-Langendoen 1993). Fire suppression policies instituted in the 1920s resulted in the succession of open oak-pine barrens to closed canopy forests dominated by black and white oaks (Michigan Natural Features Inventory 1995). Those oak-pine barren fragments that remain are often lacking the full conifer complement, which was ubiquitously harvested. In addition to simplified overstory structure, these communities are often depauperate in floristic diversity as the result of fire suppression, livestock grazing, off-road vehicle activity, and the subsequent invasion of exotic species (Michigan Natural Features Inventory 1995; Lohrentz and Mattei 1995).



Landscape and Abiotic Context: Oak-pine barrens occur on nearly level to slightly undulating ground in well-drained sandy glacial outwash, sandy glacial lakeplains, and less often on sandy areas in coarse-textured moraines. Soils of this xeric, fire-prone community are generally coarse-textured, well-drained sand or loamy sand of medium to slightly acid pH and low water retaining capacity. Soils typically lack the fine-textured illuvial horizon associated with soils of the oak openings and are thus droughtier. Oak-pine and oak barrens typically occur in bands surrounding prairie (Kost et al. 2007).

The region that contains oak-pine barrens has a cool snow-forest climate with warm summers north of the tension zone and a warm temperate rainy to cool, snow-forest climate without a dry season and with hot summers south of the tension zone. The daily maximum temperature in July ranges from 24 to 32 °C (75 to 90 °F) and the daily minimum temperature in January ranges from -21 to -4 °C (-5 to 25 °F). The mean length of freeze-free days is between 90 to 220 days and the average number of days per year with snow cover of 2.5 cm or more is between 10 and 140 days. The normal annual total precipitation ranges from 610 to 1270 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 periodic drought then maintain these barrens. Oak-pine barrens persist when fire disturbance prevents canopy closure and the dominance of woody vegetation. Presently, the prevalent catalyst of such 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 (Chapman 1984 in Lohrentz and Mattei 1995).

The character of oak-pine barrens can differ dramatically as the result of varying fire intensity and frequency, which is influenced by climatic conditions, soil texture, and topography. Infrequent, high intensity fires kill mature oaks and produce barrens covered by scrubby oak sprouts and scattered pines, which survived the burn. Park-like barrens with widely spaced trees and an open grass understory are maintained by low intensity, frequent fires, which occur often enough to restrict oak seedlings (Lohrentz and Mattei 1995; Chapman et al. 1995). Frequent fires of low intensity can maintain high levels of grass and forb diversity by deterring the encroachment of woody vegetation and limiting the dominance of the mat-forming sedge *Carex pensylvanica* (Pennsylvania sedge) (Corner 1996).

Vegetation Description: The oak-pine barrens community is a heterogeneous savanna vegetation type. Structurally oak-pine barrens range from dense thickets of brush and understory scrub oak and pine amongst a matrix of grassland to park-like open woods of widely spaced mature oak and pines with virtually no shrub or sub-canopy layer above the open forb and graminoid understory (Chapman et al. 1995; Lohrentz and Mattei 1995; Kost et al. 2007). The physiognomic variations, which occur along a continuum, are the function of the frequency and intensity of fire (Lohrentz and Mattei 1995). Typically, oak-pine barrens grade into prairie on one front and dry forest on the other. As noted by Curtis (1959), the flora of this community is a mixture of prairie and forest species.

The canopy layer generally varies from 5 to 60 percent cover (Chapman et al. 1989) and is dominated or co-dominated by the following trees: *Quercus alba* (white oak), *Quercus velutina* (black oak), *Quercus ellipsoidalis* (northern pin oak), *Quercus macrocarpa* (bur oak), *Pinus strobus* (white pine), *Pinus resinosa* (red pine) and *Pinus banksiana* (jack pine). The above species of pine and 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), and *Populus tremuloides* (trembling aspen) are often found in the overstory and sub-canopy of this community. Along the transition zone and to the south, the most common overstory dominants are white oak, black oak, and white pine. North of the transition zone, northern pin oak replaces black oak and red pine and jack pine become more prevalent in the canopy layer. (Kost et al. 2007).

Characteristic shrubs include: *Amelanchier* spp. (serviceberry), *Arctostaphylos uva-ursi* (bearberry or kinnikinnick), *Ceanothus americanus* (New Jersey tea), *Comptonia peregrina* (sweetfern), *Corylus americana* (American hazelnut), *Cornus* spp (dogwood species), *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), *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, fire suppressed communities, and north of the transition zone. Other prevalent herbs of the oak-pine barrens include: *Aster oolentangiensis* (sky-blue aster), *Aureolaria* spp. (false foxglove), *Coreopsis lanceolata* (tickseed), *Danthonia spicata* (poverty oats), *Deschampsia flexuosa* (hair grass), *Euphorbia corollata* (flowering spurge), *Helianthus divaricatus* (woodland sunflower), *Koeleria macrantha* (June grass), *Krigia biflora* (dwarf dandelion), *Lathyrus ochroleucus* (white pea), *Lespedeza hirta* (hairy lespe-deza), *Liatris cylindracea* (dwarf blazing star), *Lupinus perennis* (wild lupine), *Monarda fistulosa* (wild bergamot), *Pedicularis canadensis* (wood betony), and *Stipa avenacea* (needle grass).

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-pine barrens: *Centaurea maculosa* (spotted knapweed), *Hieracium* spp. (hawk-weeds), *Hypericum perforatum* (common St. John's-wort), *Poa compressa* (Canada bluegrass), *Poa pratensis* (Kentucky bluegrass), and *Rumex acetosella* (sheep sorrel).

Michigan indicator species:

Spring/Early Summer

Comandra umbellata (bastard toadflax), *Coreopsis lanceolata* (tickseed), *Geum triflorum* (prairie smoke, state threatened), *Lithospermum canescens* (hoary puccoon), *Lupinus perennis* (wild lupine), *Krigia biflora* (dwarf dandelion), *Pedicularis canadensis* (wood betony), *Potentilla simplex* (common cinquefoil), *Senecio plattensis* (prairie ragwort), *Stipa spartea* (needle grass), and *Viola pedata* (bird's foot violet).

Summer

Anemone cylindrica (thimbleweed), *Asclepias tuberosa* (butterflyweed), *Asclepias verticillata* (whorled milkweed), *Ceanothus americanus* (New Jersey tea), *Helianthus occidentalis* (western sunflower), *Helianthus divaricatus* (woodland sunflower), *Linum sulcatum* (furrowed flax, state special concern), *Monarda punctata* (horsemint), *Monarda fistulosa* (wild bergamot), *Opuntia humifusa* (prickly pear), and *Trichostema dichotomum* (blue curls, state threatened).

Fall

Andropogon gerardii (big bluestem), *Aristida purpurascens* (three awn grass), *Aster oolentangiensis* (sky-blue aster), *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 threat-

ened), *Liatris aspera* (rough blazing star), *Liatris cylindracea* (dwarf blazing star), *Schizachyrium scoparium* (little bluestem), *Silphium terebinthinaceum* (prairie dock), *Solidago speciosa* (showy goldenrod), *Solidago rigida* (stiff goldenrod), and *Stipa avenacea* (needle grass).

Other noteworthy species: Rare plants associated with oak-pine barrens include: *Aster sericeus* (silky aster, state threatened), *Bouteloua curtipendula* (side-oats grama grass, state threatened), *Cirsium hillii* (Hill's thistle, state special concern), *Eleocharis melanocarpa* (black-fruited spike rush, state special concern), *Festuca scabrella* (rough fescue, state threatened), *Geum triflorum* (prairie-smoke, state threatened), *Linum sulcatum* (furrowed flax, state special concern), *Prunus alleghaniensis* var. *davisii* (alleghany or sloe plum, state special concern), *Psilocarya scirpoides* (bald rush, state threatened), *Rhexia virginica* (meadow-beauty, state special concern), *Rhynchospora macrostachya* (tall beak-rush, state special concern), and *Sisyrinchium strictum* (blue-eyed grass, state special concern).

The oak-pine barrens with its surrounding prairie habitat share a rich diversity of invertebrates including numerous butterflies, skippers, grasshoppers and locusts. Rare butterflies, skippers, and moths include: *Atrytonopsis hianna* (dusted skipper, state threatened), *Catocala amestris* (three-staff underwing, state endangered), *Erynnis p. persius* (persius duskywing, state threatened), *Hesperia ottoe* (ottoe skipper, state threatened), *Incisalia henrici* (Henry's elfin, state special concern), *Incisalia irus* (frosted elfin, state threatened), *Lycaeides melissa samuelis* (Karner blue, state threatened/federal endangered), *Papaipema sciata* (Culver's root borer, state special concern), *Pygarctia spraguei* (Sprague's pygarctia, state special concern), *Pyrgus centaureae wyandot* (grizzled skipper, state special concern), *Schinia indiana* (phlox moth, state endangered), *Schinia lucens* (leadplant flower 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 threatened), *Oecanthus pini* (pinetree cricket, state special concern), *Orphulella p. pelidna* (barrens locust, state special concern), *Prosapia ignipectus* (red-legged spittlebug, state special concern), and *Scudderia fasciata* (pine katydid, state special concern).

Numerous songbirds utilize oak-pine 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 exploit this habitat include: *Accipter striatus* (sharp-shinned hawk), *Bartamia longicauda* (upland sandpiper), *Bonasa umbellus* (ruffed grouse), *Buteo jamaicensis* (red-tailed hawk), *Charadrius vociferus* (killdeer), *Falco sparverius* (American kestrel), *Melanerpes erythrocephalus* (red-headed woodpecker), *Meleagris gallopavo* (wild turkey), *Otus asio* (Eastern screech-owl), and *Zenaida macroura* (mourning dove).

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

Several rare reptiles are known from this community type. They include *Elaphe o. obsoleta* (black rat snake, state special concern), *Sistrurus c. catenatus* (eastern massasauga, state special concern, federal candidate species), and *Terrapene c. carolina* (Eastern box turtle, state special concern). *Bufo a. americanus* (Eastern American toad), *Bufo fowleri* (Fowler's toad), *Heterodon platirhinos* (Eastern hog-nosed snake) and *Ophedrys vernalis* (smooth green snake) are some of the more common amphibians and reptiles that frequent the oak-pine barrens.

Conservation/management: Prior to the logging era, fire was the single most significant factor in preserving the oak-pine barrens landscapes. Where remnants of oak-pine barrens persist, the use of prescribed fire is an imperative management tool for maintaining an open canopy and promoting high levels of grass and forb diversity by deterring the encroachment of woody vegetation and invasive exotics and limiting the dominance of *Carex pensylvanica* (Pennsylvania sedge). Chapman et al. (1995) suggest that a fire interval of 1-3 years will remove woody cover in the sapling and shrub layer and promote herbaceous diversity. Where rare invertebrates are a management concern, burning strategies should allow for ample refugia to facilitate effective post-burn recolonization (Michigan Natural Features Inventory 1995). Though most of the historical oak-pine barrens have been

degraded by selective logging, livestock grazing, and fire suppression or destroyed by extensive timber harvest followed by slash fires and conversion to tree farms or plantations, there is much opportunity for restoration of this community type. Plant species of oak-pine barrens can persist through cycles of canopy closure and removal (Chapman et al., 1989). The occurrence of oak-pine 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 and/or pine wolf trees. Wolf trees are large open grown trees with wide-spreading limbs that are often associated with oak-pine barrens plant or seedbank in the soil (Michigan Natural Features Inventory 1995).



Photo by Gary Reese

Where canopy closure has degraded the savanna character, one can restore the oak-pine barrens community by selectively cutting the majority of trees, leaving an average of 4 trees /acre. 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. Depending on what the physiognomic target of the management is, one can manipulate the intensity and frequency of the prescribed burns: low intensity and high frequency for the park-like end of the barrens continuum and low frequency and high intensity for shrubby oak-pine barrens. Summer burning should be employed to simulate naturally occurring lightning season burns. In areas where fire is undesirable or unfeasible, mowing can be utilized and should be carried forth in late fall or winter to minimize detrimental impact to herbaceous species and rare invertebrates (Michigan Natural Features Inventory 1995; Chapman et al. 1995).

Management of oak-pine barrens communities should be orchestrated in conjunction with the management of adjacent communities such as dry sand prairie, dry southern forest, coastal plain marsh and lakeplain prairie.

Research needs: As noted by Faber-Langendoen (1993), numerous distinct community types have been lumped under the phrase "Midwest oak savannas." Misunderstanding and misuse of the term can be alleviated by the continued refinement of regional classifications that correlate species composition and landscape context. Investigation into the frequency, periodicity and intensity



of fires in oak-pine barrens is needed to guide restoration and management activities.

Numerous rare Lepidoptera have host plants occurring on oak-pine barrens. The effects of fire and alternative management techniques on rare faunal populations sensitive to fire needs to be studied. In addition, because of the daunting problem of exotic encroachment, re-research needs to examine management strategies that minimize or reduce invasive species dominance.

Similar communities: Bur oak plains, dry sand prairie, dry southern forest, dry northern forest, Great Lakes barrens, lakeplain oak openings, oak openings, oak barrens and pine barrens.

Other Classifications:

Michigan Natural Features Inventory Pre-settlement Vegetation (MNFI):
Oak-Pine Barren

Michigan Department of Natural Resources (MDNR): G- grass and O0, W0, R0, or J0- Oak, White Pine, Red Pine or Jack Pine 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), 421 (Pine), 4210 (Undifferentiated Pine), 4211 (White Pine), 4212 (Red Pine), and 4213 (Jack Pine).

The Nature Conservancy National Classification:

CODE; ALLIANCE; ASSOCIATION;
COMMON NAME

V.A.6.N.f.; *Pinus strobus-Quercus (alba, rubra)*
Wooded Herbaceous Alliance; *Pinus strobus-Quercus alba-(Quercus velutina) / Andropogon gerardii* Wooded Herbaceous Vegetation; White Pine-White Oak Barrens

V.A.6.n.F.; *Pinus banksiana-(Pinus resinosa)*
Wooded Herbaceous Alliance; *Pinus banksiana-(Quercus ellipsoidalis) / Schizachyrium scoparium*-Prarie Forbs Wooded Herbaceous Vegetation; Jack Pine / Prarie Forbs Barrens

V.A.6.n.F.; *Pinus strobus-Quercus (alba, rubra)*
Wooded Alliance; *Pinus strobus-Quercus rubra /*

Danthonia spicata Acid Bedrock Wooded Herbaceous Vegetation

II.C.3.N.a.; *Pinus strobus-Quercus (alba, ellipsoidalis, rubra, velutina)* Woodland Alliance; *Pinus strobus-Pinus resinosa-Quercus (ellipsoidalis, rubra) / Juniperus communis* Rocky Woodland

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

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