# Appendix 4-Terrestrial Habitats Michigan's Wildlife Action Plan 2015-2025

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Habitat – MNFI, Jesse Lincoln

Kirtland's Warbler – Roger Eriksson

# Ecoregion Landscape Context

## Southern Lower Peninsula Ecoregion

The Southern Lower Peninsula ecoregion encompasses 24,248 square miles and includes all of Muskegon, Ottawa, Kent, Montcalm, Gratiot, Midland, Saginaw, Tuscola, Huron, Sanilac, St. Clair, Lapeer, Genesee, Shiawassee, Clinton, Ionia, Allegan, Barry, Eaton, Ingham, Livingston, Oakland, Macomb, Wayne, Washtenaw, Jackson, Calhoun, Kalamazoo, Van Buren, Berrien, Cass, St. Joseph, Branch, Hillsdale, Lenawee and Monroe counties and portions of Newaygo, Mecosta, Isabella and Bay counties. This region has a prevalence of rolling hills and flat lake plains. Landcover in this ecoregion is primarily forested (23%) and agricultural (50%). Wetlands cover 8% and urbanization covers approximately 9% of the land area.

This region is characterized by high levels of agricultural and urban development, which has led to high levels of habitat fragmentation. Rolling hills and flat lake plains are prevalent. Historically, fire-dependent oak savanna and prairie dominated this region (Albert 1995). Closed-canopy oak forests are now the prevailing vegetative cover type.

The climate is strongly influenced by the Maritime Tropical air mass and the proximity of Lake Michigan, which induces lake-effect snow and moderates inland temperature fluctuations (Eichenlaub et al. 1990, Albert et al. 1986, Denton 1985, Eichenlaub 1979). Compared to the rest of the State, this region experiences more warm, humid air masses from the Gulf of Mexico and fewer cold, dry air masses of continental origin. In addition, this region has the highest average annual temperature and the longest growing season. The average length of the growing season is 154 days (Albert et al. 1986). Intensive agriculture in Michigan is concentrated in this region because of its comparatively mild climate.

The region is underlain by Paleozoic bedrock and was completely glaciated during the Late Wisconsinan period. The bedrock, which was deposited in marine and near-shore environments, includes sandstone, shale, limestone and dolomite (Dorr and Eschman 1984). Typically, 100–400 feet of loamy glacial drift covers the bedrock. Glacial and postglacial landforms cover the entire land surface of the region. Glacial landforms include lake plain, outwash, ground moraine (till plain) and end moraine. Broad lacustrine plains occur along all of the Great Lakes; these lake plains extend more than 20 miles inland along Lake Michigan and more than 50 miles inland along the Lake Huron shoreline at Saginaw Bay. Postglacial sand dunes form a 1–5 mile band along much of the Lake Michigan shoreline. The interior of the region consists of a relatively low plain of ground and end moraines, with narrow outwash channels throughout. A broad interlobate outwash plain occupies the southern half of the region.

Most of the soils of the region are calcareous and loamy, derived from underlying limestone, shale, and sandstone bedrock. Till deposits are primarily loams, silt loams and clay loams. Fertile lacustrine soils occur on the lake plain along the east and west edges of the region. These lacustrine soils are primarily

dominated by silt and clay. Where sandy soils occur on the lake plains, they are often banded with silt or clay. The outwash plains are sands, often containing abundant gravel.

Circa 1800, fire-dependent savanna and forest systems dominated this region. Oak savanna was probably the most prevalent cover type, followed by oak–hickory forest (Albert 1995). Beech–sugar maple forest was also important on areas of lakeplain and fine-textured moraines (Comer et al. 1995). Species diversity and structural complexity of the beech–sugar maple forests were maintained by gap phase dynamics (small-scale windthrow and ice-storm events). This is the only region of Michigan that originally supported large areas of tallgrass prairie, which was concentrated in the sandy interlobate area in the southwestern part of the region. Prairie and savanna ecosystems were maintained by frequent fires which were ignited by lightning strike and also started by Native Americans. Large areas of wet prairie and Great Lakes marsh occurred on the lake plains of Lake Erie, Lake St. Clair and Lake Huron. Wetlands include extensive marshes, fens, bogs and swamp forests (Comer et al. 1993a, 1993b). Numerous broad floodplain forests occurred along the rivers of this region.

Most of the region is now farmed for row crops; this is the most heavily farmed region in Michigan. The enduring forest has become fragmented. The remaining floodplain forests provide important habitat for songbird migration and breeding, especially as adjacent upland forests are increasingly fragmented for further agricultural or residential development. Most of the oak savannas have been eliminated or converted to closed-canopy forests as a result of fire suppression. Almost all of the original tallgrass and wet prairies have been converted to farmland. Diking and pumping have allowed vast expanses of wet prairies and some marshes to be farmed. The remaining marshes and wetlands along Great Lakes shorelines are critical for maintaining migratory waterfowl, shore birds, and the Great Lakes fisheries. Rare plant communities found within this region include coastal plain marshes, which occur in sandy depressions in outwash plains and glacial lake beds, inland salt marshes, which are limited to a handful of locations along the Maple River, and prairie fens, which are concentrated in the interlobate region. The heaviest urban, industrial and residential development has occurred in this region, especially along the Great Lakes shoreline.

## Northern Lower Peninsula Ecoregion

The Northern Lower Peninsula ecoregion encompasses 17,109 square miles and includes all of Emmet, Cheboygan, Charlevoix, Presque Isle, Alpena, Montmorency, Otsego, Antrim, Leelanau, Grand Traverse, Benzie, Kalkaska, Crawford, Oscoda, Alcona, Iosco, Roscommon, Missaukee, Wexford, Mason and Oceana counties and portions of Newaygo, Mecosta, Isabella and Bay counties. Landcover in this ecoregion is primarily forest (67%) and wetlands (20%). Agricultural land use covers 4% and urbanization covers approximately 2%. The remainder of the landcover consists of open grasslands, sparsely vegetated areas, beaches and rock areas.

This region is characterized by diverse topography with extensive outwash plains and large moraines. The ecoregion remains predominantly forested with northern hardwoods, early successional aspen forest, pine systems, and lowland conifer.

Most air masses cross the Great Lakes before entering this ecoregion. As a result, the ecoregion experiences a climate that differs from that of the surrounding continent. Lake-effect snow is common throughout portions of the ecoregion within 20–30 miles of the Great Lakes shoreline. The highest elevations in the Lower Peninsula occur in this ecoregion in the High Plains area. The High Plains, which is also the portion of the ecoregion most distant from the Great Lakes, experiences the most continental climatic conditions within the ecoregion: it has more summer precipitation, the greatest summer and winter temperature extremes, the shortest growing season, and the greatest risk of spring freeze (Denton 1985). The average length of the growing season for this ecoregion is 126 days (Albert et al. 1986).

The ecoregion is underlain by Paleozoic bedrock and was completely glaciated during the Late Wisconsin period. The underlying bedrock, which was deposited in marine and near-shore environments, includes sandstone, shale, limestone and dolomite (Dorr and Eschman 1984). Limestone bedrock is locally exposed along the Lake Huron and Lake Michigan shorelines, but the sandy glacial deposits over most of the ecoregion are generally thick; the thickest deposits are 600– 1100 feet near Cadillac and Grayling. Common glacial landforms include lake plain, outwash plain, end moraine and ground moraine. Large sand dunes, formed during the Lake Nippising high-water period (approximately 4,000 years ago), occur along portions of the Lake Michigan shoreline. In addition, extensive series of parallel beach ridges or wooded dune and swale complexes occur along former embayments of the postglacial Great Lakes shoreline.

Soils in the ecoregion range from sand to clay. The majority of soils are sands, loamy sands and sandy loams; sands are the most prevalent soil type (Albert 1990, USDA 1981). Almost all of the soils are forest soils.

Circa 1800, the common forest types included northern hardwood forest, jack pine barrens, white pine–red pine forest, hardwood–conifer swamp and conifer swamp (Comer et al. 1995). Northern hardwoods were common on the end and ground moraines of the ecoregion. Jack pine, along with northern pin oak, dominated the flat, droughty, fire-prone outwash plains which occupy large portions of the ecoregion. Forests of white pine and red pine were located in narrow outwash channels and on the moraines at the edges of the outwash plains, where fires were relatively common but less intense than on the outwash plains themselves. Conifer and hardwood–conifer swamps covered large portions of the lake plains, but also occurred along drainages throughout the ecoregion. The prevalent natural disturbance factor within this ecoregion was fire. In addition, windthrow was common on both upland hardwood and conifer forests. Interior open wetlands found within this ecoregion included intermittent wetlands, bogs, northern wet meadows, northern fens, and poor fens. Coastal wetlands included interdunal wetlands, wooded dune and swale complexes, and Great Lakes marshes.

Most of the ecoregion remains forested by northern hardwoods, aspen, oaks, pines (with significant acreage constituting plantation) and lowland conifers. Intensive logging for white pine occurred in the latter half of the 19th century, causing major changes in forest composition. Eastern hemlock was also logged for the tanning industry and northern hardwoods were harvested for a number of uses. Early successional forest types (aspen/birch forest) are more prevalent today because of past and current

management. Fire suppression has resulted in the conversion of many of the barrens systems to closed-canopy forest. Following logging, farming was attempted on a broad range of soil types within the ecoregion. Farming was unsuccessful on most of the sandy soils of the ecoregion, but row crops are grown locally on some of the loamy soils. Some pasturing is also done, especially on the loamy moraines. Orchards and vineyards are numerous along the Lake Michigan shoreline, where microclimatic conditions extend the growing season and reduce frost damage to fruit crops.

## Eastern Upper Peninsula Ecoregion

The Eastern Upper Peninsula ecoregion encompasses 17,114 square miles and includes all of Chippewa, Mackinac, Luce, Schoolcraft, Delta and Alger counties and portions of Menominee, Dickinson and Marquette counties. Landcover in this ecoregion is primarily forested (67%) and wetlands (20%). Agricultural land use covers 4% and urbanization covers about 2%. The remaining landcover consists of open grasslands, sparsely vegetated areas, beaches and rock areas.

The region is characterized by relatively flat topography with large expanses of swamp forest and low-productivity peatland. Most of the landscape remains forested, with the exception of pasture lands on both clay lake plain and loamy ground moraine.

Most air masses cross the Great Lakes before entering this ecoregion, which causes climatic differences with the surrounding continent. Large amounts of lake-effect snow and rain characterize portions of the region near the Great Lakes shorelines, especially along the Lake Superior shoreline. The average length of the growing season is 109 days (Albert et al. 1986).

The ecoregion is underlain by Cambrian sandstone and Paleozoic limestone, shale and dolomite (Dorr and Eschman 1984). Sandstone is exposed along and near the Lake Superior shoreline and along the western edge of the ecoregion. Limestone and dolomite are exposed along the Lake Michigan and Lake Huron shorelines and in localized inland areas. In the interior of the region, thick glacial drift covers bedrock. The entire region was covered by late Wisconsinan glaciation; common glacial landforms include lake plain, outwash plain, end moraine and ground moraine. Glacial lake plain covers the largest part of the ecoregion. Most of the lake plains are sandy, but a large area of clay lake plain occurs near the eastern edge of the ecoregion. Broad outwash plains are located along the entire northern edge of the preglacial lakes. Ground moraine is extensive at the western edge of the region. End moraine is common along the northern edge of the ecoregion near Lake Superior. On the sand lake plains, common postglacial landforms include transverse dunes, sand spits, beach ridges and large deltas. Large sand dunes, formed during the Lake Nippising high-water period (approximately 4,000 years ago), occur along portions of the Lake Michigan and Lake Superior shorelines. In addition, extensive series of parallel beach ridges or wooded dune and swale complexes occur along former embayments of the postglacial Great Lakes shoreline.

The soils of the sand and clay lake plain, which are quite extensive in the ecoregion, tend to be poorly drained, and therefore support extensive peatlands and swamp forests. Lacustrine clays, resulting from the glacial abrasion of

limestone and dolomite are common in this ecoregion. The soils of the extensive outwash plains are generally excessively drained sands. The sandy and loamy tills near the southern edge of the region are quite variable in drainage class and depth to underlying bedrock. Sandy tills and outwash occur at the northern edge of the ecoregion, near Lake Superior.

Circa 1800, the forests included northern hardwood forest, white pine–red pine forest, jack pine barrens, hardwood– conifer swamp, conifer swamp, and muskeg (Comer et al. 1995, Comer et al. 1994). Open bogs occurred on kettle lakes within end moraines and pitted outwash. Locally, where bedrock was exposed or near the surface, alvar grassland and glade vegetation was present. Unique bedrock communities also occurred along the lakeshore. Extensive marshes and wooded dune and swale complexes occurred along the Great Lakes shoreline. Northern hardwood forests, commonly with sugar maple and beech as dominant species, were concentrated on end moraines, ground moraines and drumlin fields. Jack pine forests grew on extensive, fire-prone outwash plains, along with red pine–white pine forests where fires were less severe. The sandy lake plain supported extensive, open peatlands (patterned fen and muskeg) dominated by sedges and shrubby black spruce, tamarack and occasionally jack pine (Comer et al. 1993a). Extensive swamps of northern white cedar occurred near the margins of the lake plain. On the clay lake plain, forests were a diverse mix of hardwood and conifer species, including white spruce, balsam fir, white pine, eastern hemlock, trembling aspen, balsam poplar and red maple. The natural disturbance regime in this region was dominated by fire and wind. Fire was prevalent on the jack pine plains and in the red pine–white pine forests. Windthrow occurred in both upland and lowland forests.

Most of the ecoregion remains forested, with the exception of the clay lake plains, which are used for pasture and forage crops. Intensive logging for white pine occurred in the latter half of the 19th century, causing major changes in forest composition. Eastern hemlock was also logged for the tanning industry and northern hardwoods were harvested for multiple uses. Prevalent forest types today include northern hardwoods, aspen, pines (with significant acreage constituting plantation) and lowland conifers. Early successional forest types are more prevalent today because of past and current management. Severe deer-browse pressure throughout forested systems has resulted in reduced recruitment of cedar and hemlock. This ecoregion also contains significant areas of extensive open wetlands (northern fen, patterned fen, muskeg, Great Lakes marsh) and numerous unique bedrock communities (alvar grassland, alvar glade, bedrock lakeshore).

## Western Upper Peninsula Ecoregion

The Western Upper Peninsula ecoregion encompasses 24,287 square miles and includes all of Baraga, Iron, Houghton, Keweenaw, Ontonagon and Gogebic counties and portions of Menominee, Dickinson and Marquette counties. Landcover in this ecoregion is primarily forested (81%) and wetlands (11%). Agricultural land use covers 2% and urbanization covers approximately 2% of the land area.

The region is underlain by highly resistant igneous and metamorphic bedrock of the Precambrian Shield. Continental glaciers have overridden the section many times; eroding some of the underlying bedrock and redepositing glacial drift upon the bedrock or older underlying glacial deposits. The result is a diverse landscape of glacially scoured bedrock ridges and irregularly overlain glacial features, including

moraines, lake beds, and outwash channels and plains. A combination of cold climate, resulting from both the high latitude and high continentality, and relatively nutrient-poor, rocky, acidic soils has resulted in minimal use of most of the ecoregion for agriculture. Most of the region is managed as either private or public forest. Prevalent forest types today include northern hardwoods, aspen, pines (with significant acreage constituting plantation) and lowland conifers.

The ecoregion has a strongly continental climate, with only moderate influence from Lake Superior. Winds are generally from the Great Plains which are southwest of the ecoregion. Temperatures are extremely cold in the winter. Levels of snowfall and rainfall are high in areas adjacent to Lake Superior because moisture-laden air from the lake is forced to rise rapidly over the bedrock uplands at the northern edge of the ecoregion (Eichenlaub et al. 1990, Albert et al. 1986, Eichenlaub 1979, Wisconsin Statistical Reporting Service 1967). Compared to the other sections in the State, this ecoregion has the most extreme winter temperatures and the shortest growing season (87–107 days inland; Albert et al. 1986).

Large exposures of Precambrian bedrock are found throughout the northern part of the ecoregion. Glacial drift thickness is quite variable, with drift thicknesses often greater than 200 feet (Doonan and Hendrickson 1968, Thwaites 1929). Large exposures of bedrock occur in the northwestern portion of the region, where the bedrock knobs consists primarily of granites and gneiss, but also contain the important Negaunee iron formation (Reed and Daniels 1987, Dorr and Eschman 1984). On the Keweenaw Peninsula, Middle Precambrian volcanics, conglomerates, sandstones and shales are exposed. Middle Precambrian volcanics, conglomerates and shales are also exposed on Isle Royale. At the southern edge of the ecoregion, Cambrian sandstone, with some dolomite and shale, underlies the glacial drift (Ostrom 1981). Locally, Cambrian sandstone is within a few feet of the surface (Hole and Germain 1994). The bedrock of the section was abraded by continental glaciation and incorporated into the glacial drift, accounting for the red soils found in much of the ecoregion. Exposed bedrock knobs occur commonly in the northern areas. The most common glacial landforms are ground-and end-moraine ridges, which occur throughout the ecoregion. Clayey glacial lake plains occur near Lake Superior, extending as far as 30 miles inland. The ecoregion contains several extensive outwash plains, including one near Lac Veiux Desert along the Wisconsin–Michigan boundary and another along the Michigamme River in Michigan.

Stony, red, sandy loams are common on the moraines. One to two feet of wind-blown silt (loess) blanket large areas, creating a silt–loam surface soil (Hole and Germain 1994, Albert 1990, Hole 1976); this loess cap becomes thin and discontinuous in northern Wisconsin and Michigan. Both the sandy loam and silt–loam soils tend to be acidic. Lacustrine deposits are generally silt-and clay-rich (Cummins and Grigal 1981, Hole 1976, Veatch 1953); these fine-textured soils are typically somewhat leached (Hole and Germain 1994). Outwash soils are acidic sand and gravels that have little accumulation of organic material.

Circa 1800, landcover on the thick till soils was primarily northern hardwood forests dominated by sugar maple, eastern hemlock, basswood, yellow birch and occasionally white pine (Comer et al. 1995). This forest type persists over most of the ecoregion. Beech was absent, probably because of extremely low

winter minimum temperatures. On thin soils and bedrock knobs, red pine, white pine and red oak were common dominants. On some of the exposed bedrock knobs of the Keweenaw Peninsula, Porcupine Mountains and Isle Royale, a dwarf 'krummholz' forest of red oak occurred. Bedrock exposures also supported unique cliff, glade and lakeshore communities. Fire-tolerant jack pine and northern pin oak grew on the droughty, fire-prone, flat outwash plains.

The highly dissected lacustrine clay plain along Lake Superior supported a diverse hardwood–conifer forest which included white pine, eastern hemlock, balsam fir, northern white cedar, trembling aspen, balsam poplar and paper birch (Comer et al. 1993a). Northern hardwoods and almost pure stands of hemlock or white pine occurred on some upland plateaus on the lake plain.

Wetlands were not extensive, but numerous bogs occurred in the kettle depressions within the end moraines and tamarack–black spruce swamps occurred in the broad valleys between broad ground-moraine ridges. Hardwood–conifer swamp occurred on the poorly drained portions of the lake plain. Larger floodplains were often dominated by American elm, green and black ashes, and occasionally by silver maple. Smaller floodplains were more typically dominated by conifers, especially balsam fir.

Windthrow was the prevalent disturbance in the upland forests (Canham and Loucks 1984). Fire was important on droughty outwash plains, bedrock ridges and conifer-dominated wetlands.

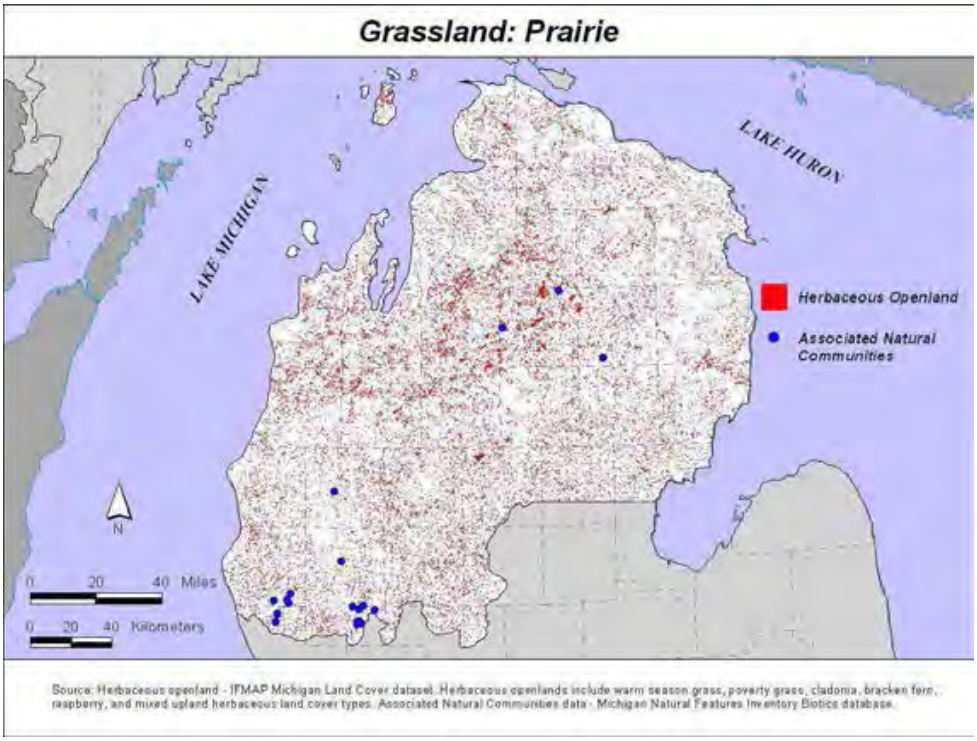
Northern hardwoods remain the prevalent vegetation type within this ecoregion. The region comprises a large part of the deciduous hardwood forest in the northeastern United States. Its forests have been recognized as the major breeding area for a large number of migratory song birds. Bedrock exposures still support unique cliff, glade and lakeshore communities. Open wetlands include bogs, poor fens and wet meadows. The primary land use is forestry. Logging of white and red pines for construction lumber began in the latter part of the 19th century and continued into the early 20th century. Logging of the pines was followed by logging of eastern hemlock for tannin from the bark and later logging of northern hardwoods for furniture and pulp. Damage caused by late 19th-and early 20th-century logging and subsequent slash fires is still much in evidence today; much of the land that was originally forested with northern hardwoods or pine was reforested with aspen and paper birch, species that are still prominent. Logging of northern hardwoods, aspen and jack pine for paper production continues. Severe deer-browse pressure throughout forested systems has resulted in reduced recruitment of cedar and hemlock.

Several iron formations were mined in the past in the Menominee, Penokee, Gogebic and Michigamme ranges. Copper was also mined on the Keweenaw Peninsula and near the Porcupine Mountains. Mining resulted in rapid, early development of the section, through logging for mine timbers, housing and fuel. However, mining is no longer a major industry, and human populations and development have slowed or stopped in most mining areas.

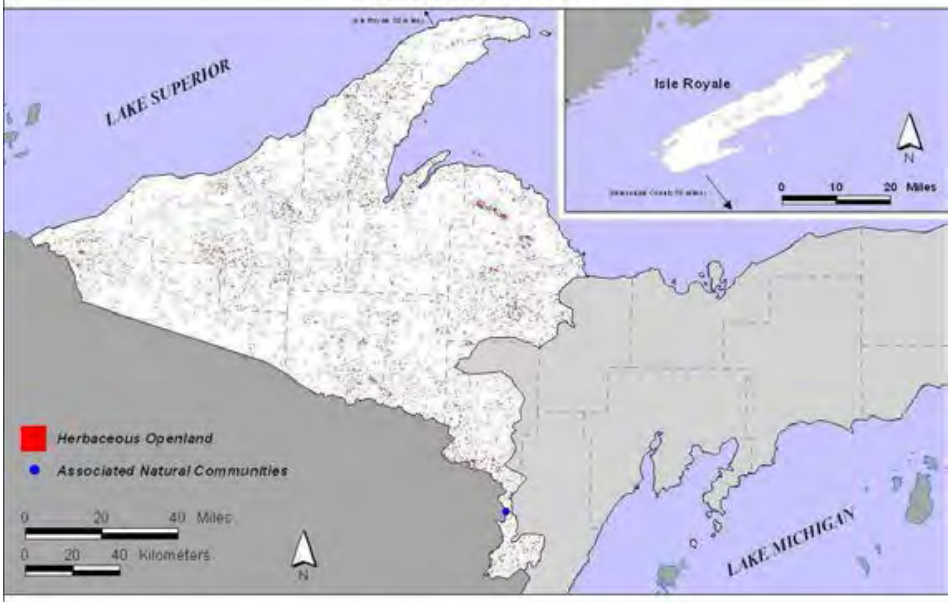
# Habitats

## Grassland: Prairie

Description: Prairies are a type of natural grassland that is dominated by herbaceous plants. Trees are either absent or only widely scattered on the landscape (<5% canopy cover). There are many prairie communities that differ in plant composition due primarily to differences in soil moisture, hydrology, geology, landscape context, and frequency of disturbance. Prairies range from dry sandy prairies associated with savannas to wet prairies that are also ephemeral wetlands. Prairies are disturbance-dependent and must be maintained either by fire, seasonal inundation, or droughty soil conditions that are not amenable to tree growth. Without these frequent disturbances, prairies are invaded by trees or shrubs.

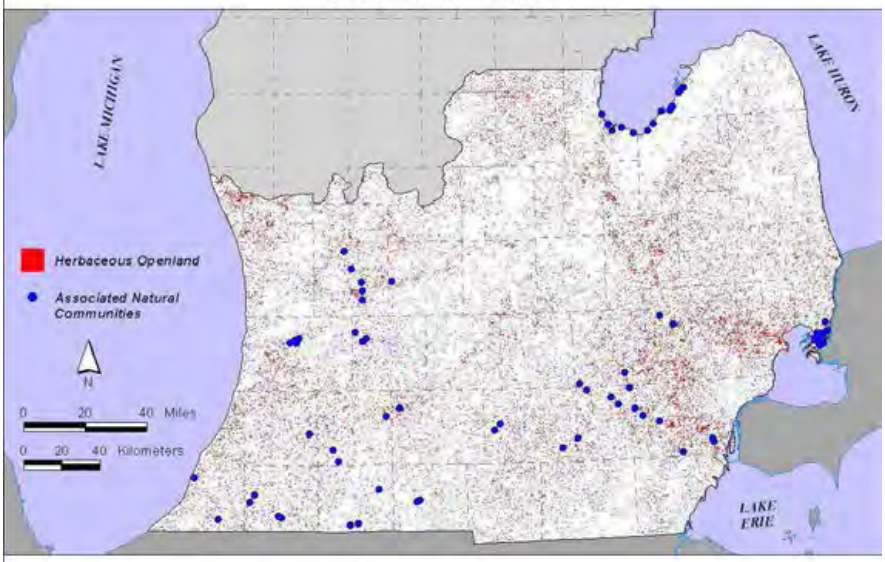


## Grassland: Prairie




Source: Herbaceous openland - IFMAP Michigan Land Cover dataset. Herbaceous openlands include warm season grass, poverty grass, cladonia, bracken fern, raspberry, and mixed upland herbaceous land cover types. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.

## Grassland: Prairie

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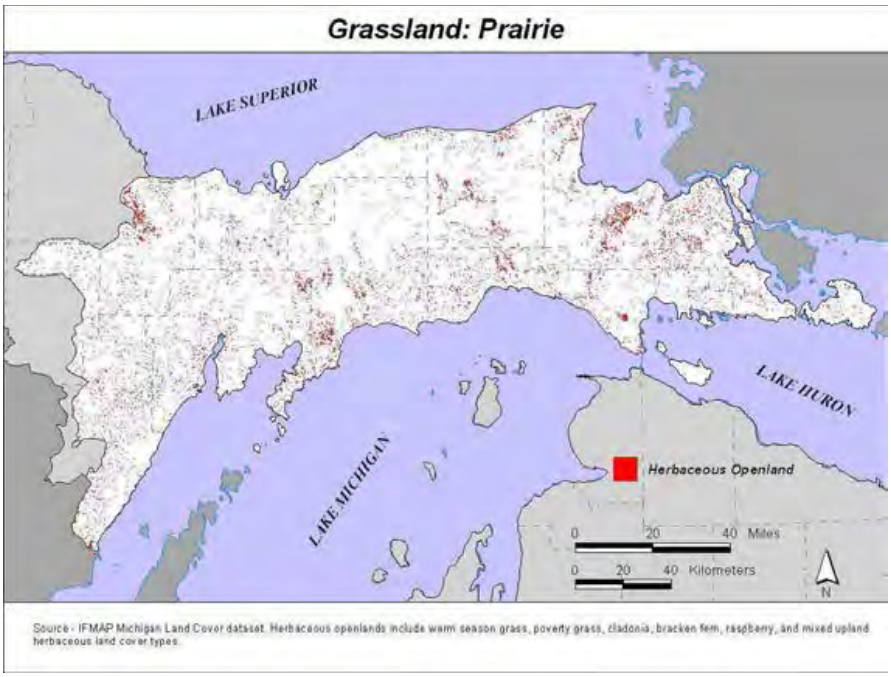
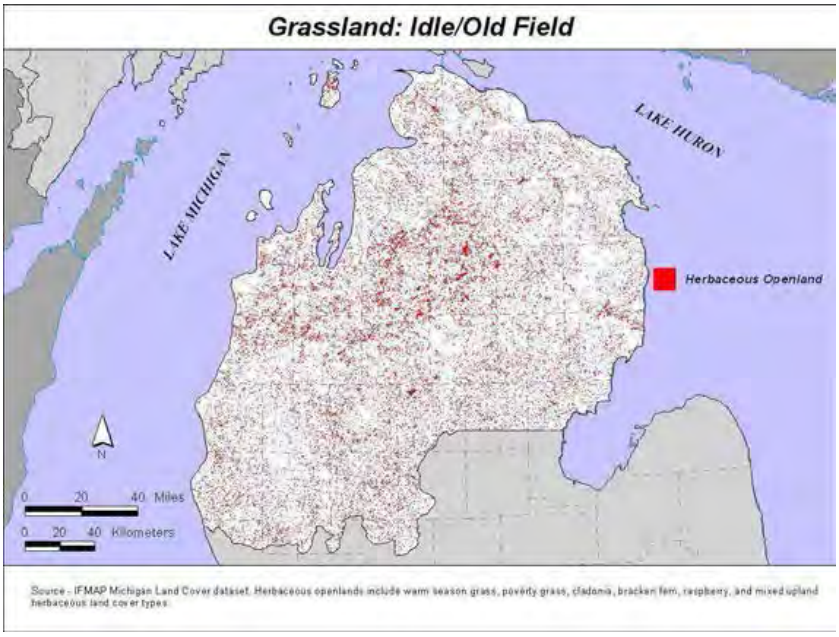
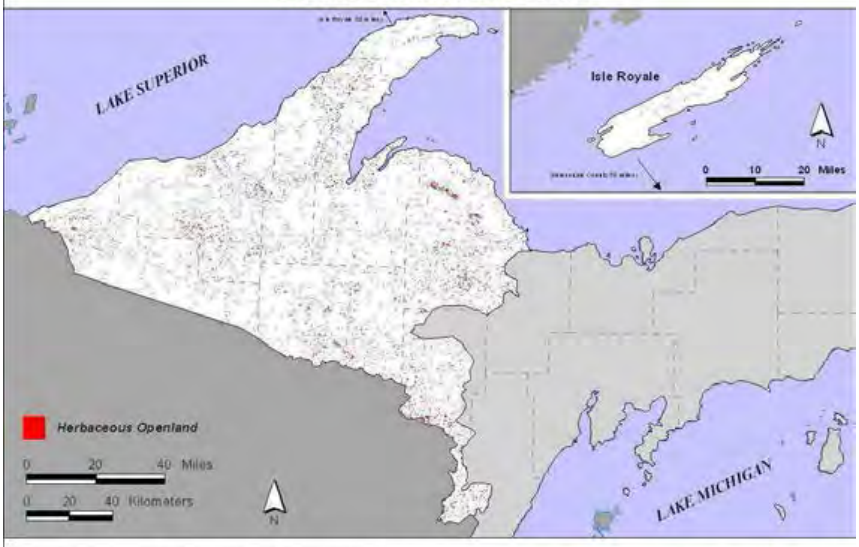



## Grassland: Idle/Old field

Description: Idle/old field is a grassland community of opportunistic plants and animals that take over bare ground previously disturbed by humans—usually for agricultural purposes. These grassland communities are often a mix of opportunistic (weedy) native and invasive species. These communities are often ultimately replaced by early successional trees if left alone without disturbance (e.g., fire).

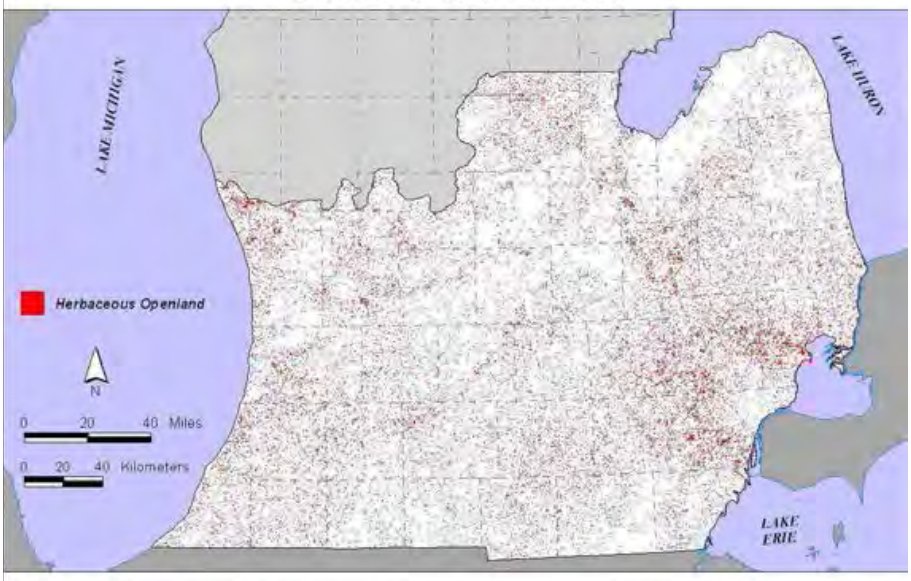


## Grassland: Idle/Old Field




Source - IFMAP Michigan Land Cover dataset. Herbaceous openlands include warm season grass, poverty grass, cladonia, bracken fern, raspberry, and mixed upland herbaceous land cover types.

## Grassland: Idle/Old Field

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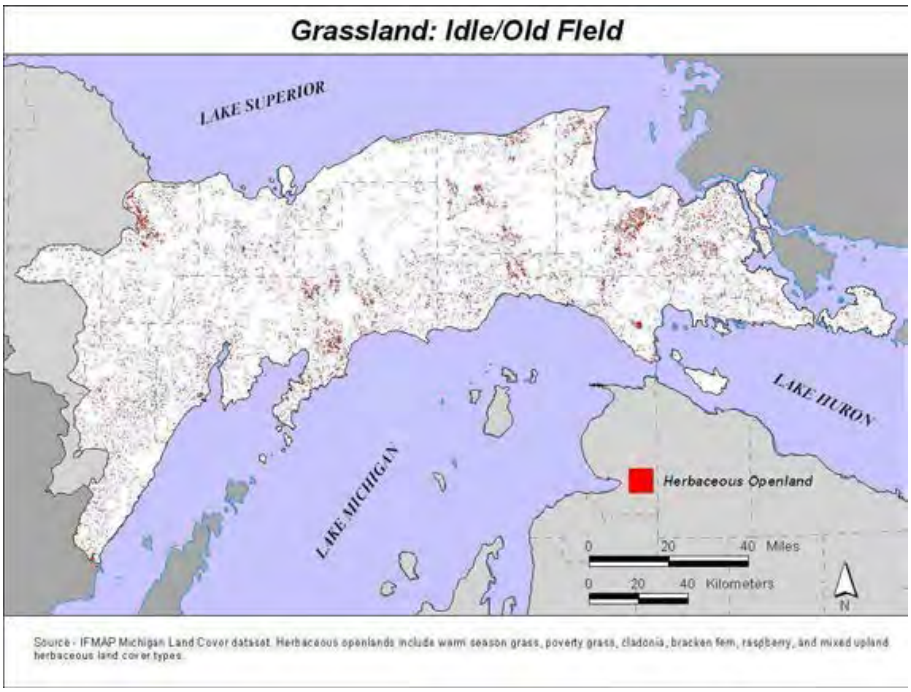
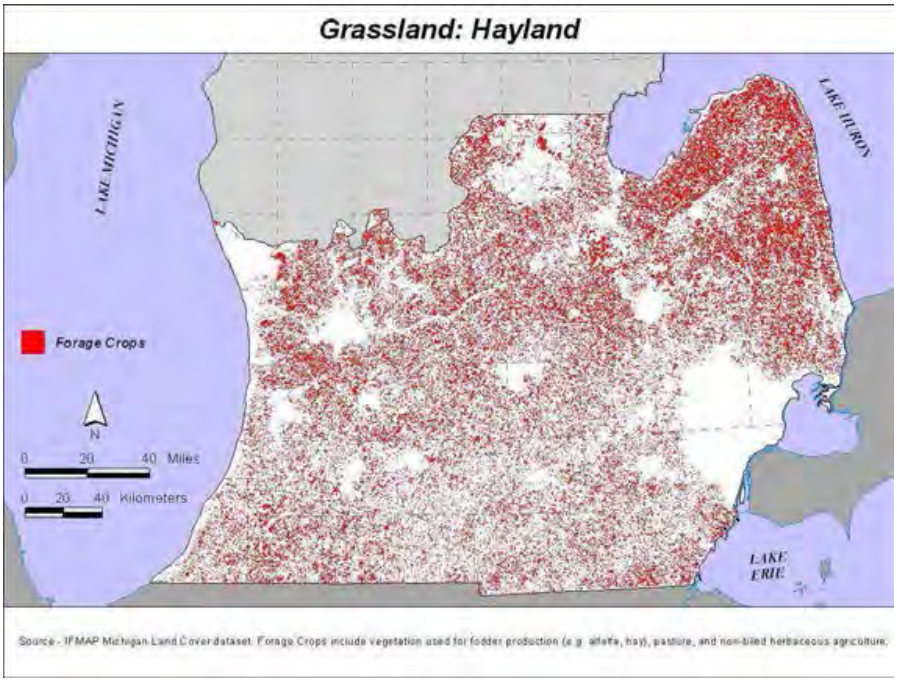
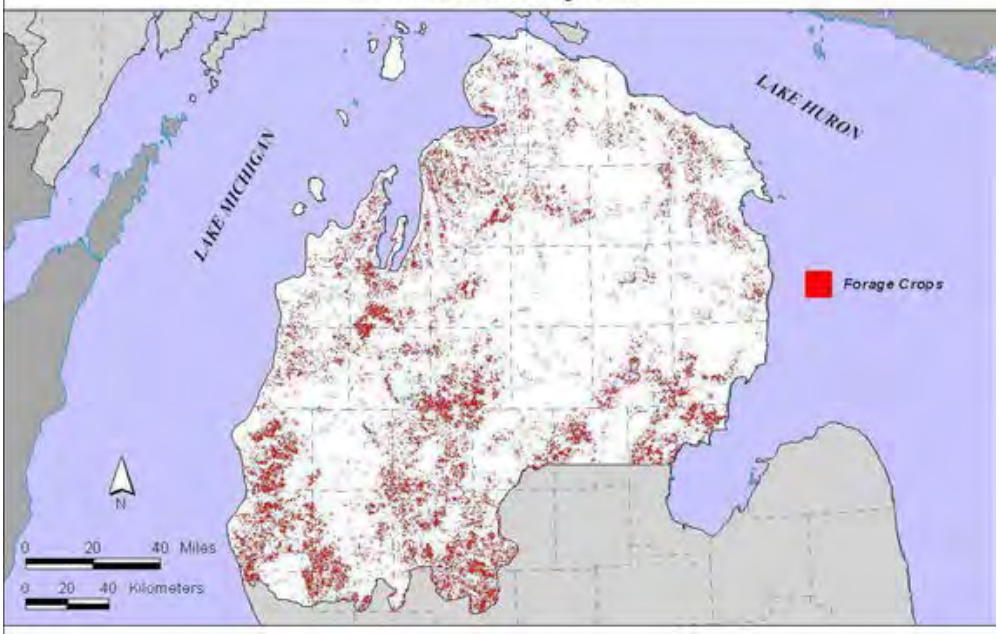



## Grassland: Hayland

Description: Hayland is agricultural grassland from which the "grass" is periodically harvested. Small grain crops (e.g., wheat) were included here since they are structurally similar to hayland during the growing season. Hayland has fewer plant species than native prairie or old fields and is simpler structurally.

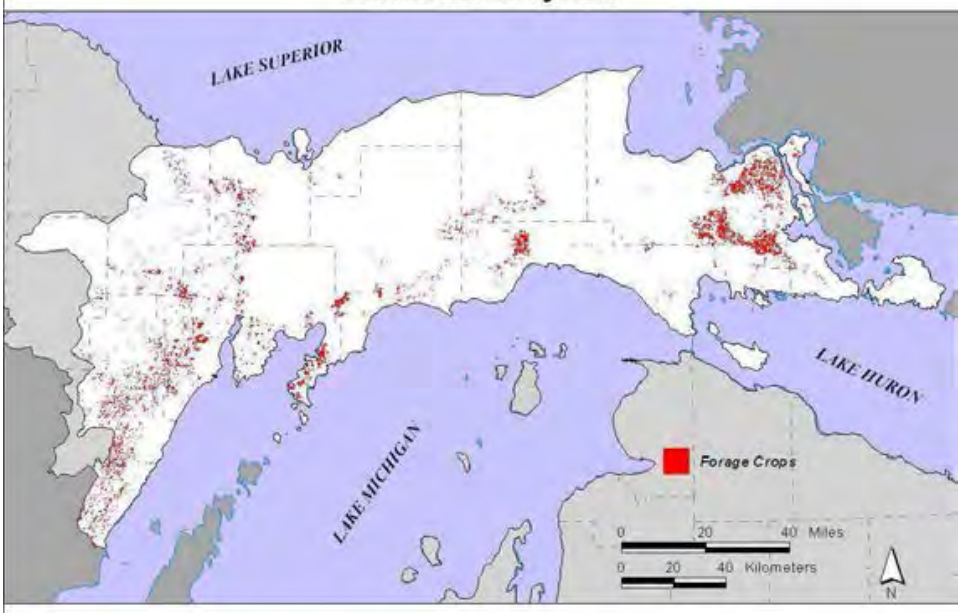


## Grassland: Hayland




Source - IFMAP Michigan Land Cover dataset. Forage Crops include vegetation used for fodder production (e.g. alfalfa, hay), pasture, and non-tilled herbaceous agriculture.

## Grassland: Hayland

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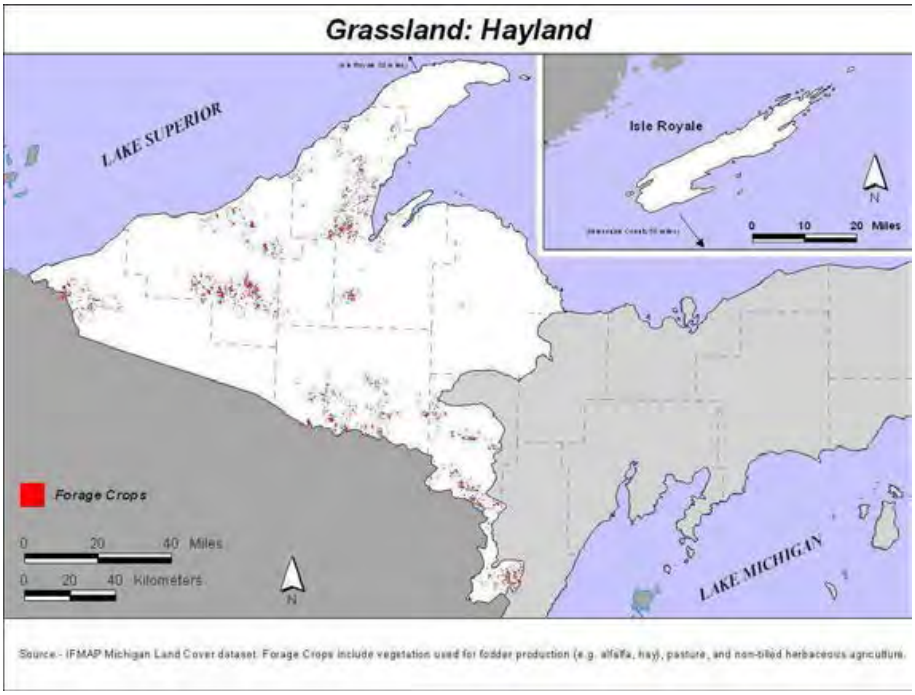
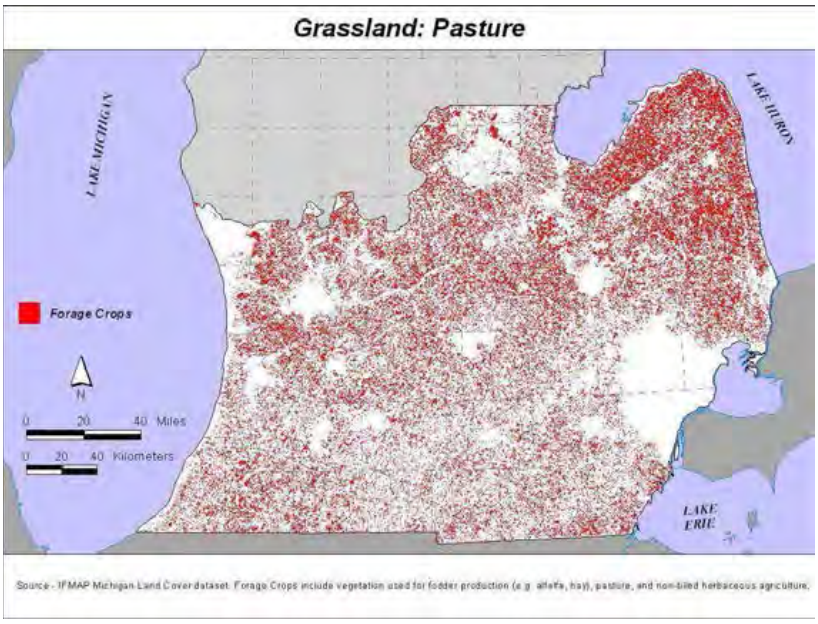
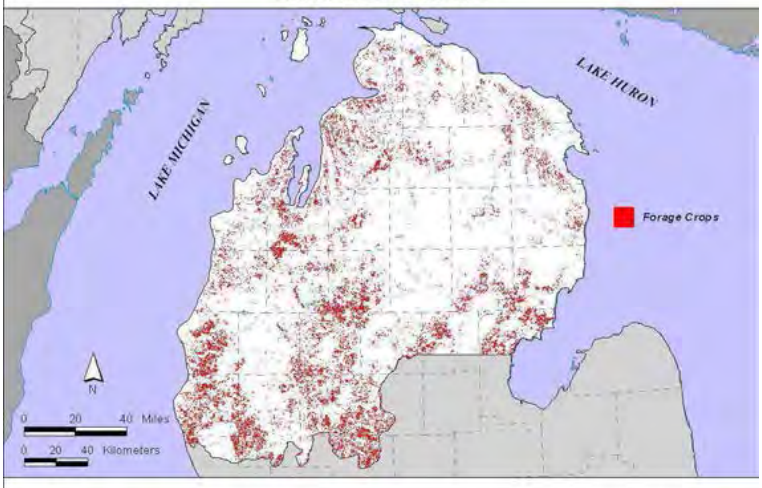



## Grassland: Pasture

Description: Pastures are agricultural grasslands used for grazing livestock. They are simpler structurally (shorter grass) and have fewer plant species than prairie or idle/old fields. Exotic plant species that are more resistant to impacts from heavy grazing generally have displaced the native plants, except on some dry sites where native species may hold on due to the higher moisture demand of most exotics.

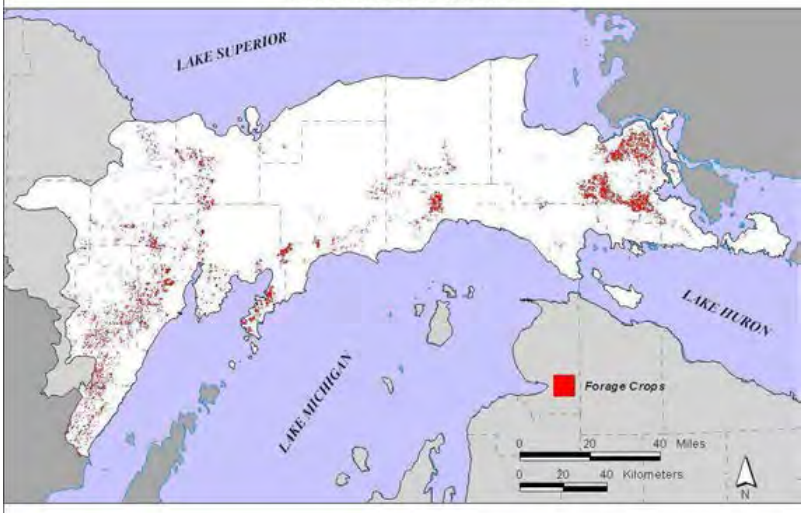


## Grassland: Pasture

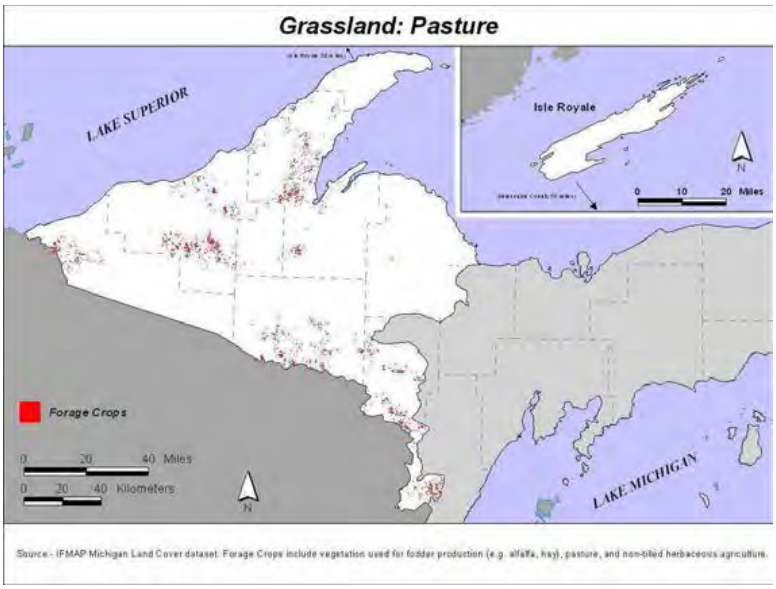



Source - IFMAP Michigan Land Cover dataset. Forage Crops include vegetation used for fodder production (e.g. alfalfa, hay), pasture, and non-tilled herbaceous agriculture.

## Grassland: Pasture

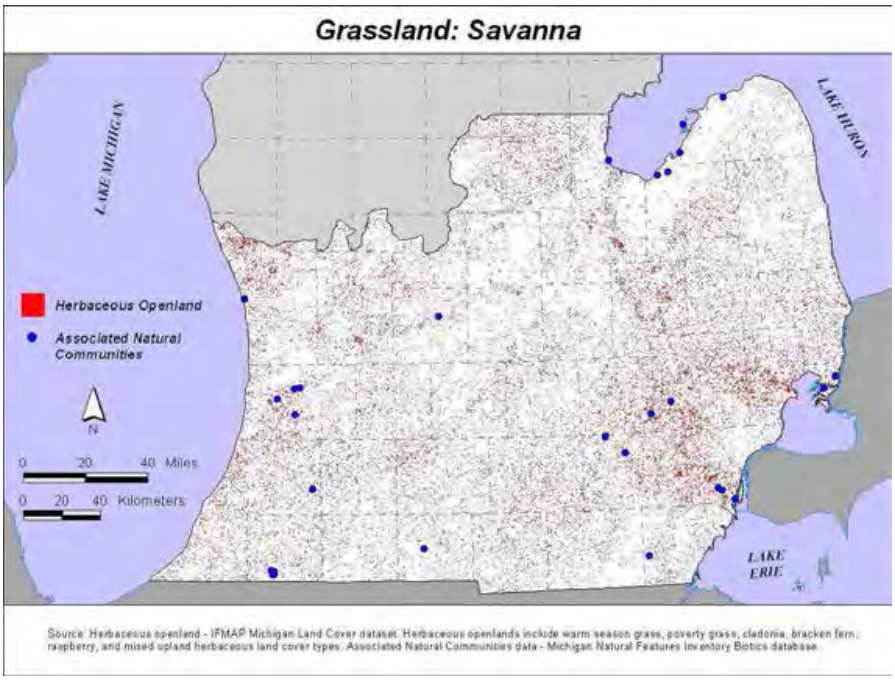



Source - IFMAP Michigan Land Cover dataset. Forage Crops include vegetation used for fodder production (e.g. alfalfa, hay), pasture, and non-tilled herbaceous agriculture.

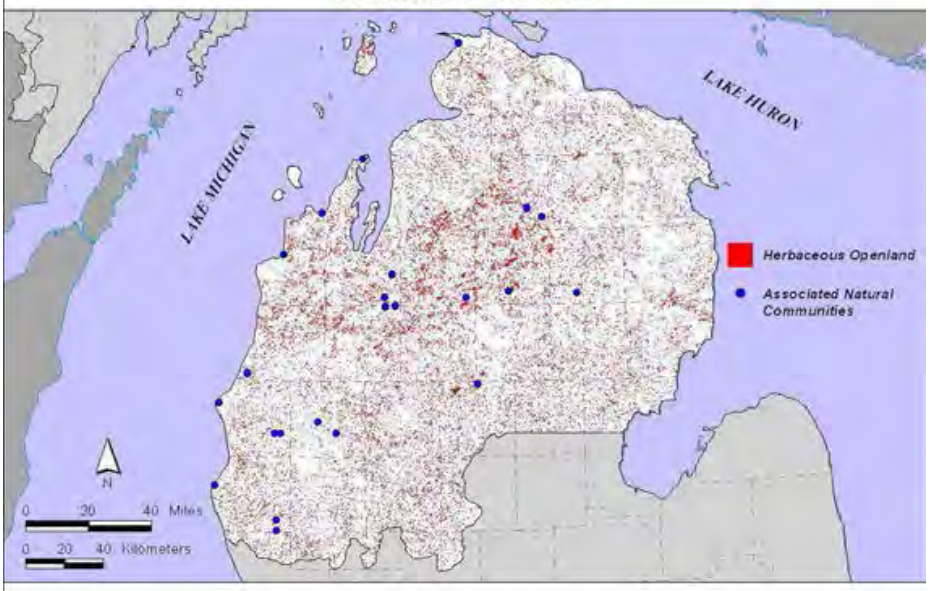



## Grassland: Savanna

Description: Savannas are native grasslands scattered with isolated trees or shrubs with 5-60% canopy cover. In Michigan, the primary trees in savanna communities are fire-adapted species such as white oak (Quercus alba), bur oak (Quercus macrocarpa), black oak (Quercus velutina), and jack pine (Pinus banksiana). These communities are largely maintained by fire, without which the canopy closes and succession to forest occurs. In some areas, sparse tree growth is maintained by droughty soil conditions.

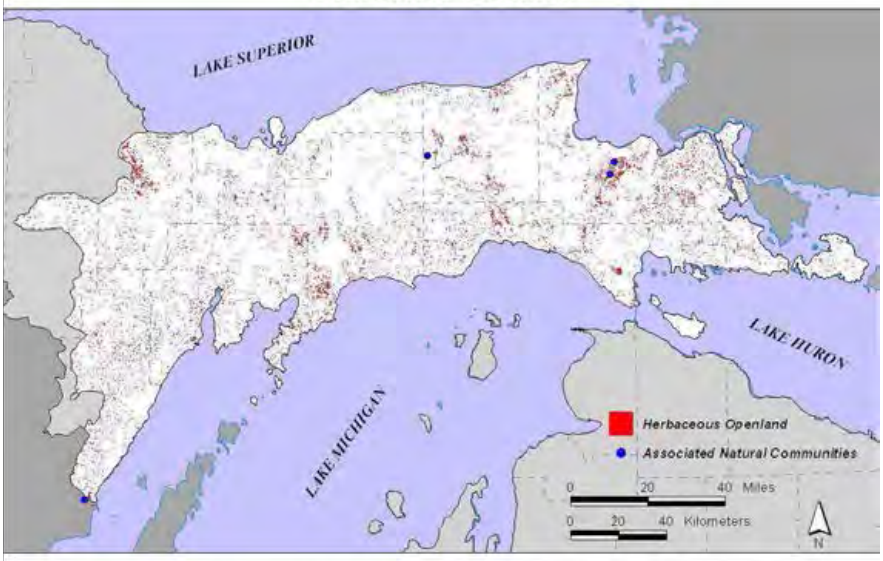


## Grassland: Savanna

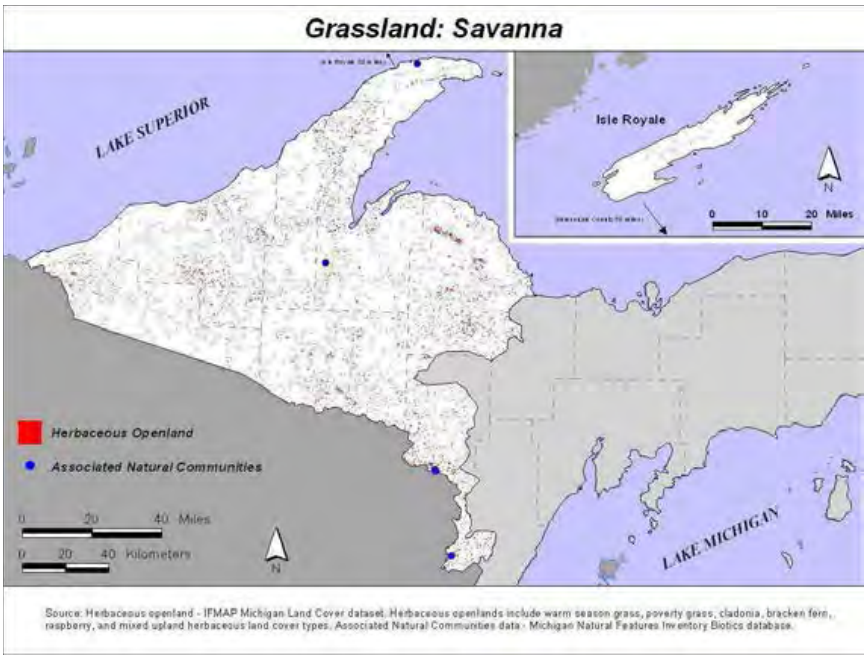



Source: Herbaceous openland - IFMAP Michigan Land Cover dataset. Herbaceous openlands include warm season grass, poverty grass, cladonia, bracken fern, raspberry, and mixed upland herbaceous land cover types. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.

## Grassland: Savanna



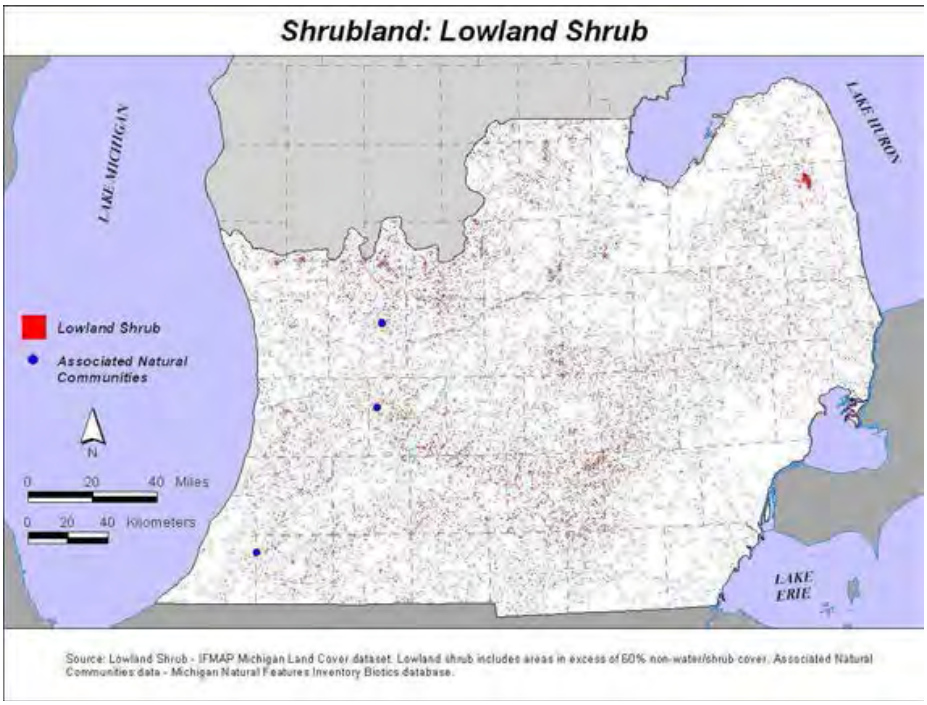

Source: Herbaceous openland - IFMAP Michigan Land Cover dataset. Herbaceous openlands include warm season grass, poverty grass, cladonia, bracken fern, raspberry, and mixed upland herbaceous land cover types. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.



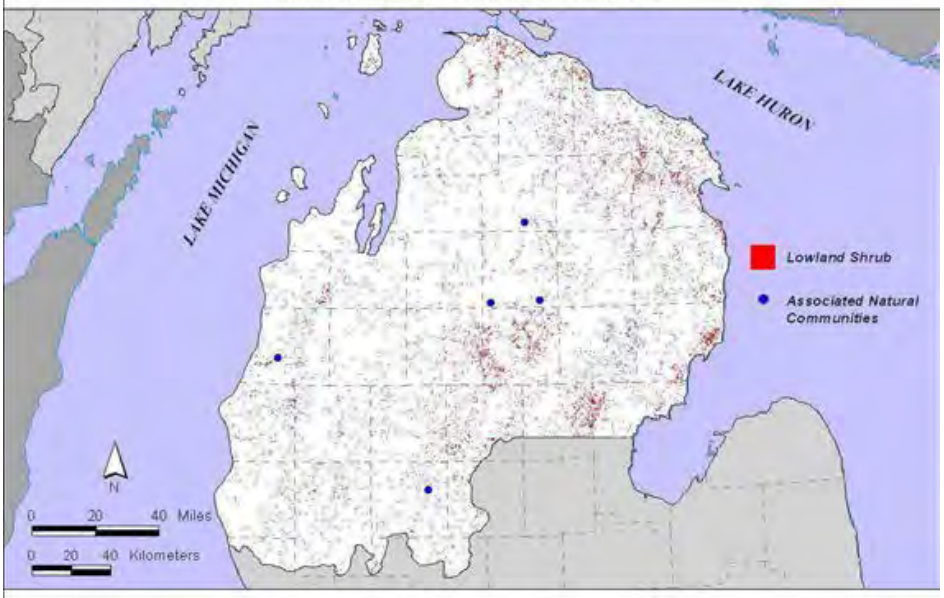

## Shrubland: Lowland shrub

Description: Lowland shrub areas have seasonally or permanently saturated soils and are dominated by woody shrubs. These areas are often adjacent to open wetlands, lakes, rivers, or streams. Many of these areas are disturbance dependent; windthrow, fluctuating water table, seasonal flooding, and beaver limit tree establishment.

Associated Natural Communities: Inundated Shrub Swamp; Southern Shrub-Carr

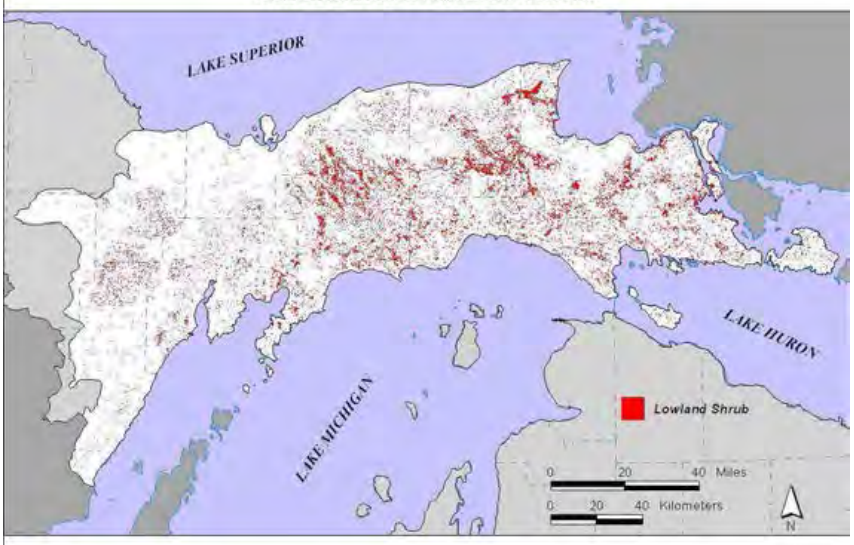


## Shrubland: Lowland Shrub

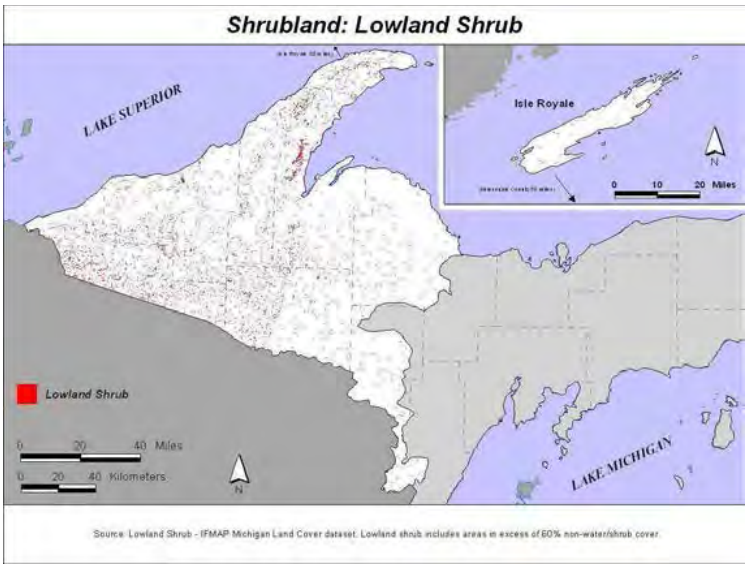



Source: Lowland Shrub - IFMAP Michigan Land Cover dataset. Lowland shrub includes areas in excess of 60% non-water/shrub cover. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.

## Shrubland: Lowland Shrub



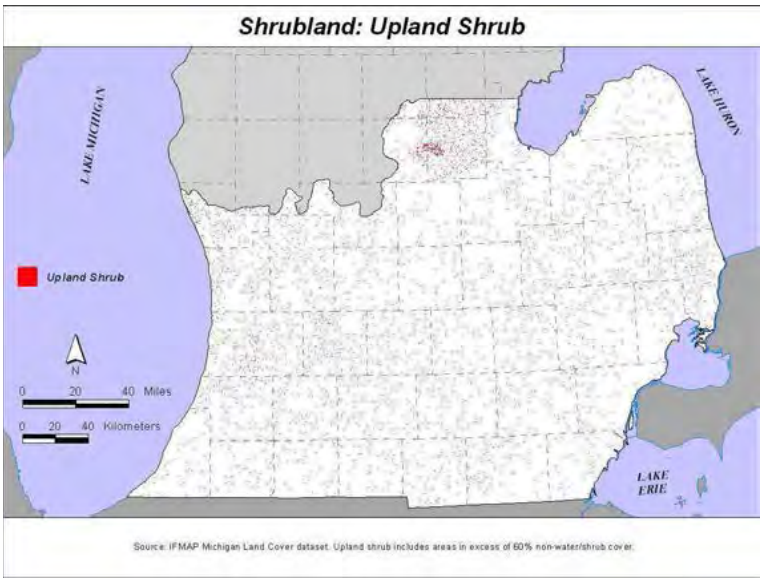

Source: Lowland Shrub - IFMAP Michigan Land Cover dataset. Lowland shrub includes areas in excess of 60% non-water/shrub cover.




## Shrubland: Upland shrub

Description: Upland shrub areas have relatively dry soils and are dominated by woody shrub vegetation. These areas are often spatially and temporally dynamic across the landscape since they are an intermediate successional stage between early successional herbaceous vegetation and forest.

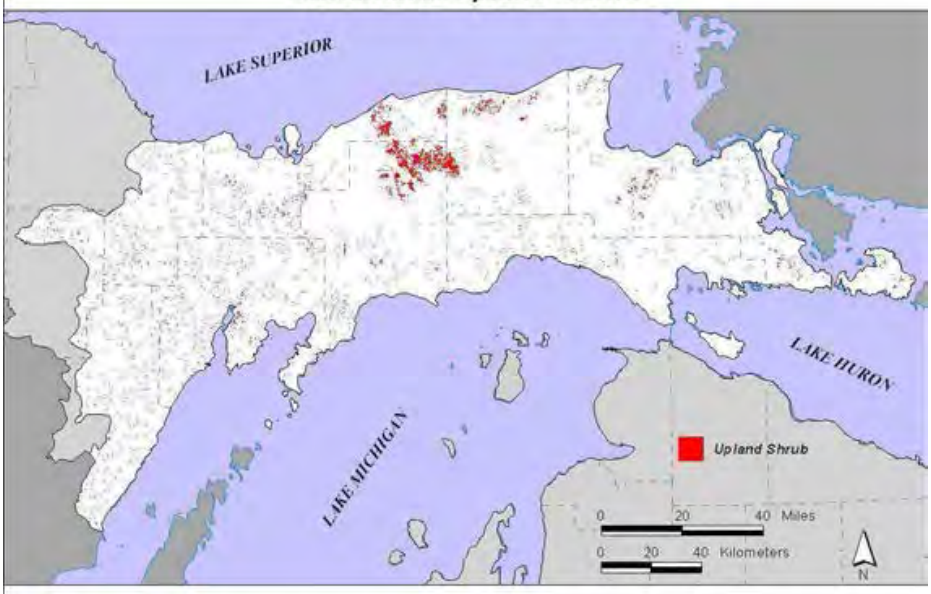
Associated Natural Communities: N/A – No defined natural communities



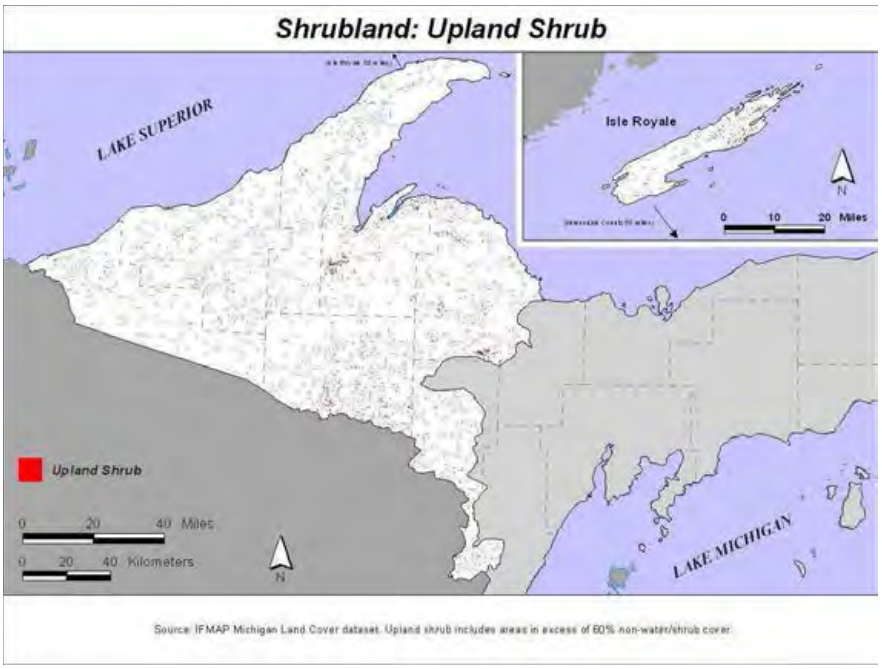
## Shrubland: Upland Shrub

Source: IFMAP Michigan Land Cover dataset. Upland shrub includes areas in excess of 60% non-water/shrub cover.

## Shrubland: Upland Shrub




Source: IFMAP Michigan Land Cover dataset. Upland shrub includes areas in excess of 60% non-water/shrub cover.

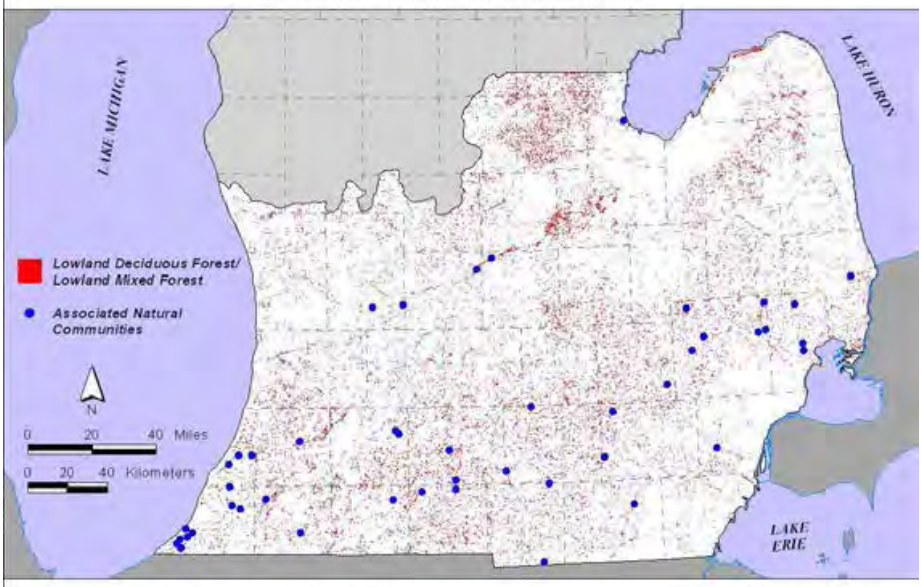



## Forest: Lowland hardwood

Description: Lowland hardwood areas have seasonally or permanently saturated soils and are dominated by moisture-tolerant hardwood trees such as silver maple (Acer saccharinum), red maple (Acer rubrum), green ash (Fraxinus pennsylvanica), black ash (Fraxinus nigra), American elm (Ulmus americana), yellow birch (Betula alleghaniensis), pin oak (Quercus palustris), swamp white oak (Quercus bicolor), and cottonwood (Populus deltoides). These areas are often adjacent to open wetlands, lakes, rivers, or streams. Natural disturbances in lowland hardwood forests include prolonged flooding, fluvial erosion or deposition, windthrow, and infrequent fire.

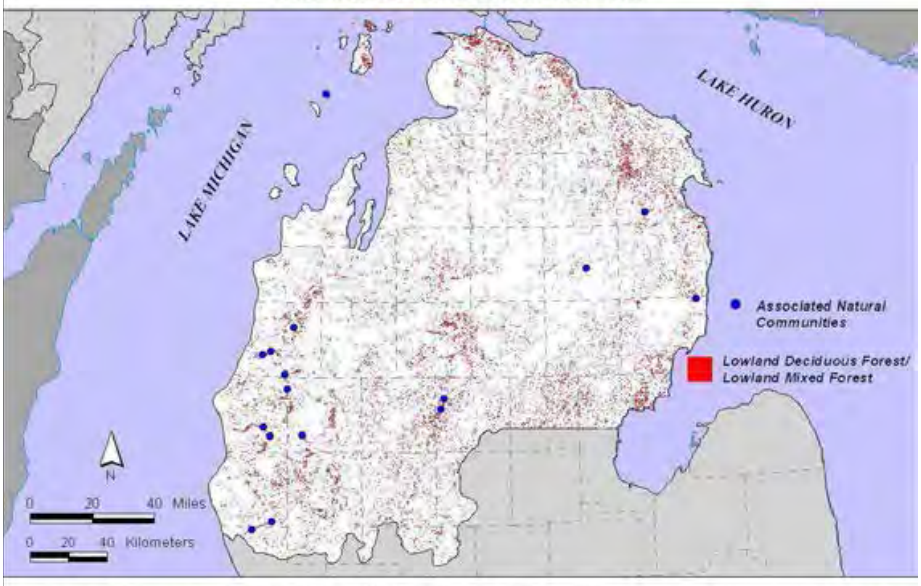
Associated Natural Communities: Hardwood-Conifer Swamp; Southern Floodplain Forest; Southern Swamp

## Forest: Lowland Hardwood

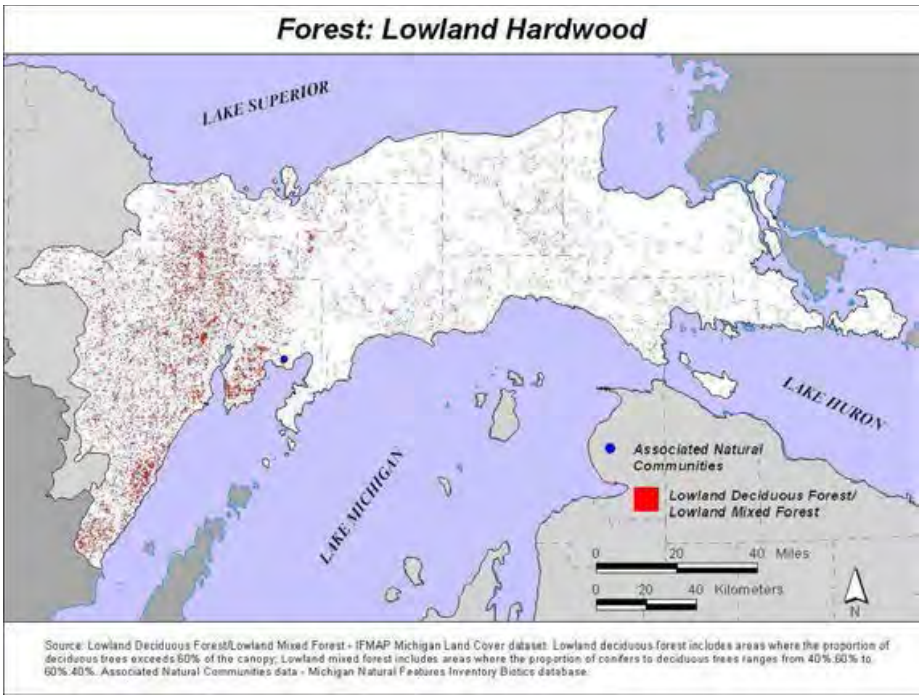


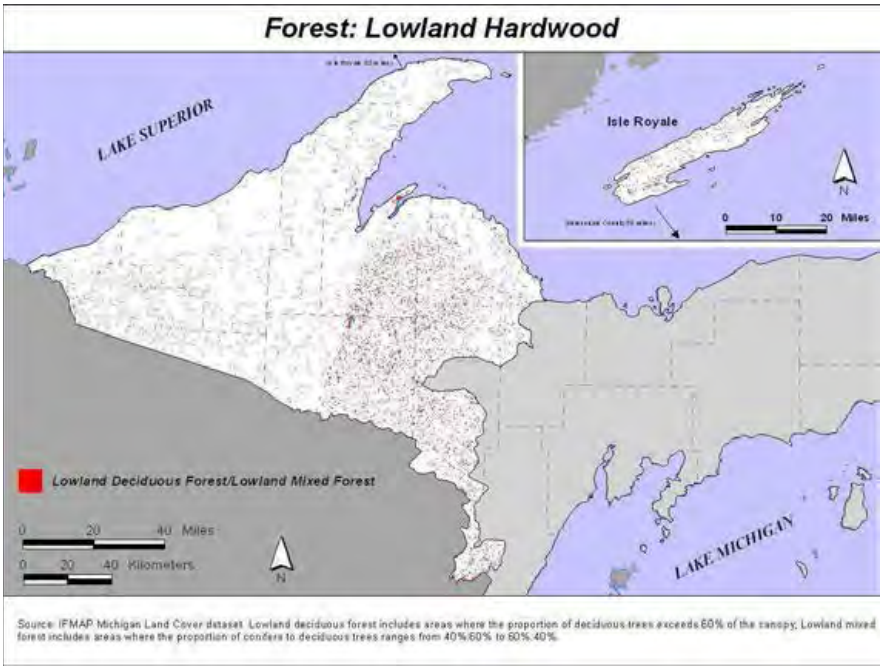

Source: Lowland Deciduous Forest/Lowland Mixed Forest - IFMAP Michigan Land Cover dataset. Lowland deciduous forest includes areas where the proportion of deciduous trees exceeds 60% of the canopy; Lowland mixed forest includes areas where the proportion of conifers to deciduous trees ranges from 40%:60% to 60%:40%. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.

## Forest: Lowland Hardwood




Source: Lowland Deciduous Forest/Lowland Mixed Forest - IFMAP Michigan Land Cover dataset. Lowland deciduous forest includes areas where the proportion of deciduous trees exceeds 60% of the canopy; Lowland mixed forest includes areas where the proportion of conifers to deciduous trees ranges from 40%:60% to 60%:40%. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.



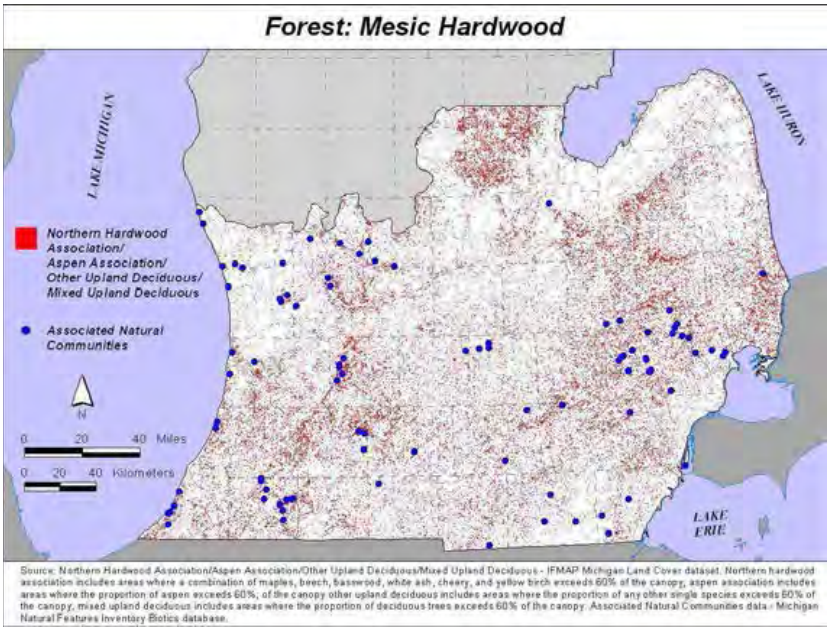



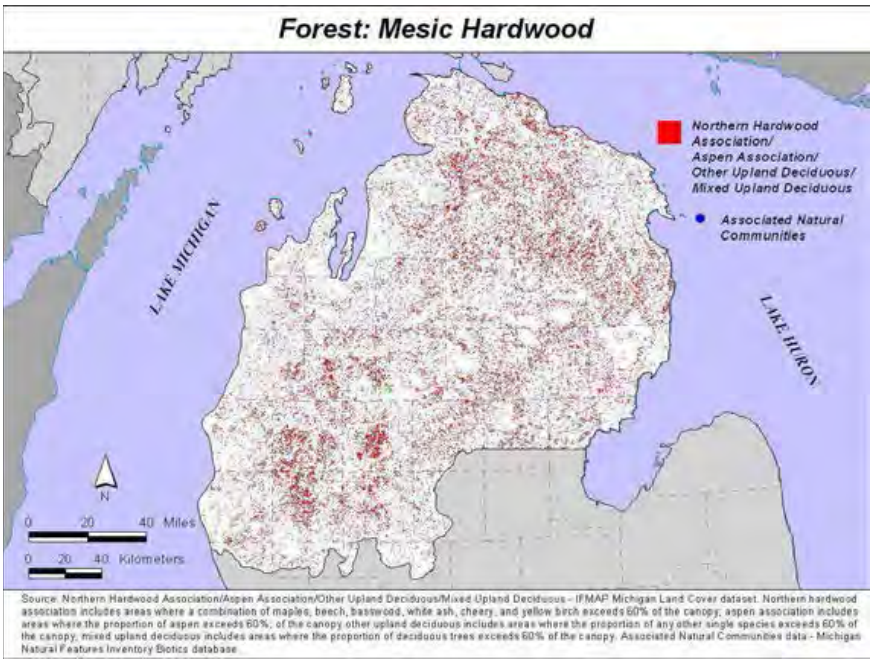

## Forest: Mesic hardwood

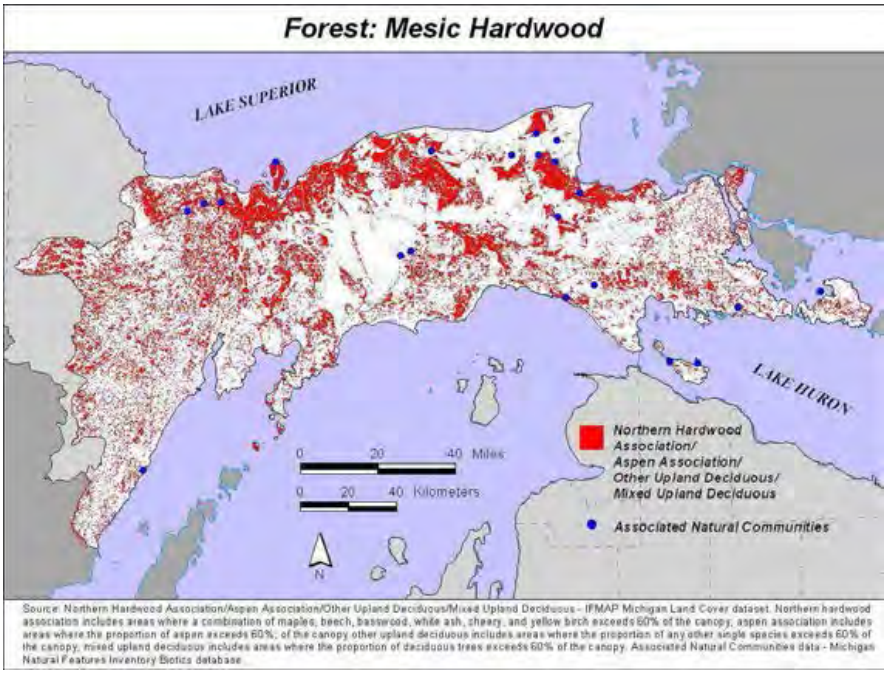
Description: Mesic hardwood forests have moist soils and are generally dominated by American beech (Fagus grandifolia), sugarmaple (Acer saccharum), red oak (Quercus rubra), and basswood (Tilia americana). High soil moisture in mesic forests is often maintained by high canopy cover and a dense leaf litter. Mesic forests also commonly occur in transitional areas between dry upland areas and wet lowland areas. Mature mesic forests are characterized by shade-tolerant species, especially sugar maple and American beech. The natural disturbance regime is characterized by gap phase dynamics: frequent,

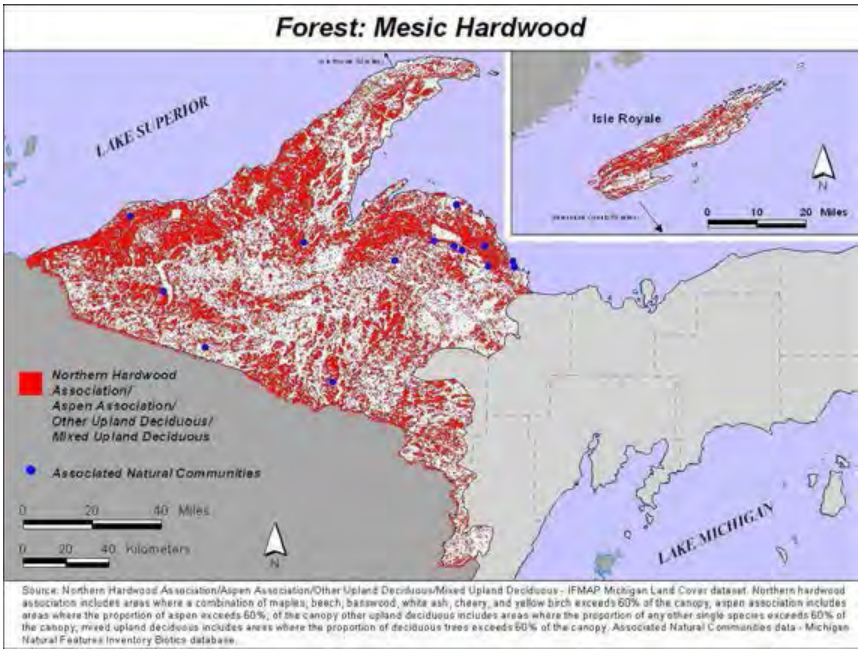
small windthrow gaps allow for the regeneration of shade-tolerant canopy dominants. These areas are characterized by a rich diversity of spring wildflowers and relatively high numbers of berry-producing herb and shrub species.

Associated Natural Communities: Dry-mesic Southern Forest; Mesic Northern Forest; Mesic Southern Forest





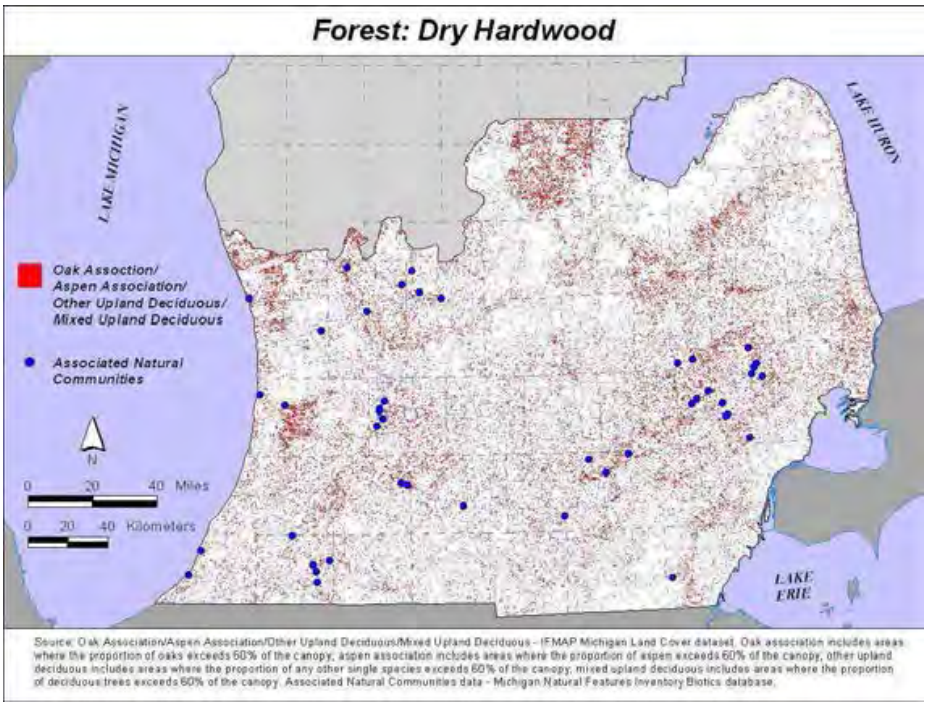



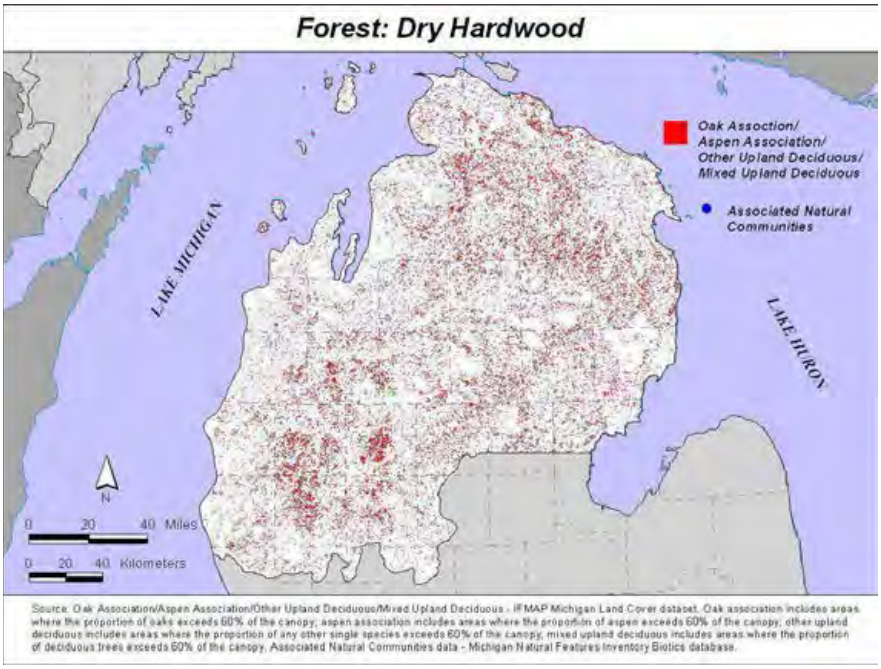

## Forest: Dry hardwood

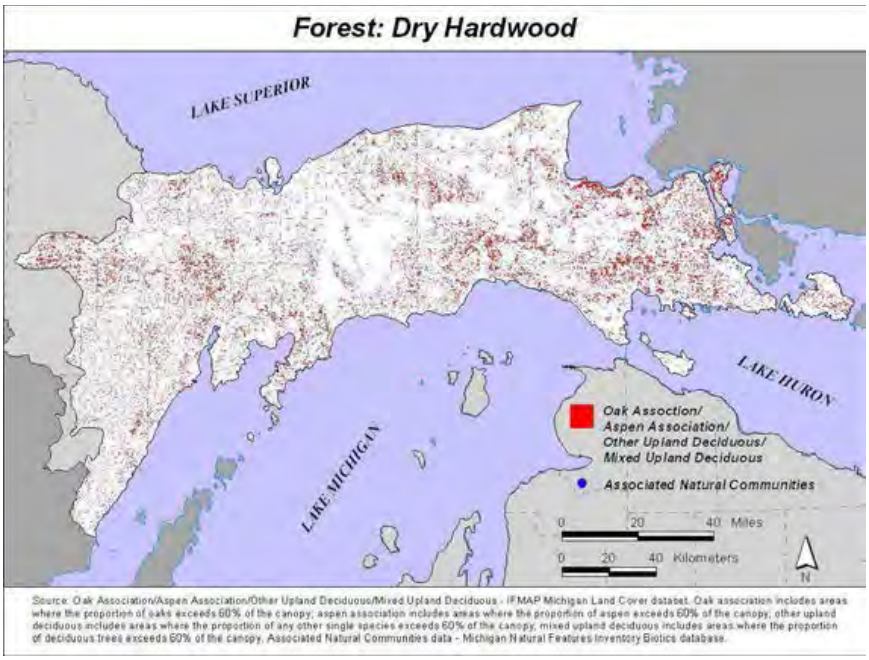
Description: Dry hardwood forests have dry soils and are generally dominated by such trees as white oak (Quercus alba), black oak (Quercus velutina), northern pin oak (Quercus ellipsoidalis), black cherry (Prunus serotina), bigtooth aspen (Populus grandidentata), and quaking aspen (Populus tremuloides). Dry hardwood forests generally have relatively open canopies that allow for the regeneration of shade-intolerant species, especially oaks. Fire is an important natural disturbance in many dry hardwood forests, where the frequency and magnitude of fires play a major role in determining species composition, successional stage, forest structural characteristics, and configuration. Dry forest openings

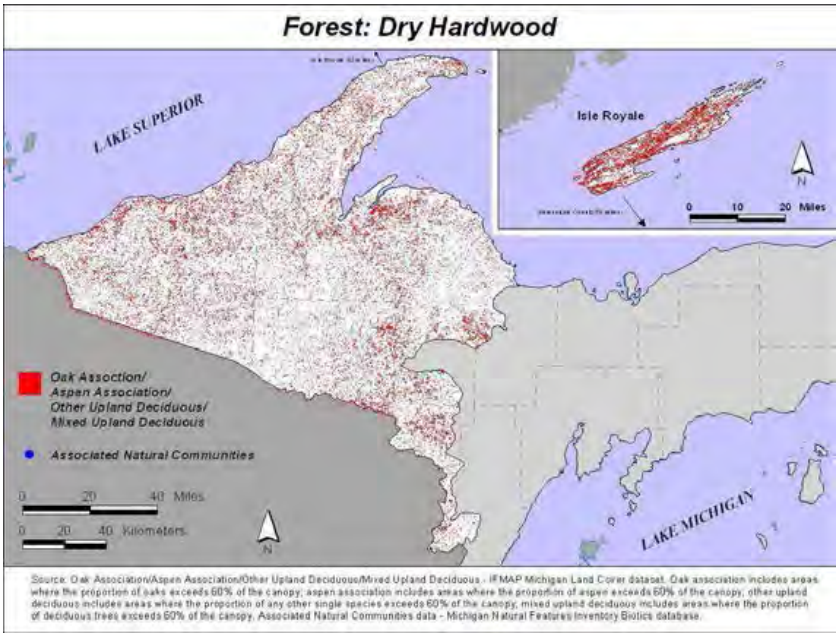
are also created by high winds or disease (e.g., oak wilt). These gaps are often colonized by less vigorous species such as aspen (aspen also colonize disturbed dry conifer gaps). Dry hardwood forests have a high diversity of shrub and woody vine species. These shrub species are represented in early successional stages as well as within the understory of more advanced stages. With fire suppression, many dry hardwood forests are colonized by shade-tolerant maples and thus succeed to mesic forests.

Associated Natural Communities: Dry Southern Forest; Dry-mesic Southern Forest



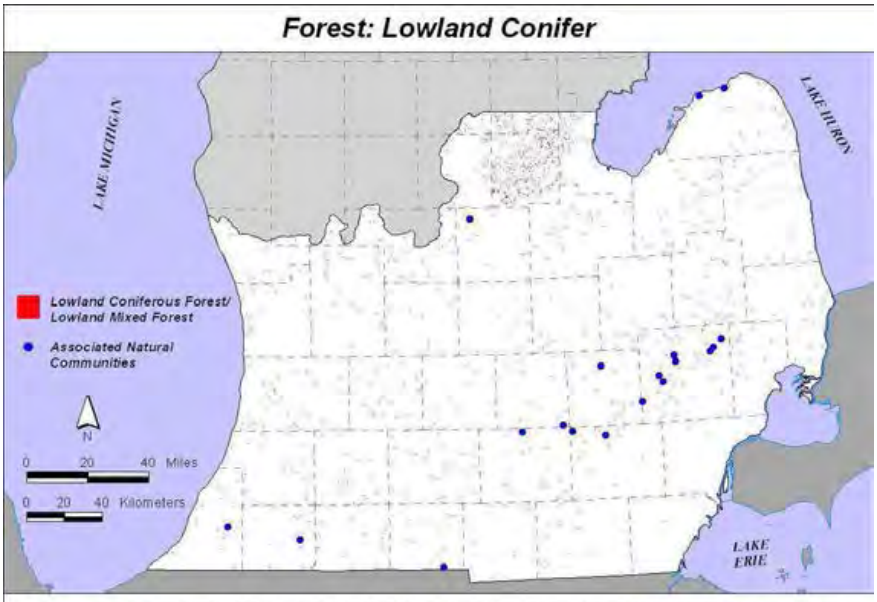


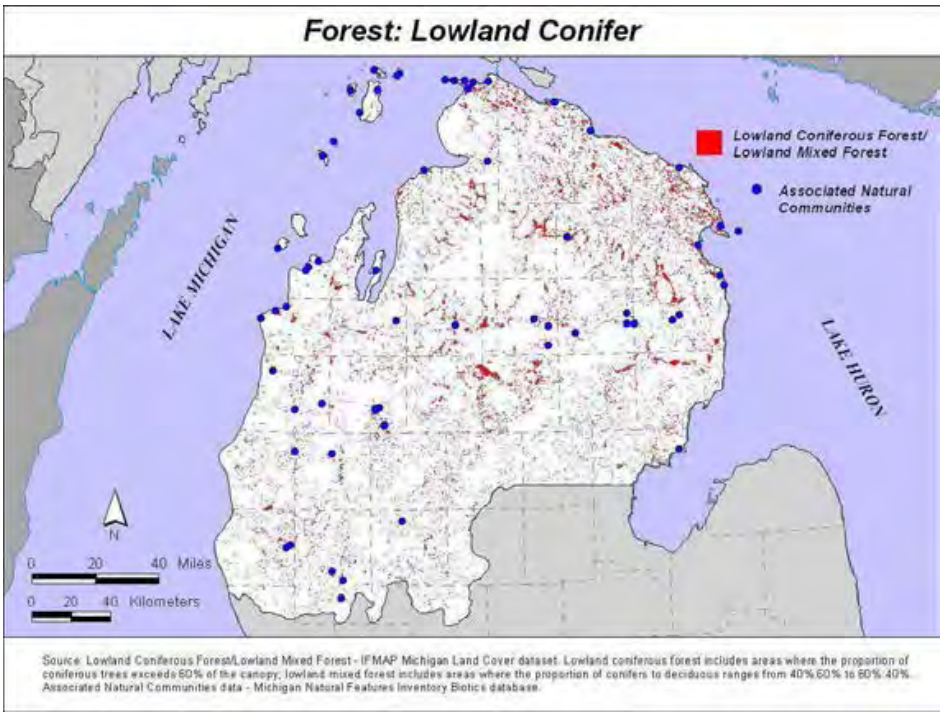



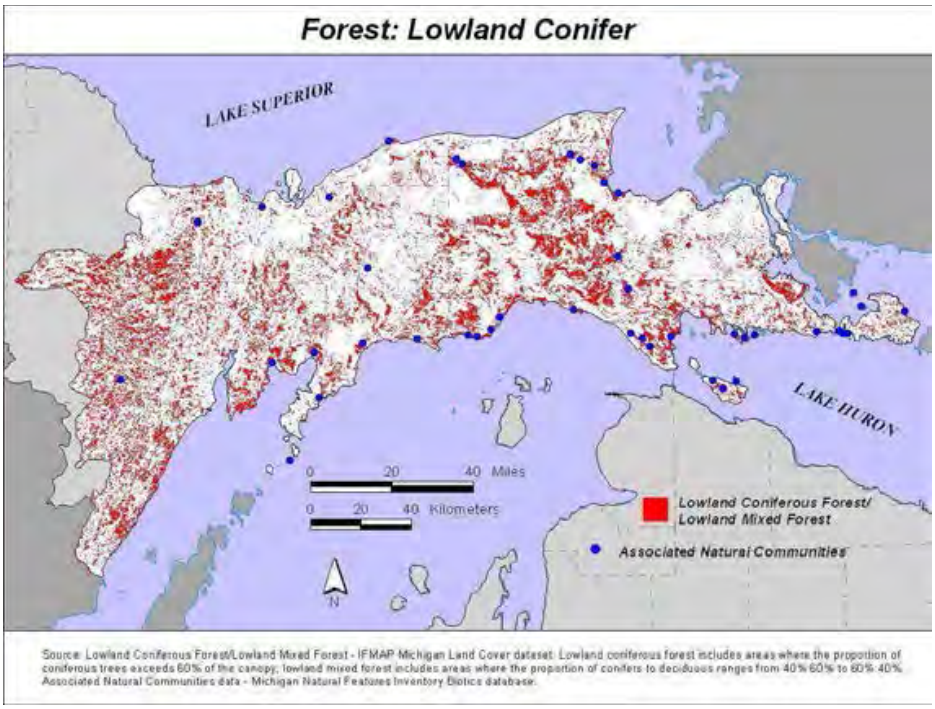

## Forest: Lowland conifer

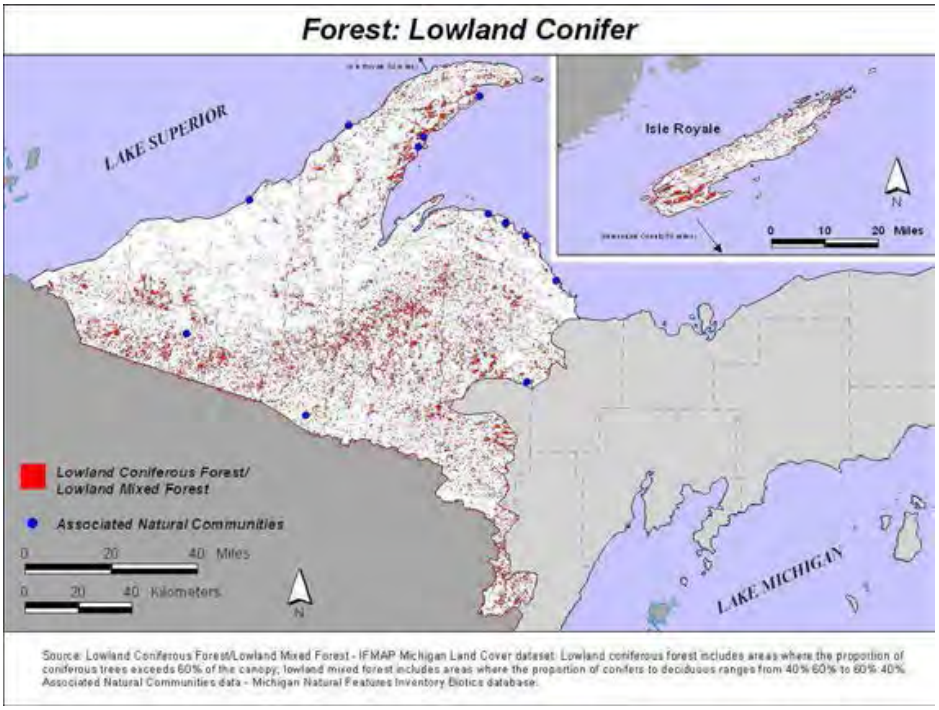
Description: Lowland conifer forests have seasonally or permanently saturated soils and are dominated by moisture-tolerant conifers such as black spruce (Picea mariana), tamarack (Larix laricina), white cedar (Thuja occidentalis), balsam fir (Abies balsamea), and jack pine (Pinus banksiana). These areas are often adjacent to open wetlands, lakes, rivers, or streams. They are characterized by diverse microtopography and ground cover (especially in systems dominated by cedar or tamarack). Natural disturbances in lowland conifer forests include seasonal and beaver-induced flooding, windthrow, and fire.

Associated Natural Communities: Hardwood-Conifer Swamp; Poor Conifer Swamp; Relict Conifer Swamp; Rich Conifer Swamp; Wooded Dune and Swale Complex





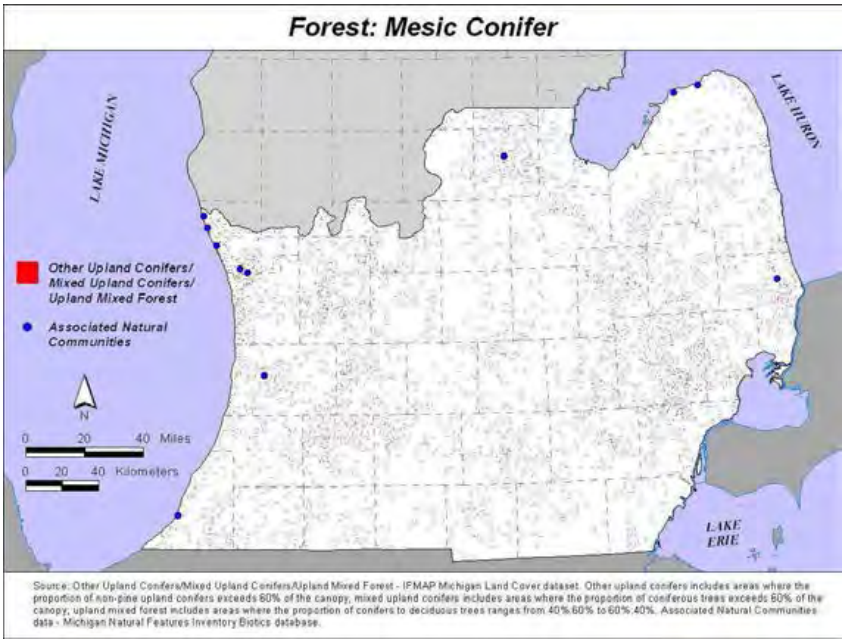



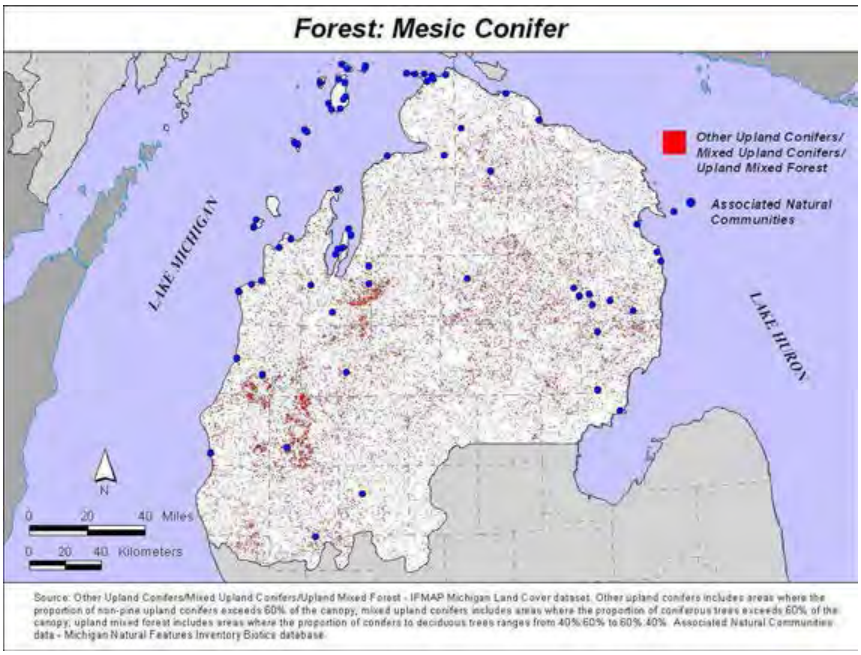

## Forest: Mesic conifer

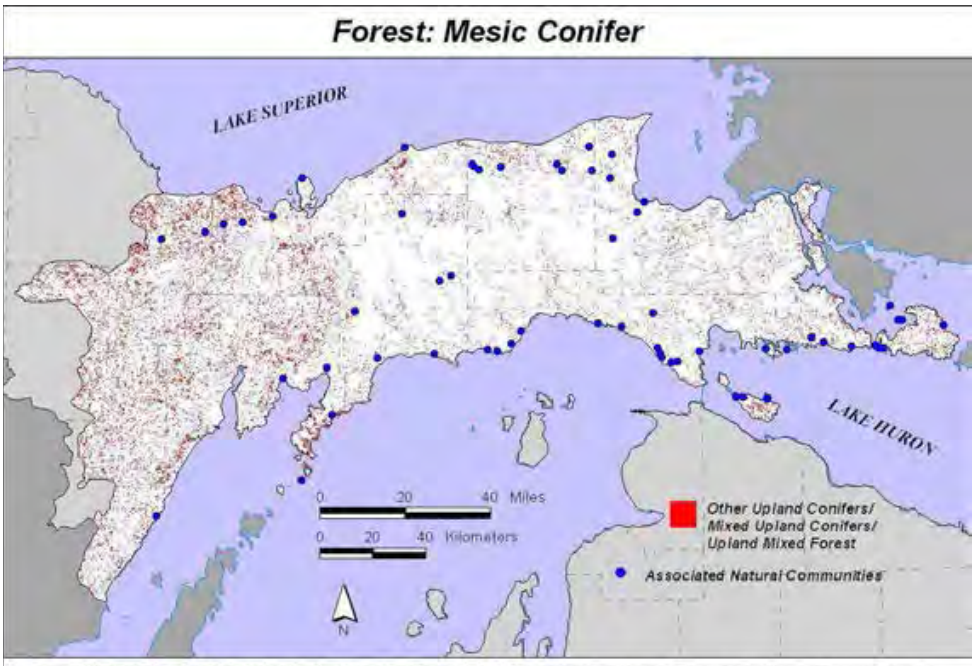
Description: Mesic conifer forests have moist soils and are generally dominated by hemlock (Tsuga canadensis), balsam fir (Abies balsamea), or white pine (Pinus strobus). High soil moisture in mesic forests is often maintained by high canopy cover and a dense leaf litter. Mesic forests also commonly occur in transitional areas between dryer upland areas and wet lowland areas. Mature mesic conifer forests are characterized by shade-tolerant species, especially hemlock, but also sugar maple and

American beech. Natural disturbances in mesic conifer forests include windthrow and fire. These forests generally have a relatively low density of herbaceous vegetation due to high canopy cover, low light infiltration, and nutrient poor needle litter. However, when mesic hardwoods are prevalent in the canopy, these systems can have very high spring wildflower densities. The soil moisture, thick layers of humus, and down woody debris within these forests can lead to very favorable habitat for fungal species, lichens, and other epiphytic flora.

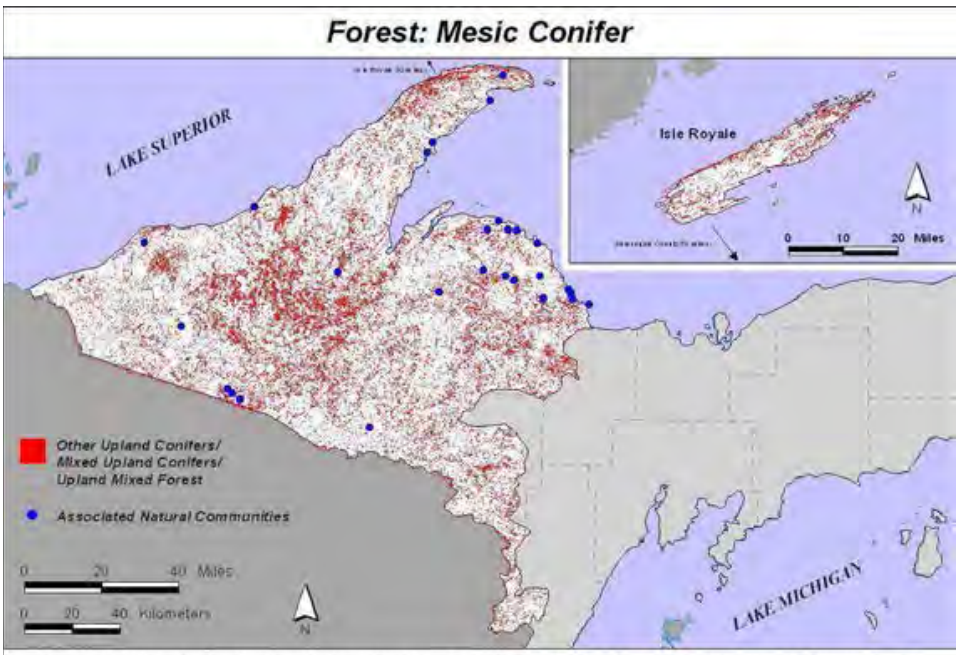
Associated Natural Communities: Dry-mesic Northern Forest; Mesic Northern Forest; Wooded Dune and Swale Complex






Source: Other Upland Conifers/Mixed Upland Conifers/Upland Mixed Forest - IFMAP Michigan Land Cover dataset. Other upland conifers includes areas where the proportion of non-pine upland conifers exceeds 60% of the canopy; mixed upland conifers includes areas where the proportion of coniferous trees exceeds 60% of the canopy; upland mixed forest includes areas where the proportion of conifers to deciduous trees ranges from 40%:60% to 60%:40%. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.



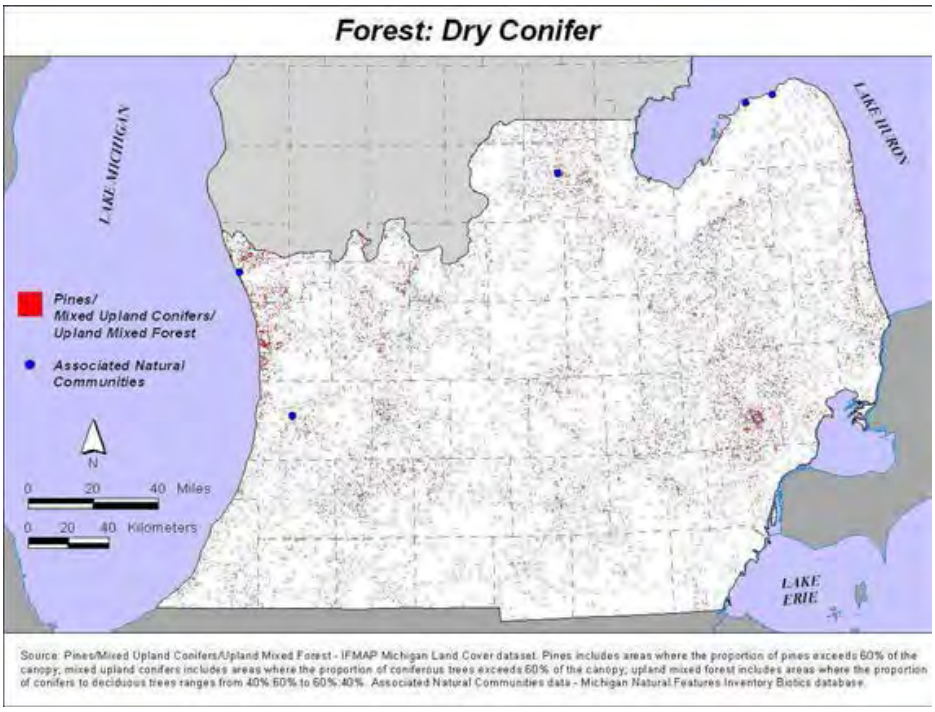

Source: Other Upland Conifers/Mixed Upland Conifers/Upland Mixed Forest - IFMAP Michigan Land Cover dataset. Other upland conifers includes areas where the proportion of non-pine upland conifers exceeds 60% of the canopy; mixed upland conifers includes areas where the proportion of coniferous trees exceeds 60% of the canopy; upland mixed forest includes areas where the proportion of conifers to deciduous trees ranges from 40%:60% to 60%:40%. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.

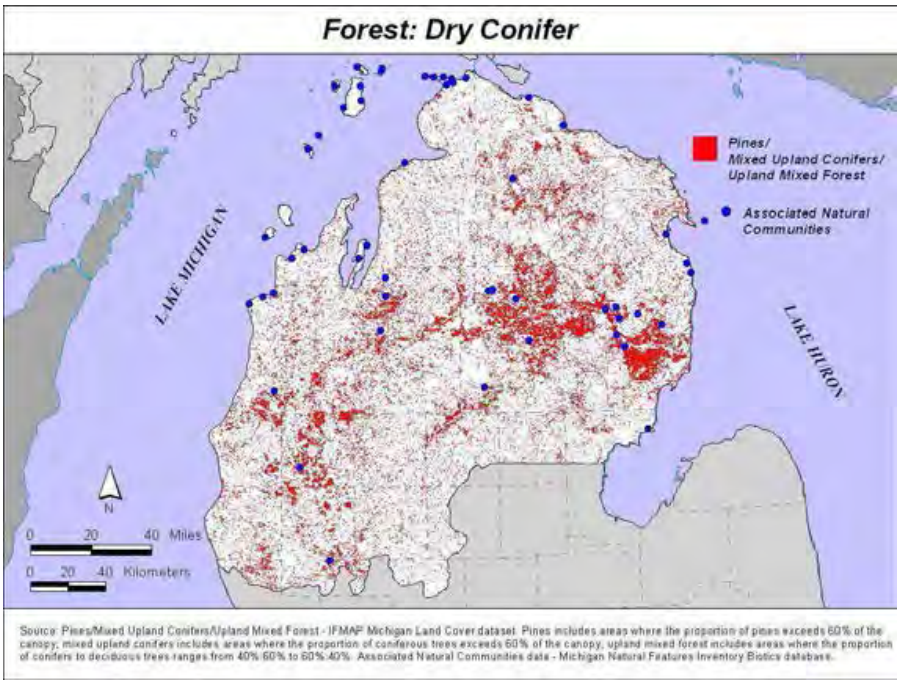
## Forest: Dry conifer

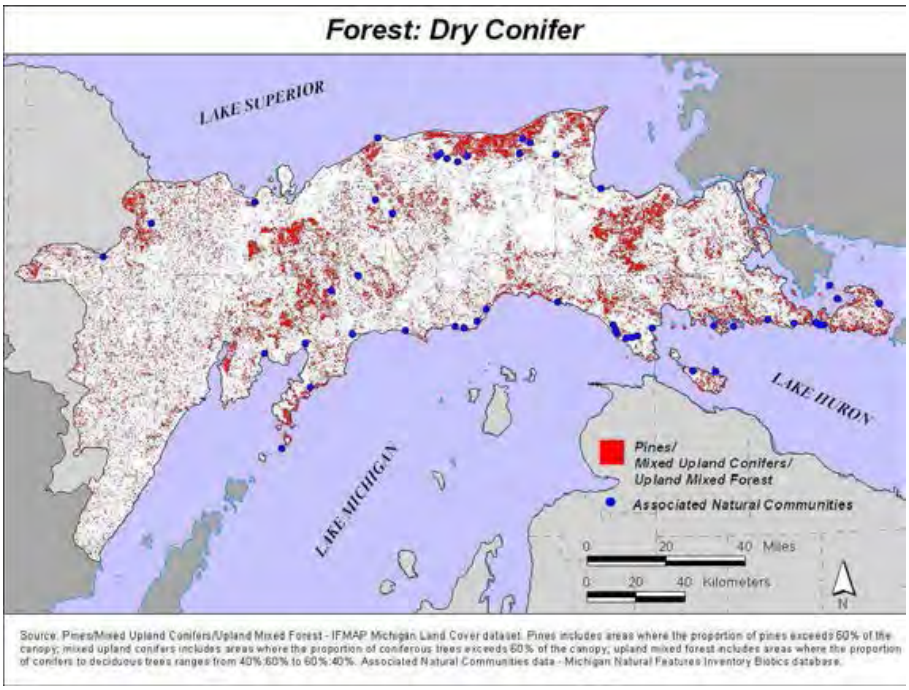
Description: Dry conifer forests have dry soils and are generally dominated by such trees as jack pine (Pinus banksiana), red pine (Pinus resinosa), and white pine (Pinus strobus). Fire is an important natural disturbance in many dry conifer forests, where the frequency and magnitude of fires play a major role in determining species composition, successional stage, forest structural characteristics, and configuration.

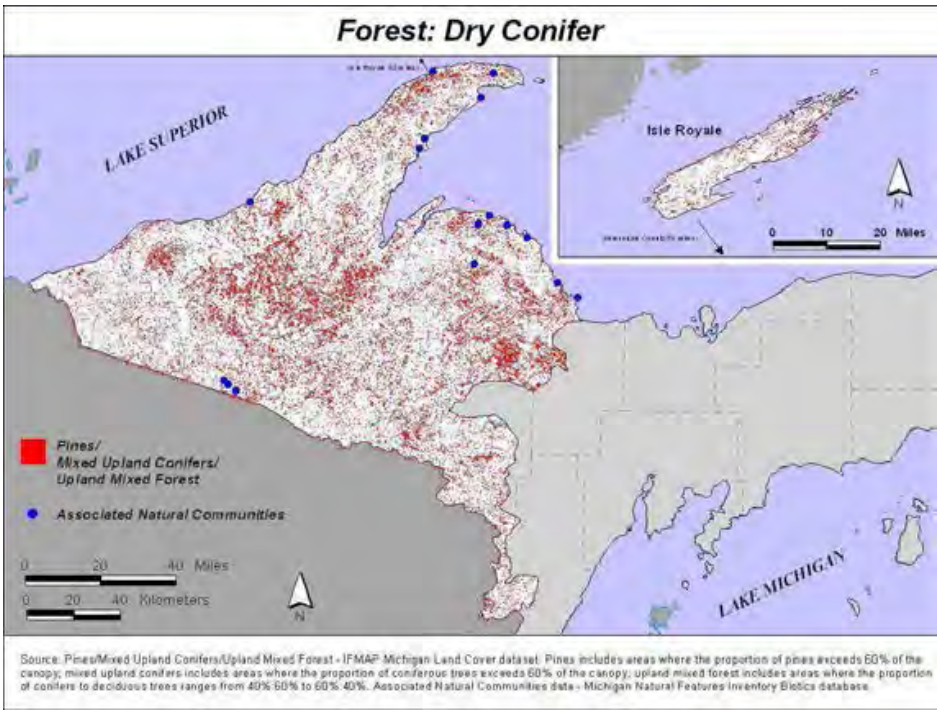
Dry forest openings are also created by high winds or disease. With fire suppression, some dry conifer forests are colonized by shade-tolerant maples or conifers (i.e., balsam fir, white spruce) and thus succeed to mesic forests.

Associated Natural Communities: Dry-mesic Northern Forest; Wooded Dune and Swale Complex



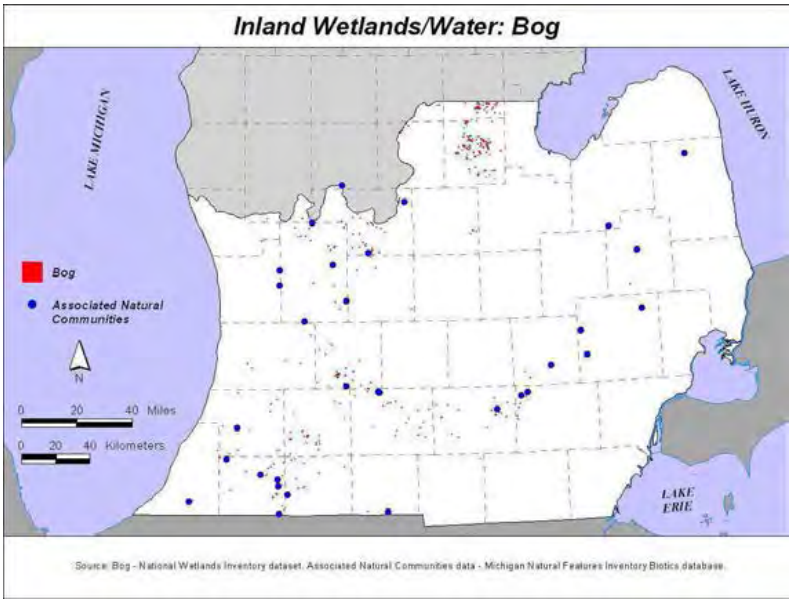


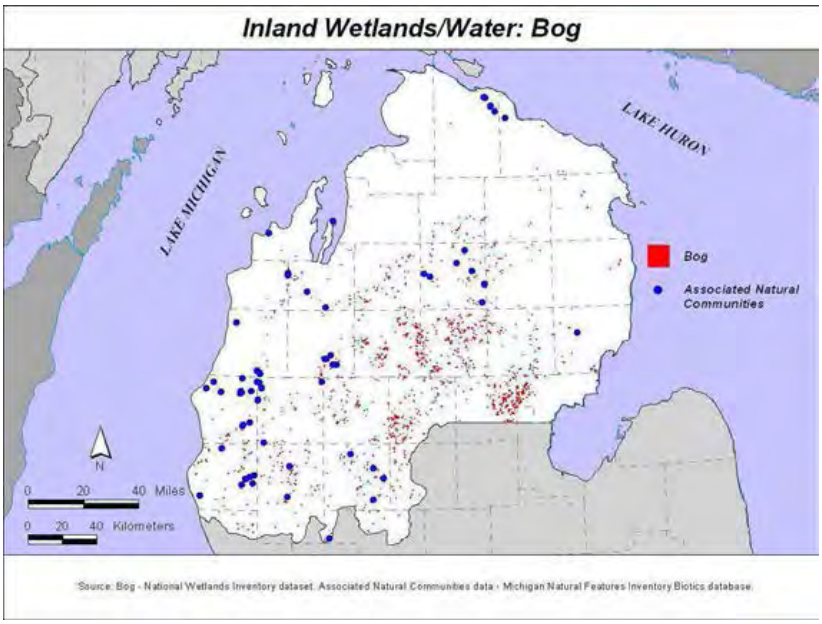



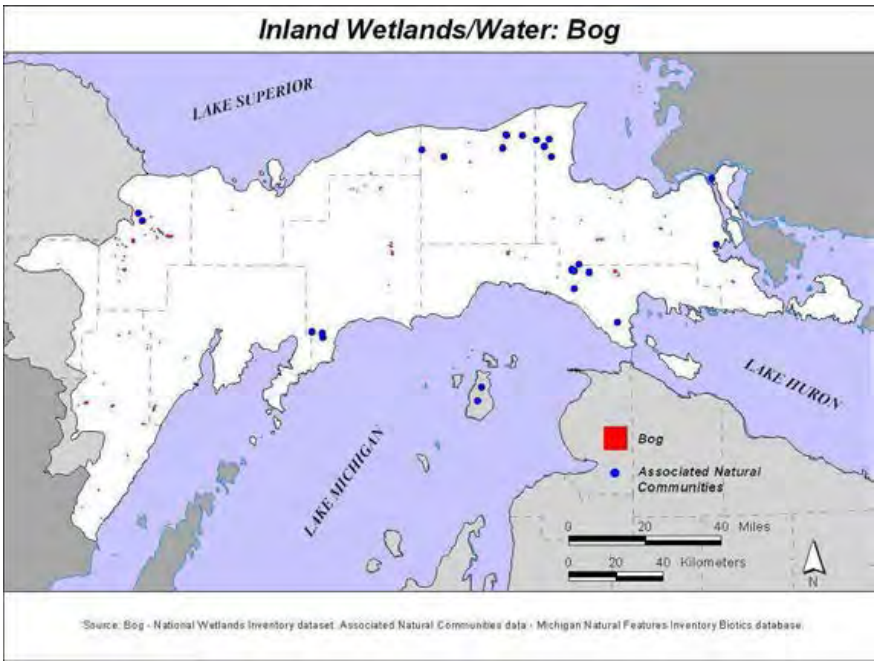

## Inland wetlands/water: Bog

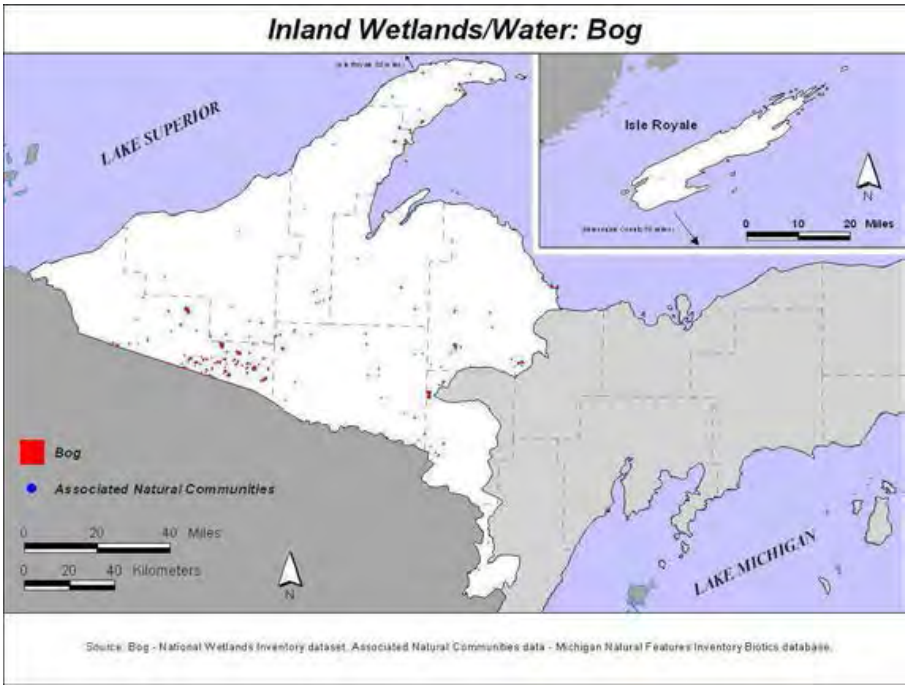
Description: Bogs are peat-accumulating, acidic, low nutrient wetlands that receive all or most of their water and nutrients from precipitation. Sphagnum moss (Sphagnum andersonianum) mats are characteristic of bogs. Other characteristic vegetation includes carnivorous plants such as sundew (Drosera sp.) and pitcher plants (Sarracenia purpurea), shrubs from the Heath family, and sedges (Carex sp.).

Associated Natural Communities: Bog



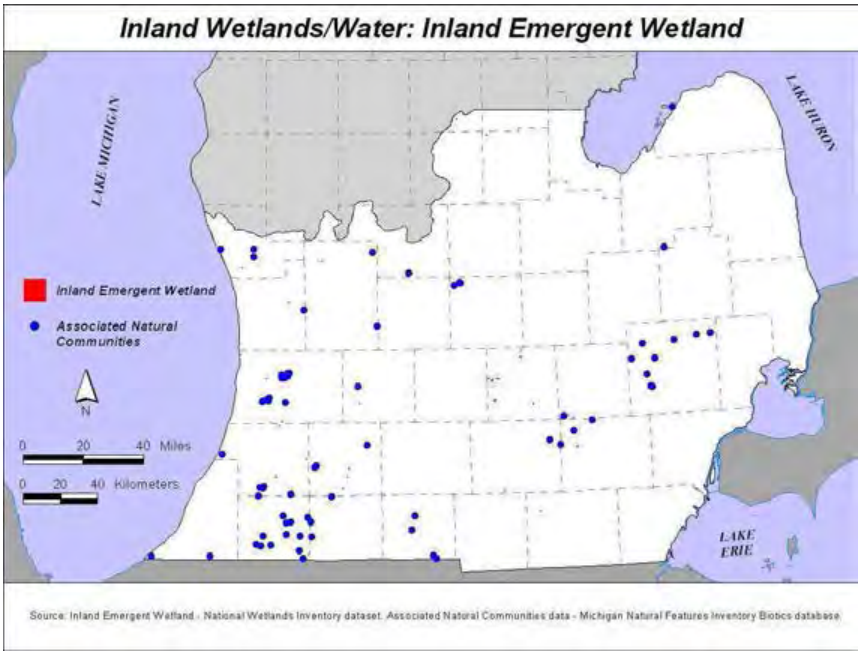


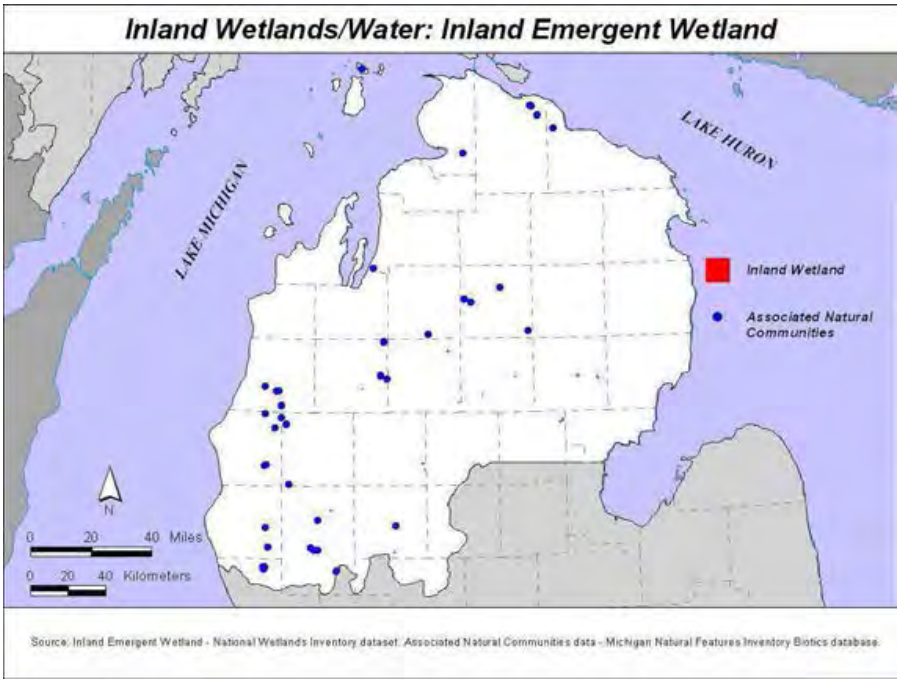




## Inland wetlands/water: Inland emergent wetland

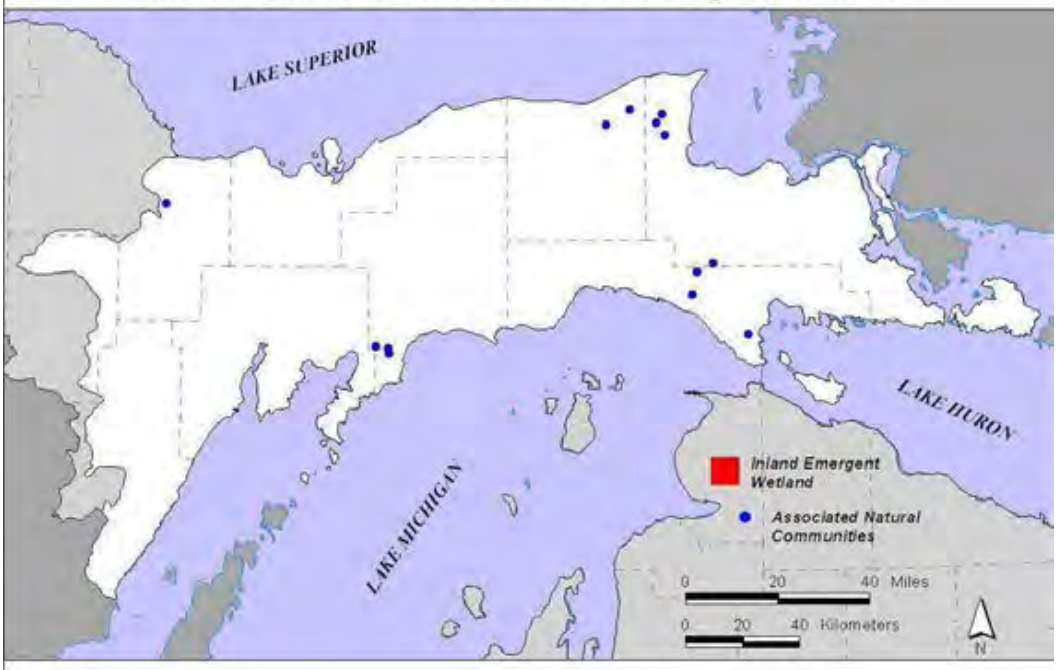
Description: Inland emergent wetlands, also called marshes, are frequently or continually inundated with water and are characterized by emergent herbaceous vegetation adapted to saturated soil conditions. These wetlands tend to have abundant nutrients and are highly organic. Inland emergent wetlands are quite varied and can be found in poorly drained depressions and along lakes, ponds, and rivers.

Associated Natural Communities: Coastal Plain Marsh; Emergent Marsh; Inland Salt Marsh; Interdunal Wetland; Intermittent Wetland; Southern Wet Meadow



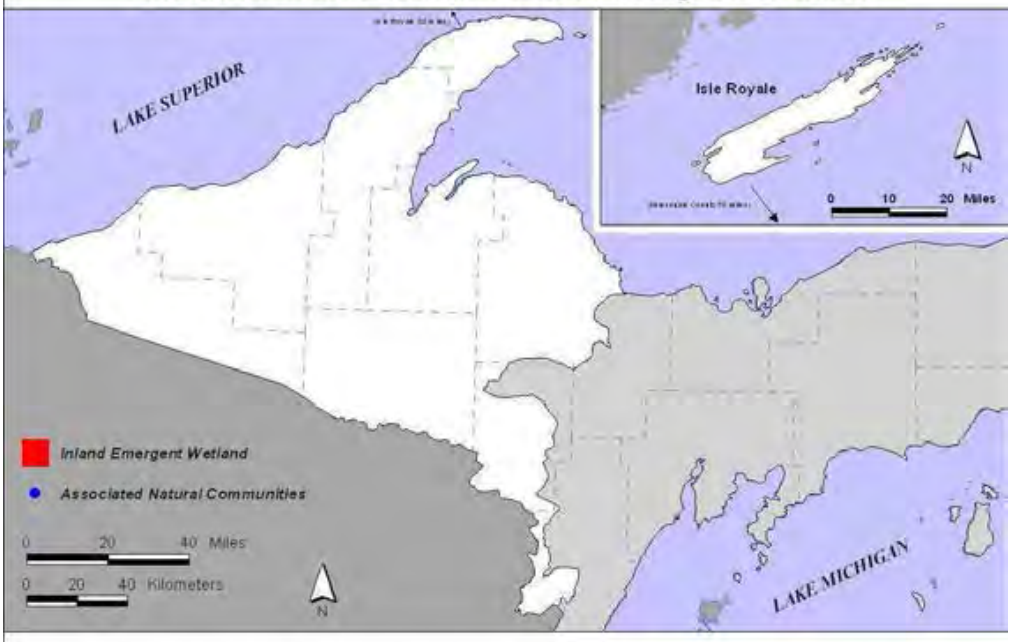



## Inland Wetlands/Water: Inland Emergent Wetland




Source: Inland Emergent Wetland - National Wetland's Inventory dataset. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.

## Inland Wetlands/Water: Inland Emergent Wetland

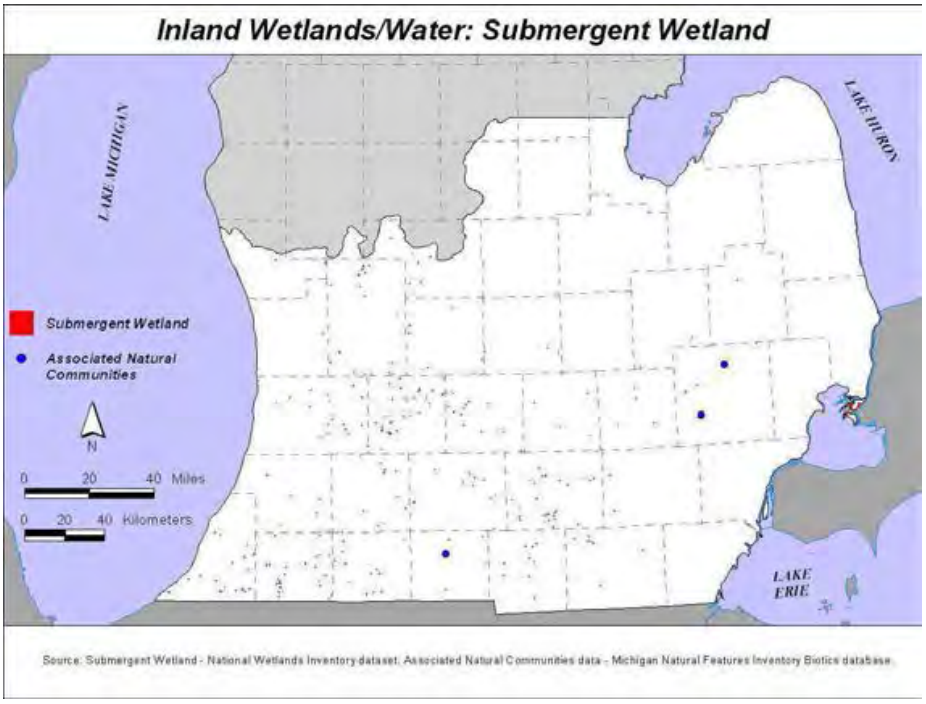



Source: Inland Emergent Wetland - National Wetlands Inventory dataset. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.

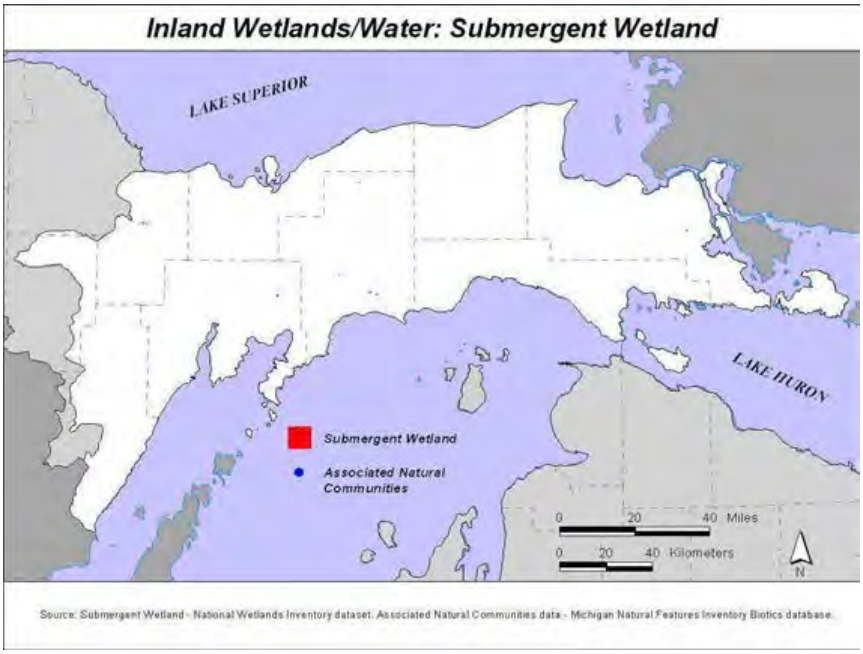
## Inland wetlands/water: Submergent wetland

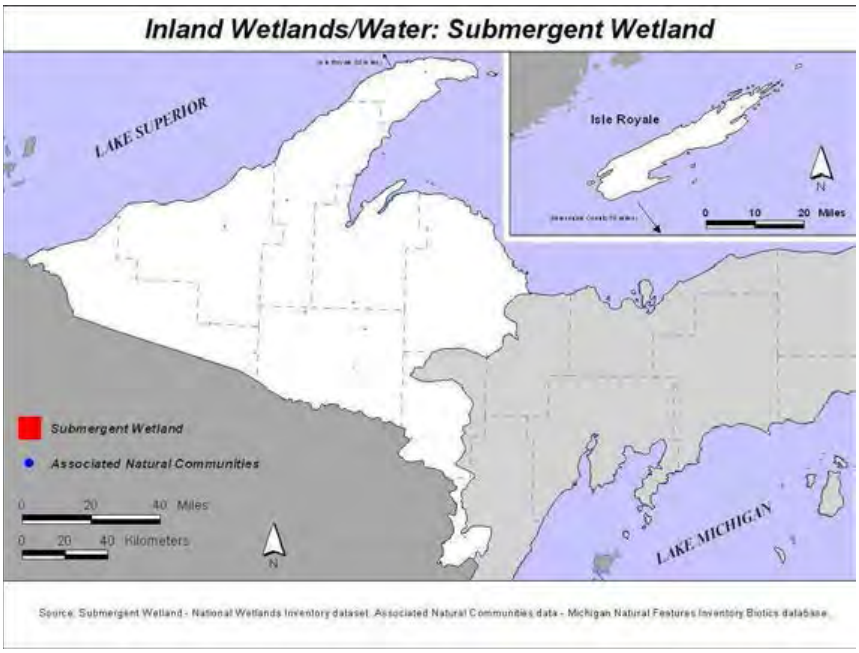
Description: Submergent wetlands are a submerged marsh of deep to sometimes shallow water in lakes and streams. Submergent wetlands are characterized by submerged, floating, and floating-leaved plants, including pondweeds (Potamogeton spp.), water milfoil (Myriophyllum exalbescens), coontail (Ceratophyllum demersum), duckweed (family Lemnaceae), water-lily (Nymphaea spp.) and water shield (Brasenia schreberi). Submergent wetlands typically transition to emergent wetlands with decreasing water depths along the edges of lakes and streams.

Associated Natural Communities: Submergent Marsh



Inland Wetlands/Water: Submergent Wetland
LAKE MICHIGAN
LAKE HURON
Submergent Wetland
Associated Natural Communities
N
0 20 40 Miles
0 20 40 Kilometers
Source: Submergent Wetland - National Wetlands Inventory dataset. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.

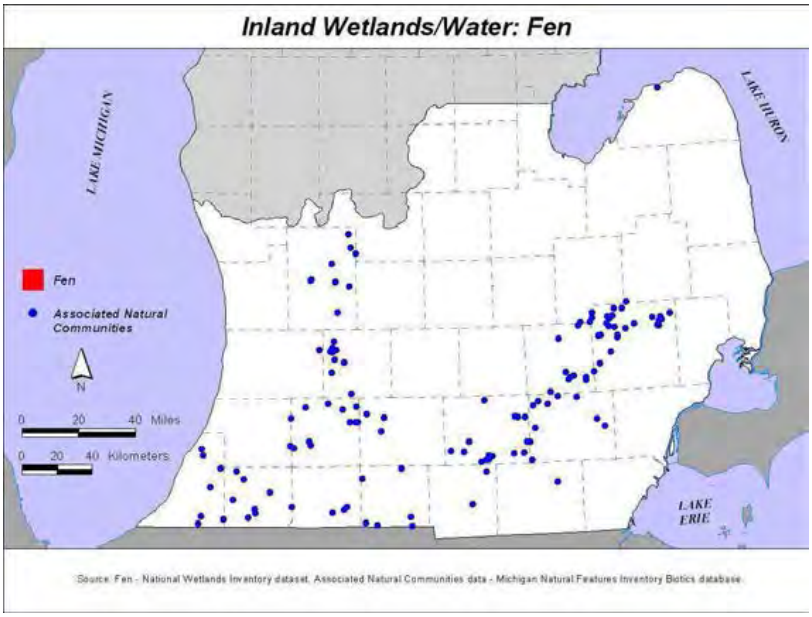

Inland Wetlands/Water: Submergent Wetland
LAKE SUPERIOR
LAKE HURON
Submergent Wetland
Associated Natural Communities
0 20 40 Miles
0 20 40 Kilometers
N
Source: Submergent Wetland - National Wetlands Inventory dataset. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.




## Inland wetlands/water: Fen

Description: Fens are peat-accumulating wetlands that receive much of their water and nutrients from groundwater rich in calcium and magnesium carbonates. Fens tend to have relatively high pH and nutrient levels, hence supporting a great diversity of grasses, sedges (Carex sp.), rushes (Juncus sp.), and wildflowers. Open conditions are maintained by seasonal water fluctuations, fire, and beaver-flooding.

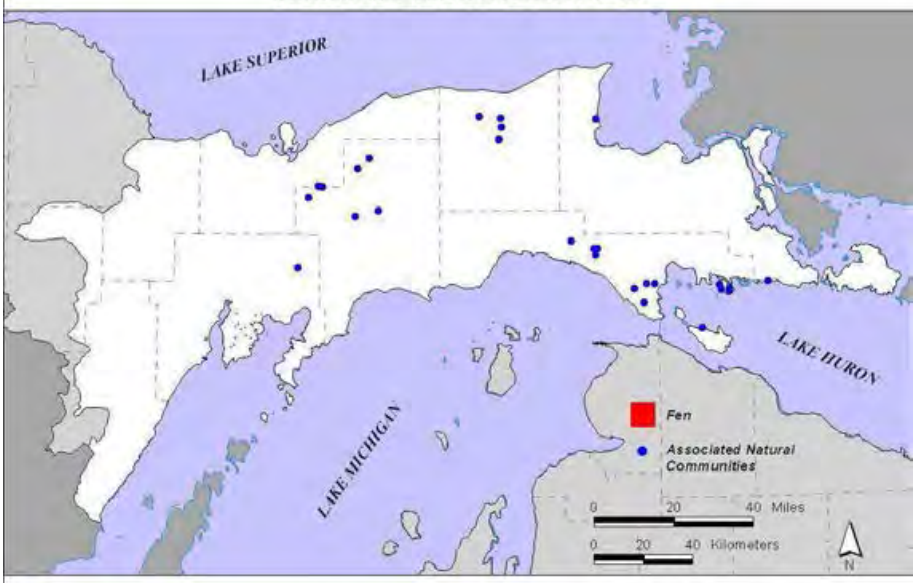
Associated Natural Communities: Fen



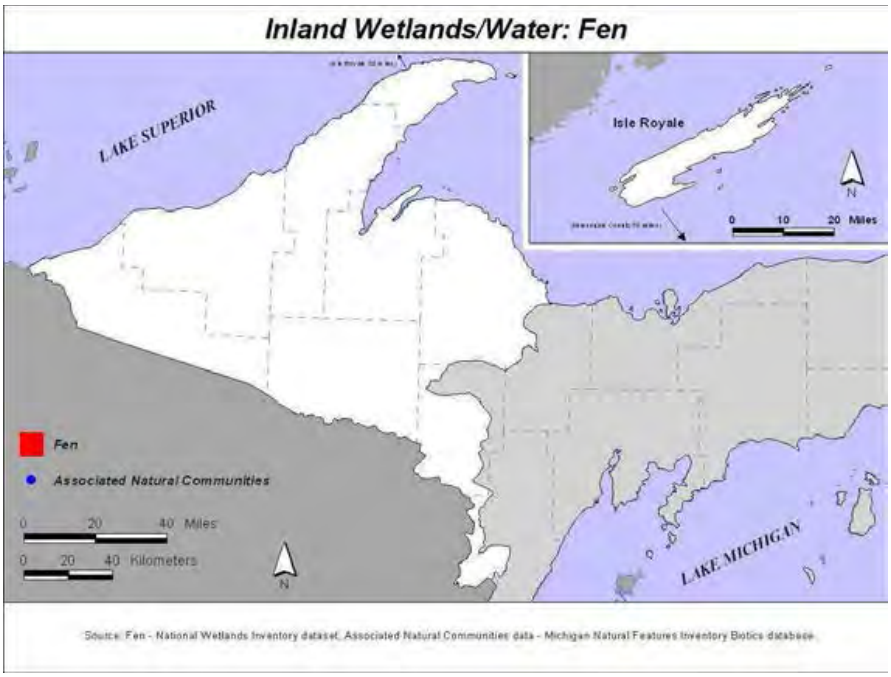
## Inland Wetlands/Water: Fen

Source: Fen - National Wetlands Inventory dataset. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.

## Inland Wetlands/Water: Fen



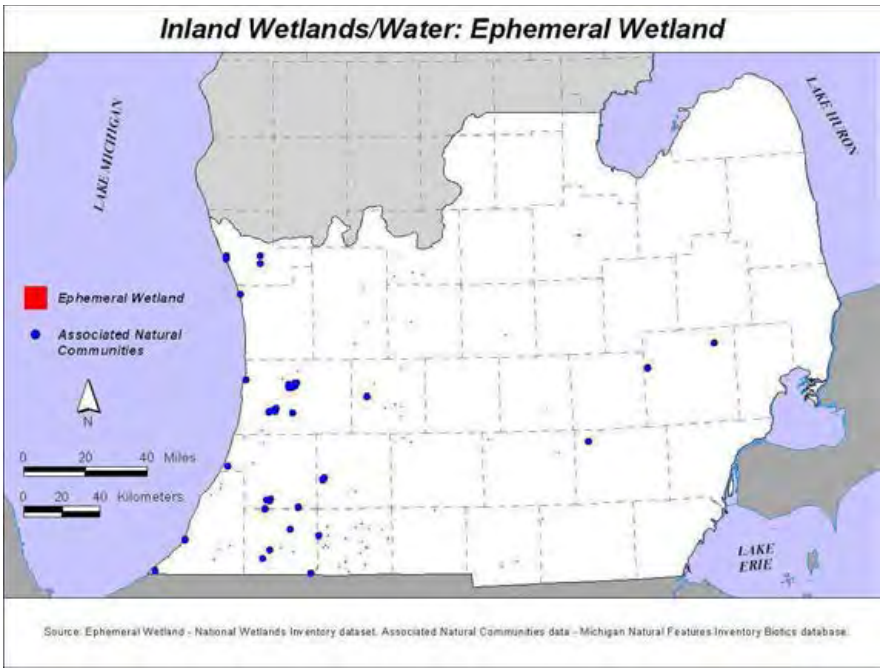

Source: Fen - National Wetlands Inventory dataset. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.

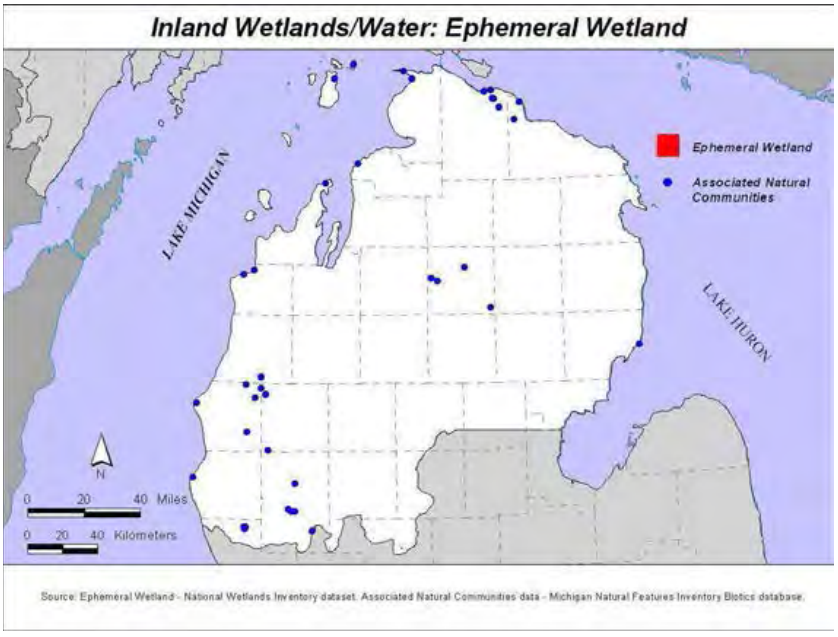


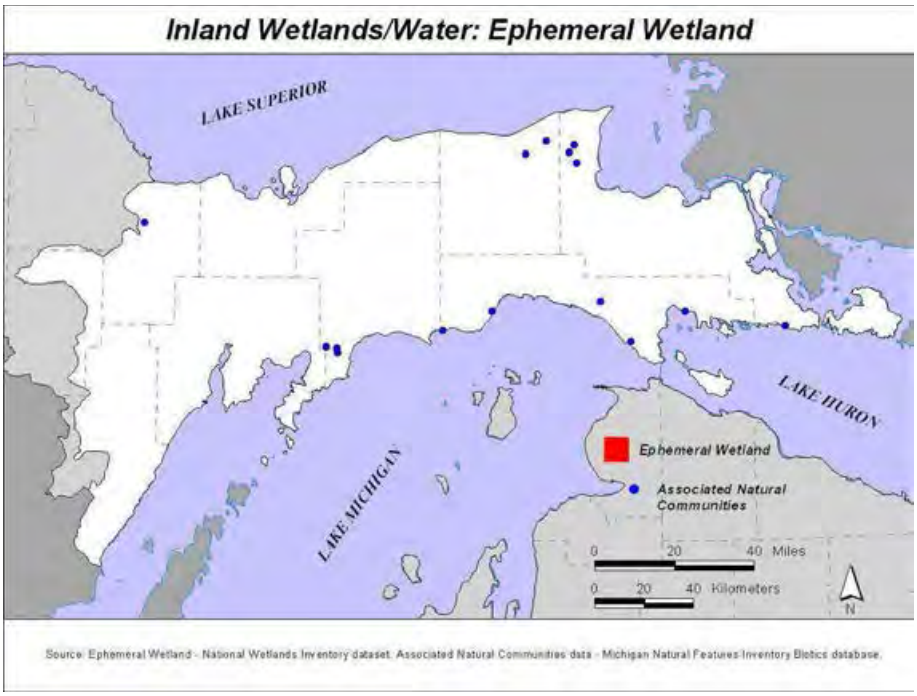

## Inland wetlands/water: Ephemeral wetland

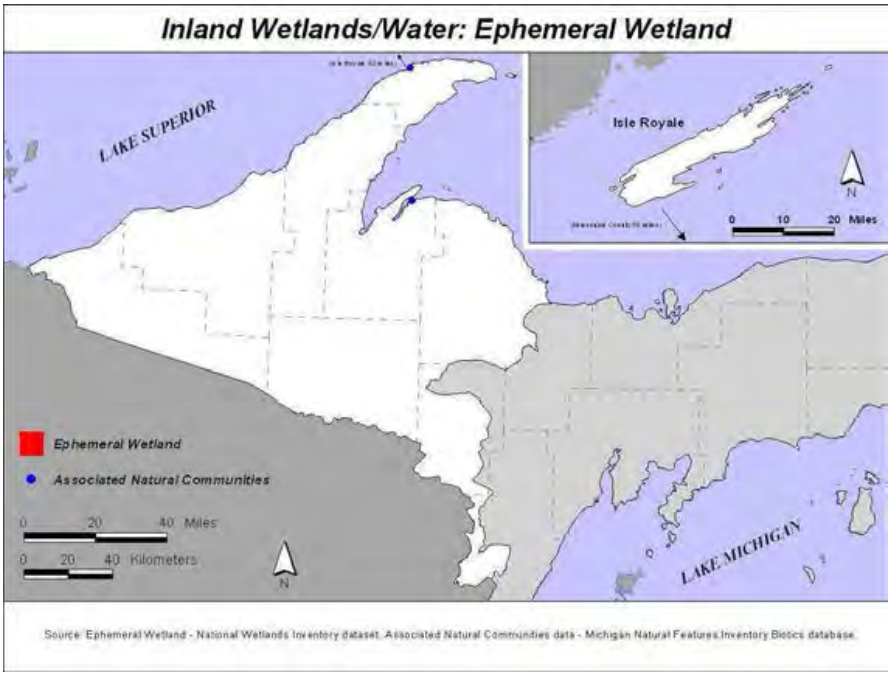
Description: Ephemeral wetlands are semi-permanent, seasonally flooded areas. These areas may be small and only a couple of feet in diameter or very large. Ephemeral wetlands can have standing water for a few weeks in the spring or short periods after heavy rains during the rest of the year. When not flooded, soils in ephemeral wetlands may feel dry but typically show evidence of hydric conditions. In addition to seasonal fluctuations, water level can vary dramatically from year to year in ephemeral wetlands such as coastal plain marsh, interdunal wetland, and intermittent wetland. Vernal pools, or upland ephemeral depressional wetlands isolated from permanent water bodies, are common within mesic southern forests and dry-mesic southern forests.

Associated Natural Communities: Coastal Plain Marsh; Interdunal Wetland; Intermittent Wetland


Inland Wetlands/Water: Ephemeral Wetland
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
Ephemeral Wetland
Associated Natural Communities
N
0 20 40 Miles
0 20 40 Kilometers
Source: Ephemeral Wetland - National Wetlands Inventory dataset. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.


Inland Wetlands/Water: Ephemeral Wetland
LAKE MICHIGAN
LAKE HURON
Ephemeral Wetland
Associated Natural Communities
N
0 20 40 Miles
0 20 40 Kilometers
Source: Ephemeral Wetland - National Wetlands Inventory dataset. Associated Natural Communities data - Michigan Natural Features Inventory Biotics database.



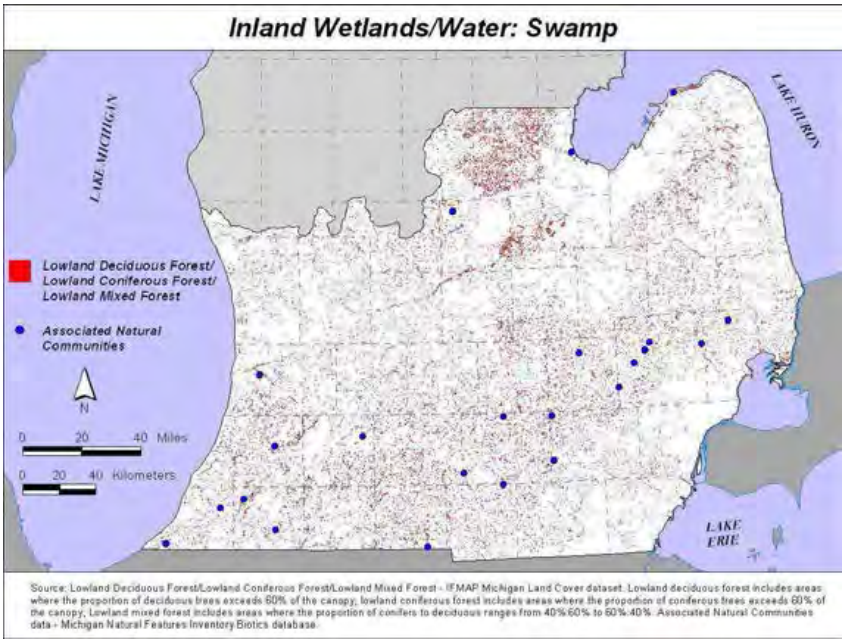



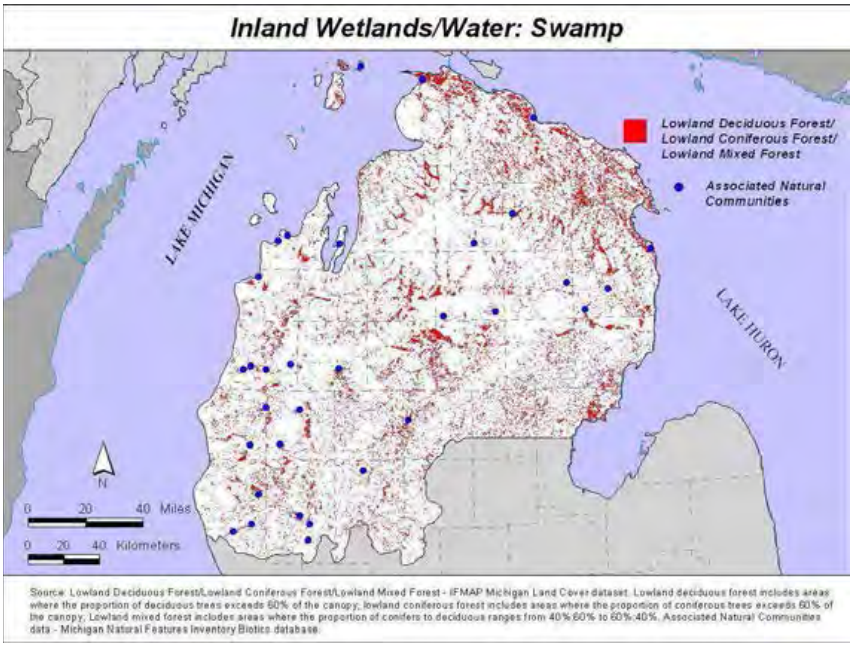

## Inland wetlands/water: Swamp

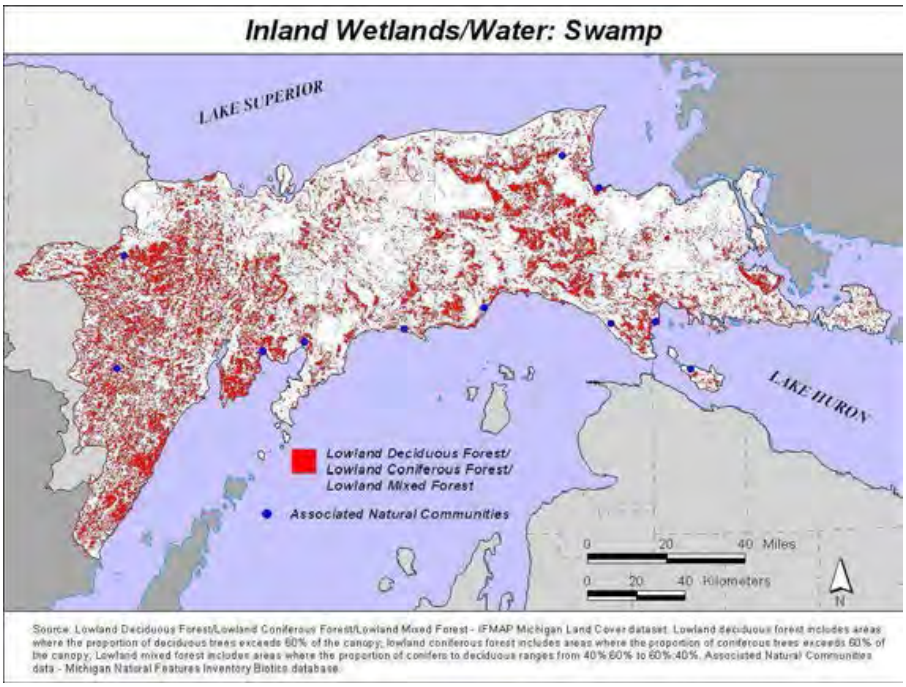
Description: Swamps are wetlands dominated by trees or shrubs with saturated soils during the growing season and standing or slowly moving water during certain times of the year. Swamps can be dominated by trees such as red maple (Acer rubrum), black ash (Fraxinus nigra), yellow birch (Betula alleghaniensis), northern white cedar (Thuja occidentalis) and tamarack (Larix laricina), or shrubs such as speckled alder (Alnus rugosa), buttonbush (Cephalanthus occidentalis), willow (Salix sp.), and dogwood (Cornus sp.).

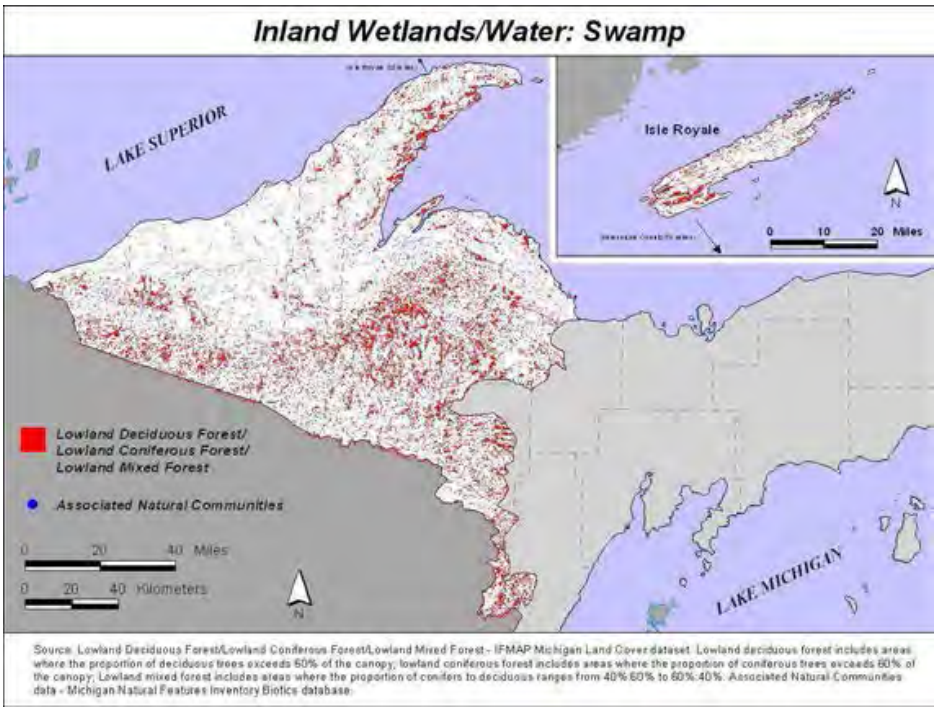
Composition and structure are influenced by disturbance factors such as flooding regime, windthrow, insect outbreak, and beaver (Castor canadensis).

Associated Natural Communities: Hardwood-Conifer Swamp; Inundated Shrub Swamp; Poor Conifer Swamp; Relict Conifer Swamp; Rich Conifer Swamp; Southern Floodplain Forest; Southern Swamp; Wooded Dune and Swale Complex





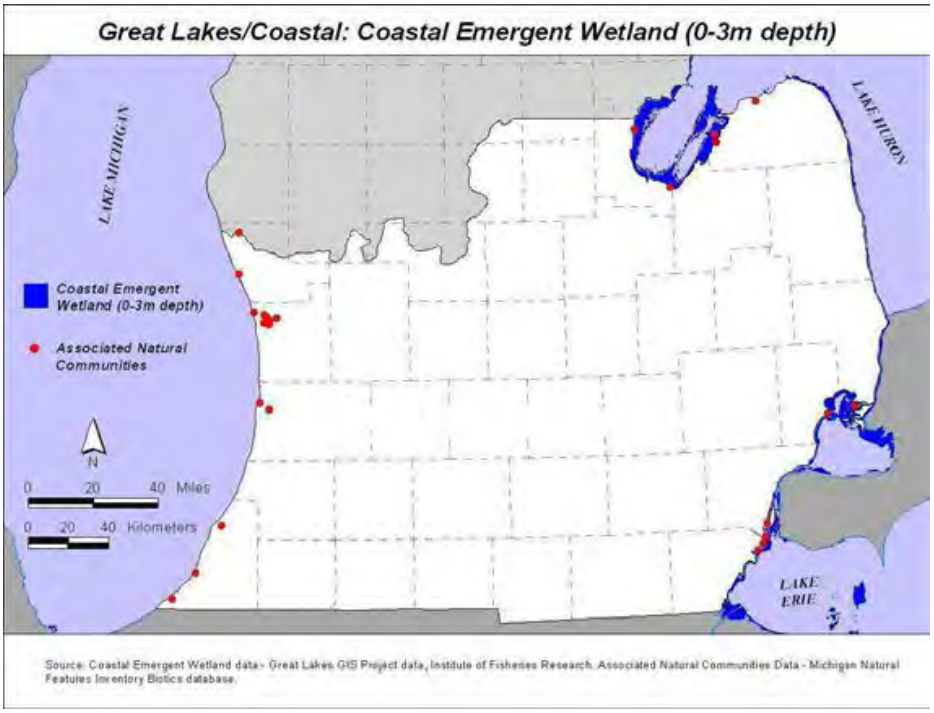




## Great Lakes/Coastal: Coastal emergent wetland

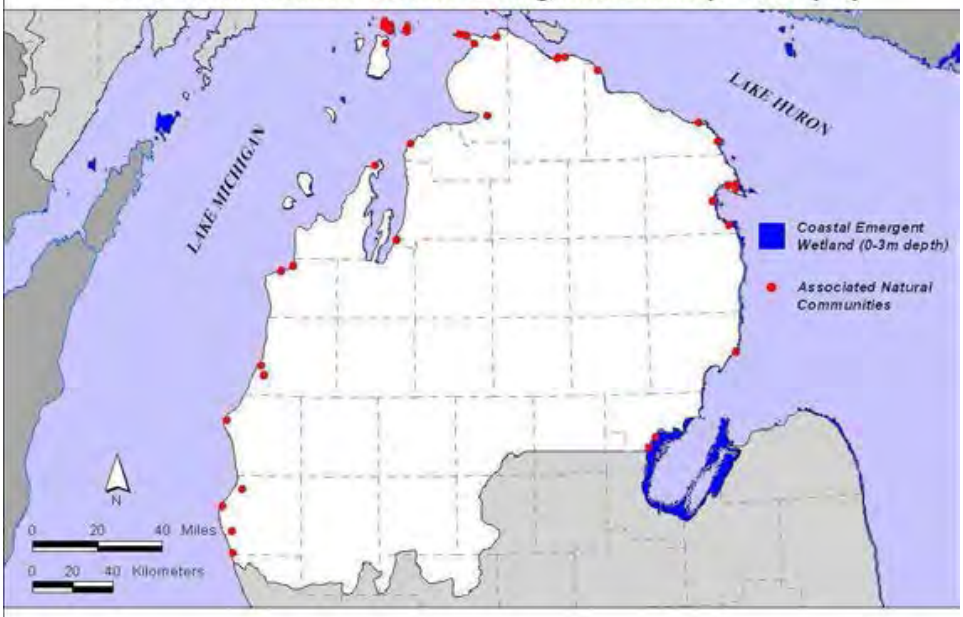
Description: Coastal emergent wetlands are directly influenced by and connected to the Great Lakes. Like inland emergent wetlands, these areas are frequently or continually inundated with water and dominated by emergent herbaceous vegetation adapted to saturated soil conditions. These wetlands tend to have abundant nutrients and highly organic soils. Typical vegetation zones include a deep marsh with submerged plants, an emergent marsh of mostly narrow-leaved species, and a marsh meadow,

which is inundated by storms and dominated by sedges. Because of their proximity and hydrologic connection to the Great Lakes, water levels in these areas are highly influenced by water levels in the Great Lakes. Seiches, storms, and water level cycles strikingly change vegetation over short periods by destroying some vegetation zones, creating others, and forcing all zones to shift lakeward or landward to accommodate water levels. Coastal emergent wetlands provide important habitat for migrating and breeding waterfowl, shorebirds, spawning fish, and medium-sized mammals.

Associated Natural Communities: Great Lakes Marsh; Interdunal Wetland

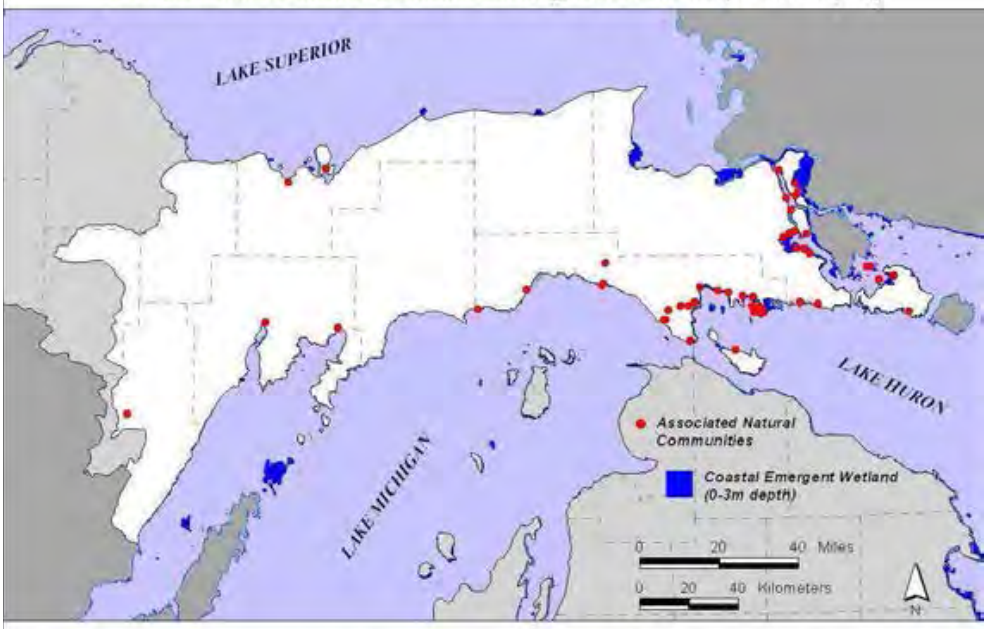


## Great Lakes/Coastal: Coastal Emergent Wetland (0-3m depth)

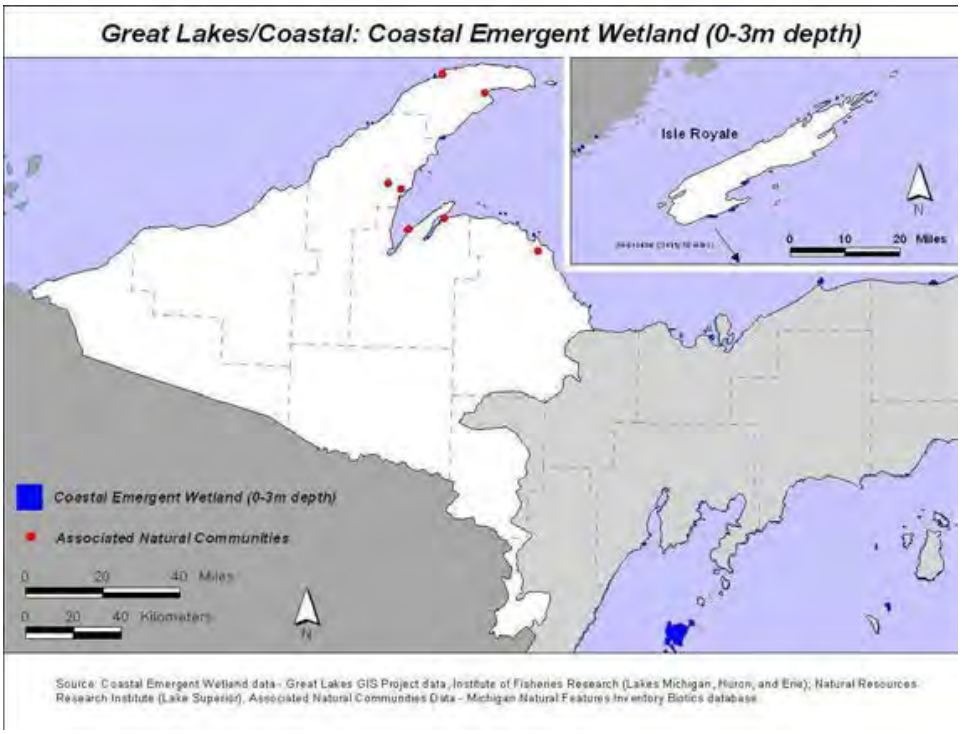



Source: Coastal Emergent Wetland data - Great Lakes GIS Project data, Institute of Fisheries Research. Associated Natural Communities Data - Michigan Natural Features Inventory Biotics database.

## Great Lakes/Coastal: Coastal Emergent Wetland (0-3m depth)




Source: Coastal Emergent Wetland data - Great Lakes GIS Project data, Institute of Fisheries Research (Lakes Michigan, Huron, and Erie), Natural Resources Research Institute (Lake Superior). Associated Natural Communities Data - Michigan Natural Features Inventory Biotics database.

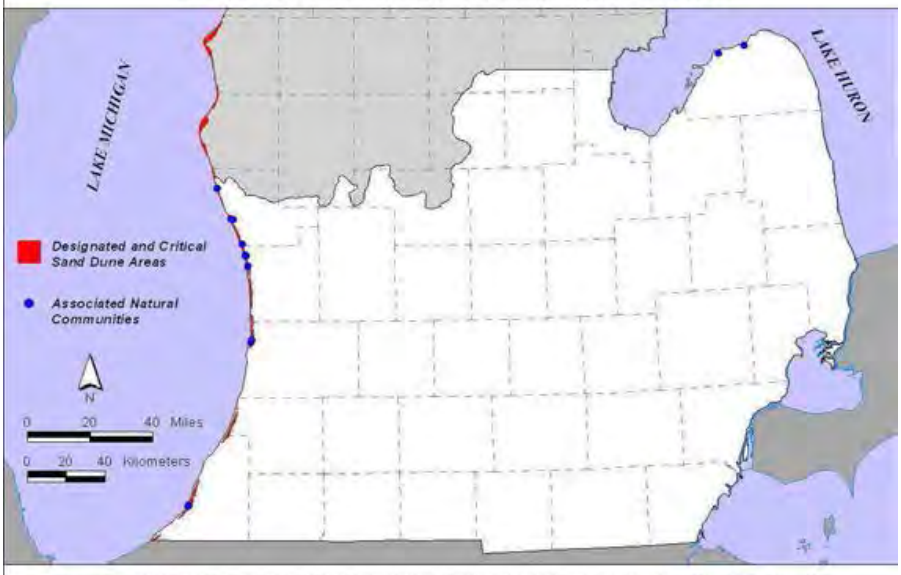



## Great Lakes/Coastal: Coastal dune/beach

Description: The Coastal dune/beach feature is generally represented by areas associated with Great Lakes shorelines that have sand, gravel or cobble substrates. These areas include lakeshore beaches and open dunes. Beach communities can be divided into three separate areas with distinct vegetative associations, the lower, middle and upper beaches. The lower beach is hard-packed and under the constant influence of waves. The middle beach is influenced by waves only during storms. The upper beach is usually dry and highly influenced by blowing sand. Coastal sand dunes are found immediately inland from the beach. They are created, maintained, and influenced by water and wind erosion and the deposition of blowing sand. Dune communities include foredunes, perched dunes, blow outs, barrier dunes, Great Lakes barrens, interdunal wetlands, and wooded dune and swale complexes. Vegetation changes significantly across dune areas and over time as dunes stabilize. Dominant plants and community structure vary depending on the degree of sand deposition, sand erosion, and distance from the lake.

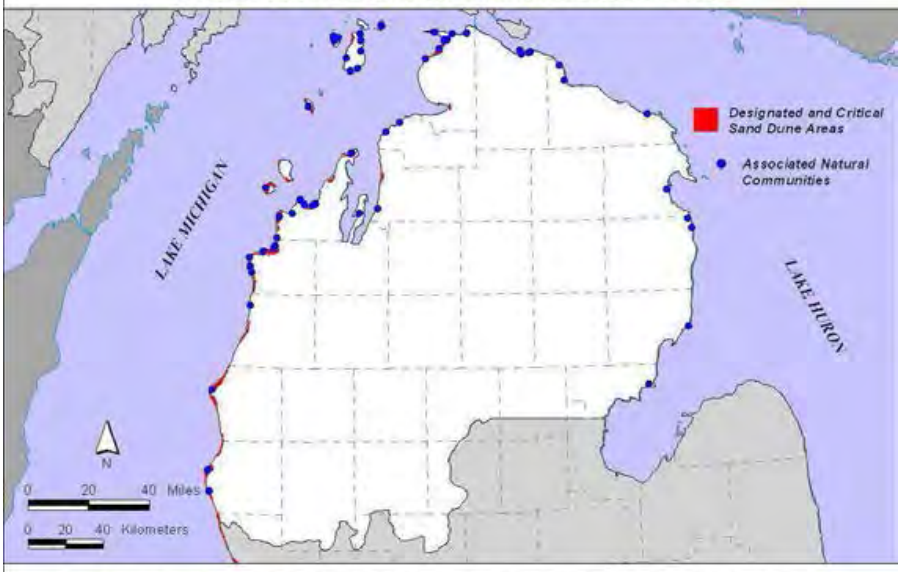
Associated Natural Communities: Cobble Beach; Great Lakes Barrens; Interdunal Wetland; Open Dunes; Sand/Gravel Beach; Wooded Dune and Swale Complex

## Great Lakes/Coastal: Coastal Dune/Beach

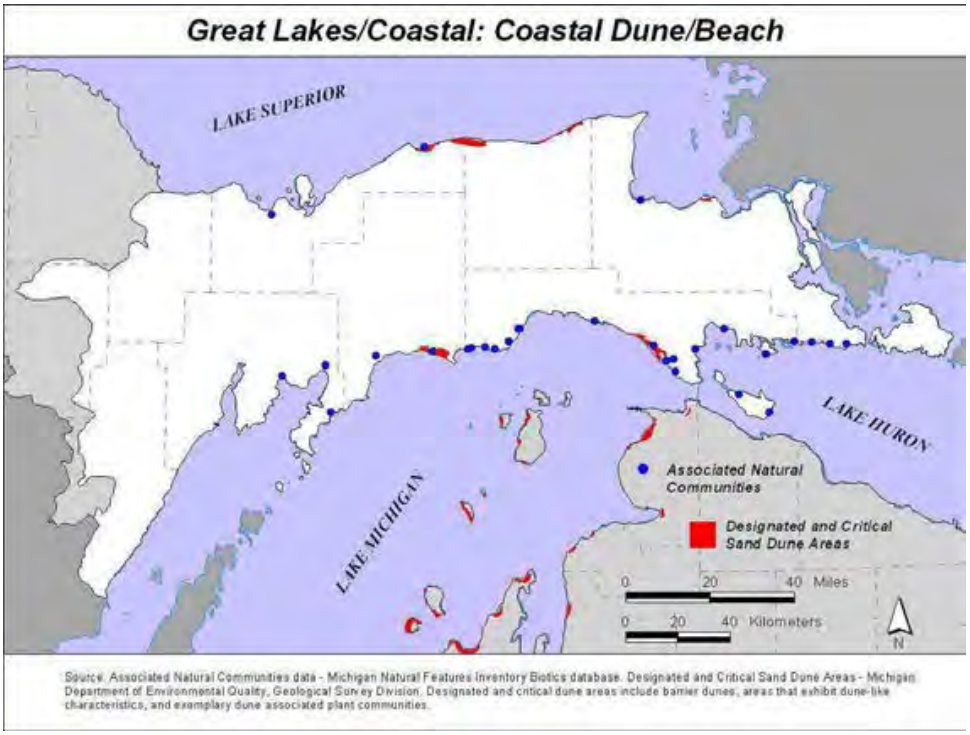


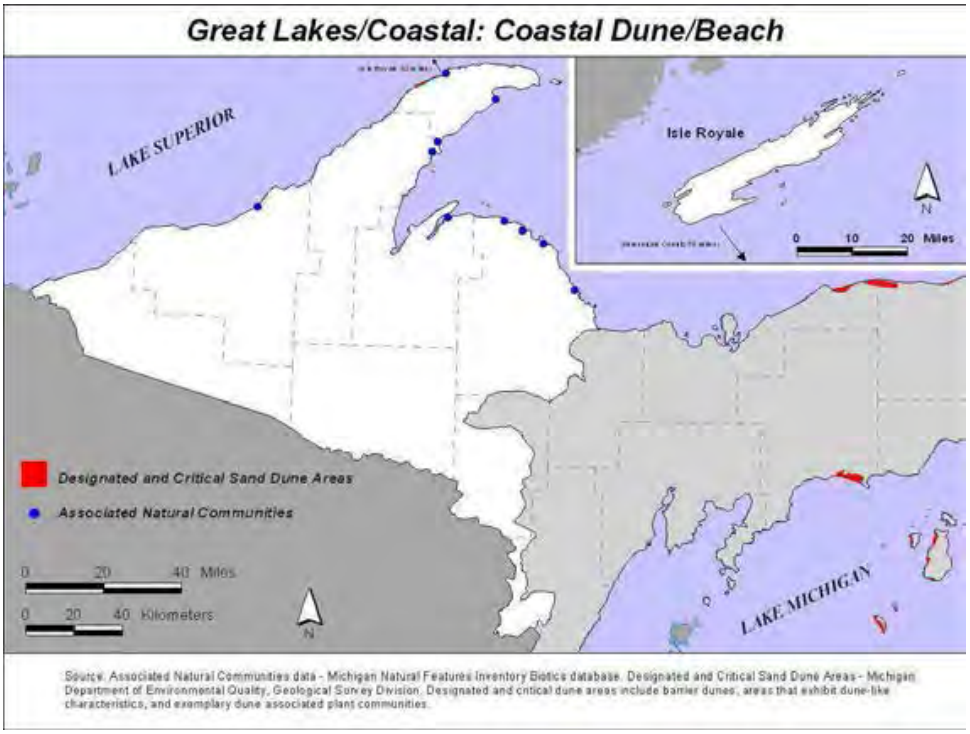

Source: Associated Natural Communities data - Michigan Natural Features Inventory Biotics database. Designated and Critical Sand Dune Areas - Michigan Department of Environmental Quality, Geological Survey Division. Designated and critical dune areas include barrier dunes, areas that exhibit dune-like characteristics, and exemplary dune associated plant communities.

## Great Lakes/Coastal: Coastal Dune/Beach




Source: Associated Natural Communities data - Michigan Natural Features Inventory Biotics database. Designated and Critical Sand Dune Areas - Michigan Department of Environmental Quality, Geological Survey Division. Designated and critical dune areas include barrier dunes, areas that exhibit dune-like characteristics, and exemplary dune associated plant communities.



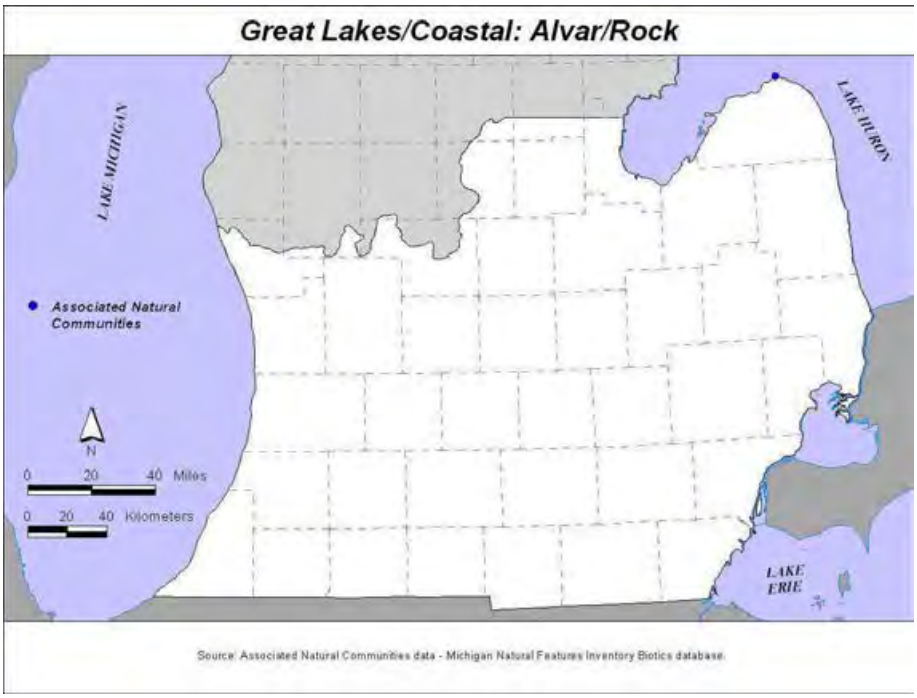



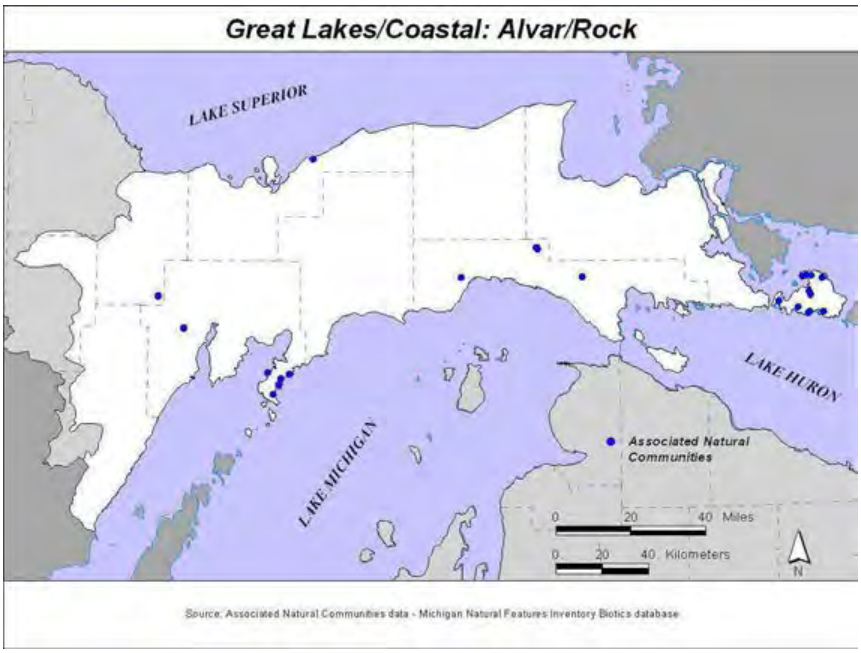

## Great Lakes/Coastal: Alvar/rock

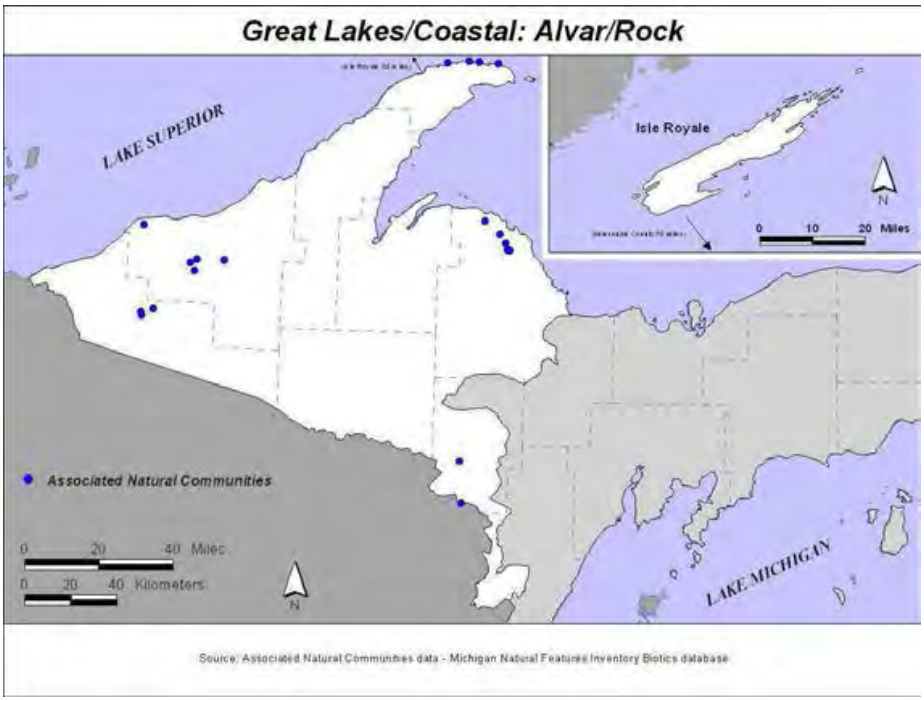
Description: Alvar/rock Great Lakes features represent the various rocky shoreline areas along the Great Lakes. Alvar/rock includes a wide variety of distinct bedrock types including limestone, sandstone, basalt, volcanic conglomerate, and other igneous and metamorphic bedrock types. While all of the shoreline bedrock communities are considered rare in Michigan, alvar or limestone pavement

lakeshores is an ecologically significant natural community that is considered globally rare. Alvar communities generally have a distinctive vegetative zonation from the non-vegetated wave-swept shoreline to the more densely vegetated herbaceous or shrubby areas inland that grade into the upland forest. Because of their stability and diversity of habitats, alvars generally possess very diverse plant communities.

Associated Natural Communities: Sandstone Lakeshore Cliff





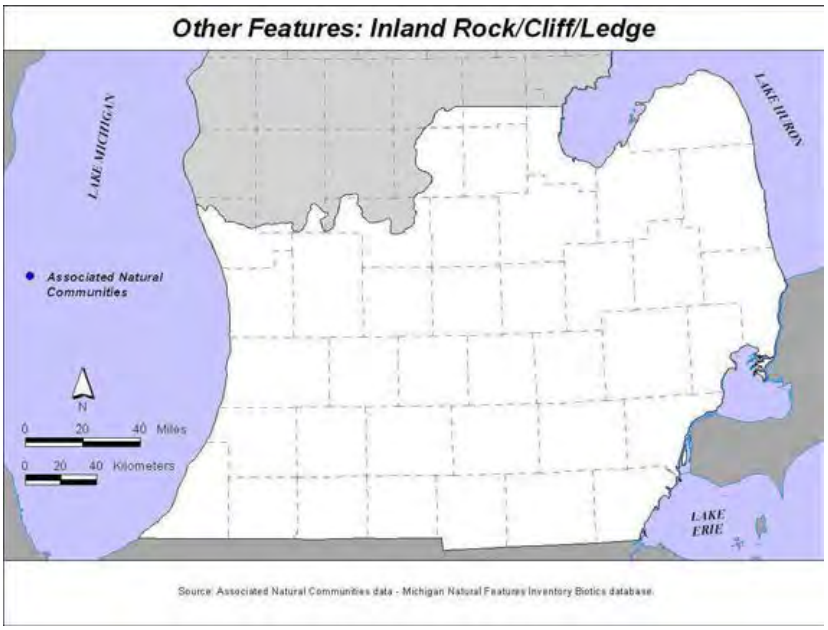



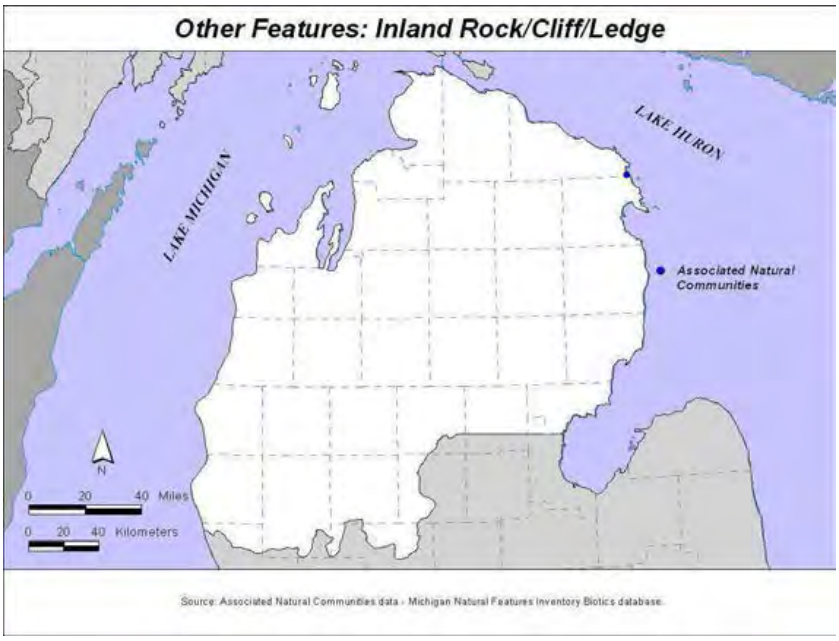

## Other Features: Inland rock/cliff/ledge

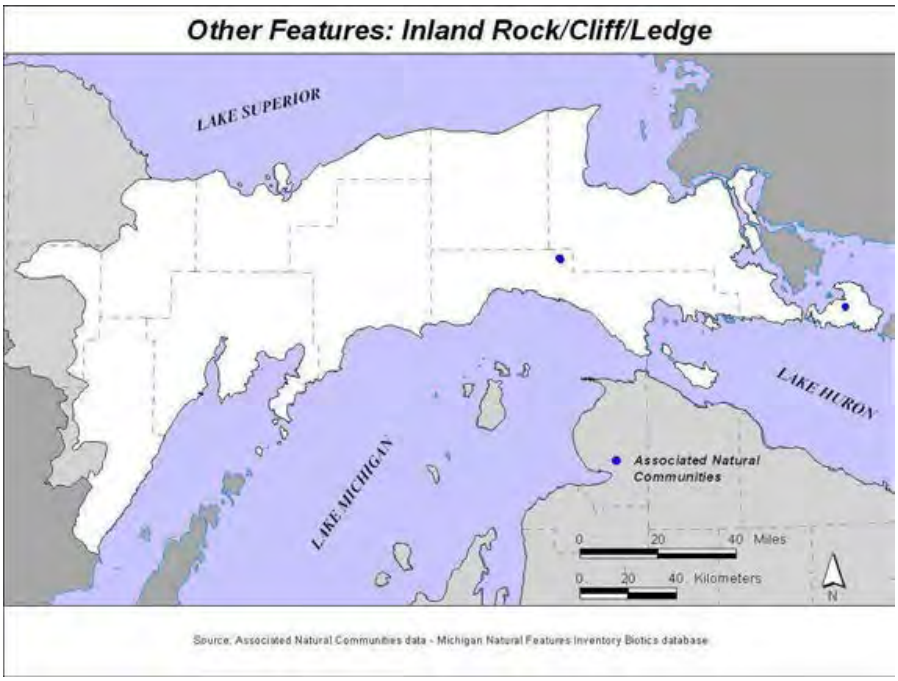
Description: Inland rock/cliff/ledge areas generally represent inland areas with significant rock substrate, including rock outcrops, rocky cliffs, and other areas that generally have significant rock available for wildlife use. Cliffs are geological features that form from a variety of rock types and erosion processes. Cliffs present very unique environmental conditions that allow for very specialized plant and animal associations. Rock outcrops are rocky areas that lack vegetation or differ in vegetation from the surrounding communities (these are often forest openings) due to the presence of rock on or near the

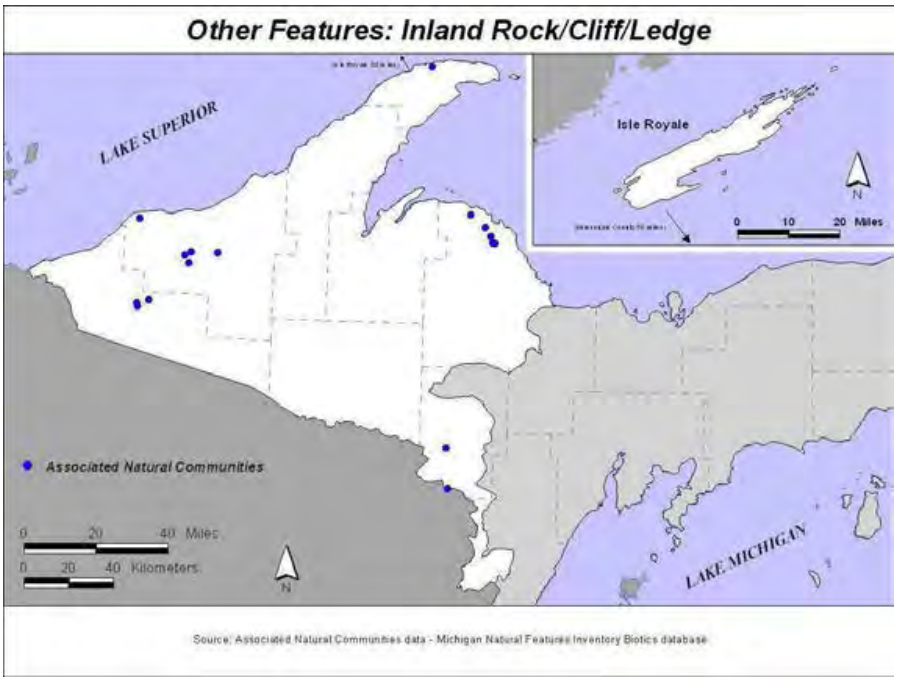
land surface. Where rock isn't exposed, thin soils result in droughty conditions with sparse herbaceous communities, low shrubs, and/or stunted trees.

Associated Natural Communities: Moist Acid Cliff



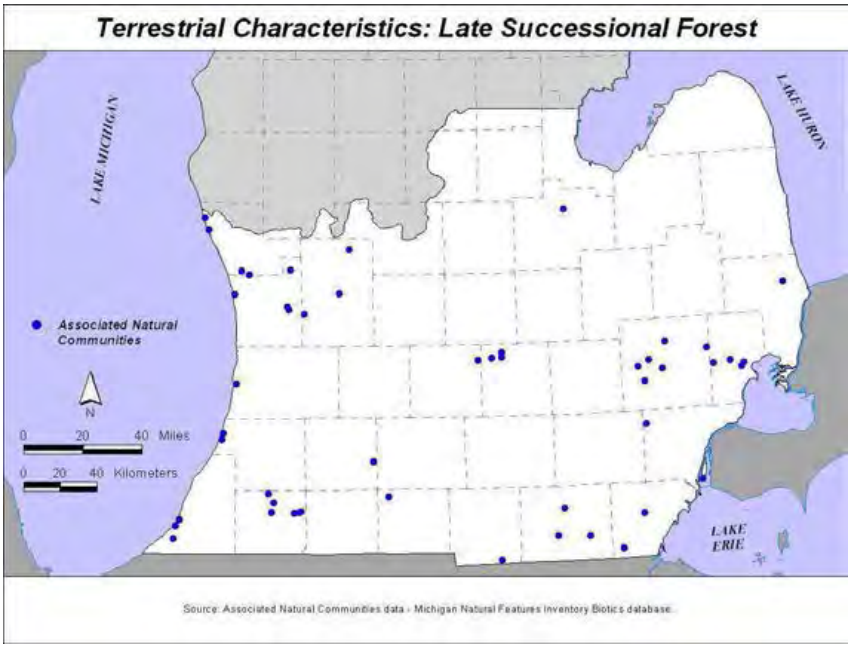


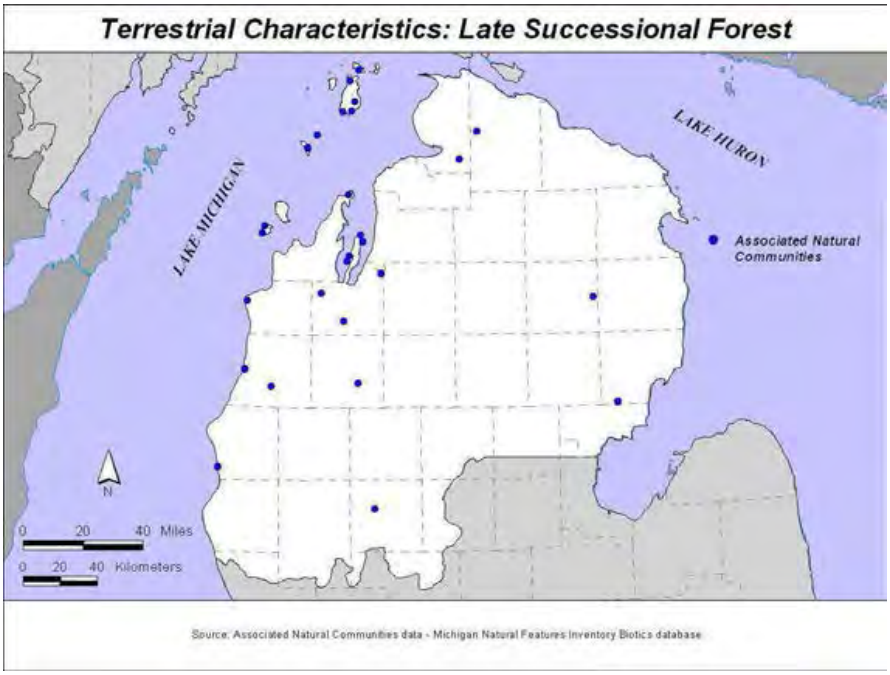




## Terrestrial characteristics: Late successional forest

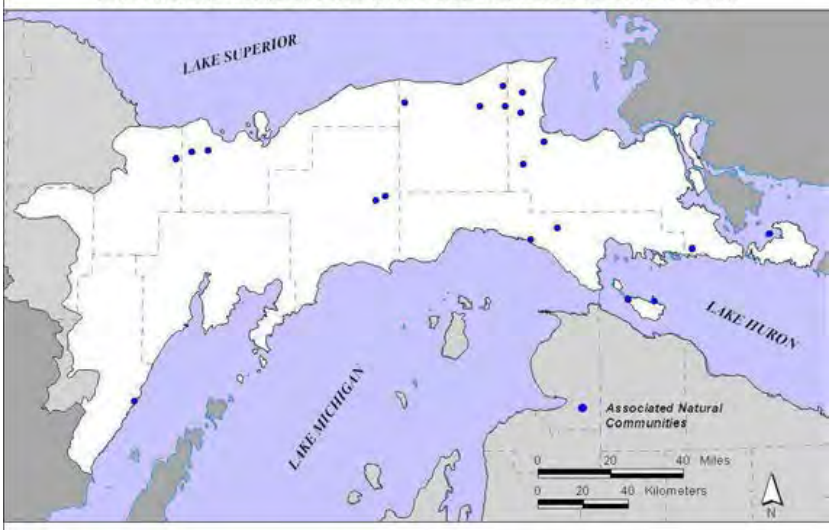
Description: Late successional forests are forests that have experienced many decades or centuries without significant environmental disturbance. Plant communities of these forests have gone through a series of successional stages over time. The natural disturbance regime is characterized by gap phase dynamics: frequent, small windthrow gaps allow for the regeneration of the shade-tolerant canopy dominants. In Michigan, late successional forests commonly include hemlock (Tsuga canadensis), sugar maple (Acer saccharum), American beech (Fagus grandifolia), and yellow birch (Betula alleghaniensis).

Associated Natural Communities: Mesic northern forest; Mesic southern forest



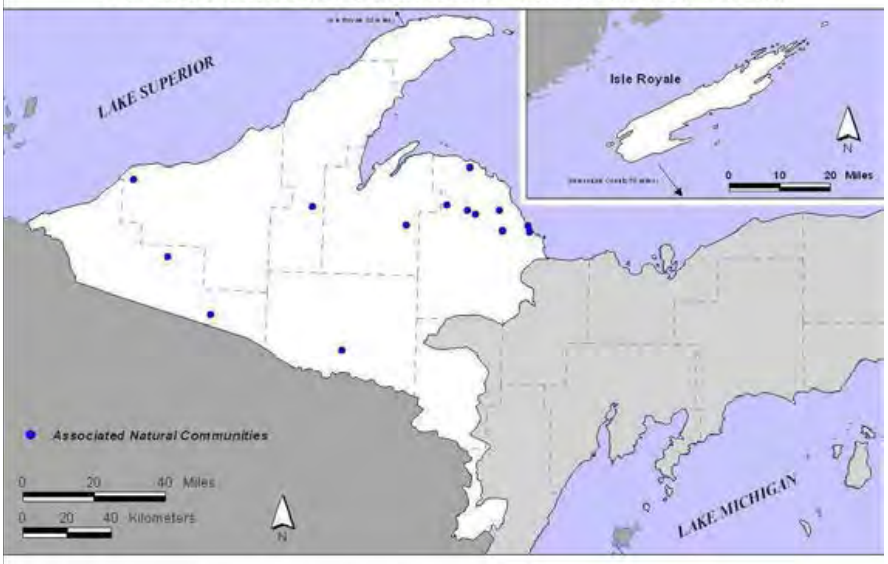



## Terrestrial Characteristics: Late Successional Forest




Source: Associated Natural Communities data - Michigan Natural Features Inventory Biotics database

## Terrestrial Characteristics: Late Successional Forest




Source: Associated Natural Communities data - Michigan Natural Features Inventory Biotics database