

# Allegan State Game Area Compartment 23 Review



Prepared by:

Aaron P. Kortenhoven and Jesse M. Lincoln  
Michigan Natural Features Inventory  
P.O. Box 13036  
Lansing, MI 48901-3036

For:

Michigan Department of Natural Resources

Wildlife Division

Dec 18, 2017

Report Number 2017-15



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## ACKNOWLEDGEMENTS

Funding for this project was provided by the Wildlife Division of the Michigan DNR. We express our sincere gratitude to the numerous DNR staff that helped administer and guide this project including Michael Donovan, Patrick Lederle, Ann LeClaire-Mitchell, Steve Chadwick, Mark Sargent, Mark Mills, Maria Albright, Keith Kluting, Jesse Bramer, Nathan Poley, Nick Dohm, Brian Maki, and Mark MacKay. This report relies on data collected by many present and former MNFI field scientists, especially: Joshua Cohen, Dennis Albert, Mike Penskar, Mike Kost, Justin Burchet, Aaron Kortenhoven, and Mike Monfi ls. For their support and assistance throughout this project, we thank our MNFI colleagues, especially Rebecca Rogers, Helen Enander, Phyllis Higman, Kraig Korroch, Nancy Toben, Ashley Adkins, and Brian Klatt.

### **Suggested Citation:**

Aaron P. Kortenhoven, Lincoln J M. 2017. Allegan State Game Area Compartment 23 Review. Michigan Natural Features Inventory Report Number 2017-15, Lansing, MI. 28 pp.

**Cover Photo:** Mesic Southern Forest in Allegan State Game Area. Photo by Aaron P. Kortenhoven. Photos throughout the document by Aaron P. Kortenhoven unless otherwise noted.

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## INTRODUCTION

At 50,656 acres Allegan State Game Area (ASGA) is one of the largest blocks of public land in southern Michigan (Figure 1). Because the landscape surrounding Allegan SGA is dominated by agriculture and rural development, the area of natural cover in the game area serves as an important island of biodiversity for the local region. Allegan SGA functions as a biodiversity “hotspot.”

During 2011 and 2012, the Department of Natural Resources (DNR) and Michigan Natural Features Inventory (MNFI) conducted the Stage 1 survey of ASGA as part of the DNR’s Michigan Forest Inventory (MiFI). This project is part of a long-term effort by the DNR Wildlife Division (WLD) to document and sustainably manage areas of high conservation significance on state lands. During the survey information was collected on basic stand data which helped target the locations of previously undocumented exemplary natural community presented in this report.

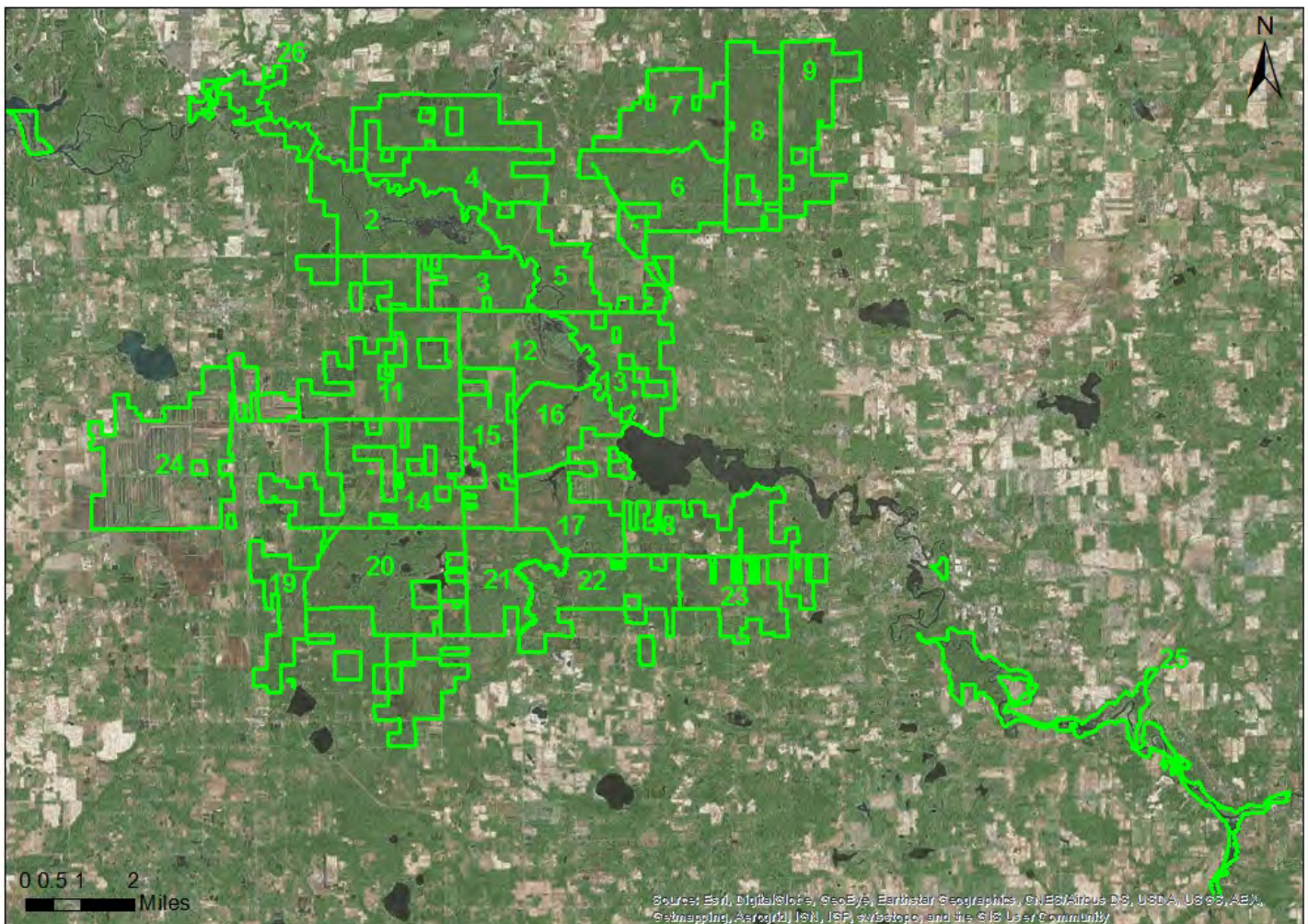
Allegan State Game Area is in the middle of Allegan County and contains 25 compartments (Figure 1). Compartment 23 is 1679 acres and is in the far southeast of the game area. Our review is intended to complement ongoing management plans by WLD. This report will provide an overview of the historical and ecoregional context of ASGA and Compartment 23, give an overview of known element occurrences and natural communities in Compartment 23, and provide management recommendations for these natural communities. Much

of the information in this report was gathered from MNFI’s Biotics database and the MNFI website which provides descriptions of natural communities, rare plants and rare animals. We made field visits to key areas in the compartment this fall before preparing the report. These visits are an integral part of the process as they ensure we present accurate and up to date information in our compartment reviews.

The focus of this project and this report is on native biodiversity with an emphasis on high-quality ecosystems. Biodiversity stewardship considerations are included in the report and we acknowledge that the DNR manages for multiple values including wildlife management, hunting and other wildlife related recreation, as well as biodiversity, and that the report does not necessarily reflect the planned management actions of the DNR.

### *Ecoregional Context*

The regional landscape ecosystems of Michigan have been classified and mapped based on an integration of climate, physiography, soils, and natural vegetation (Albert 1995) (Figure 2). This classification system can be useful for conservation planning and integrated resource management because it provides a framework for understanding the distribution patterns of species, natural communities, anthropogenic activities, and natural disturbance regimes.



**Figure 1.** Compartment boundaries and land cover in and around Allegan State Game Area.

The classification has a hierarchical structure with three levels in a nested series, from broad landscape regions called sections, down to smaller subsections and sub-subsections.

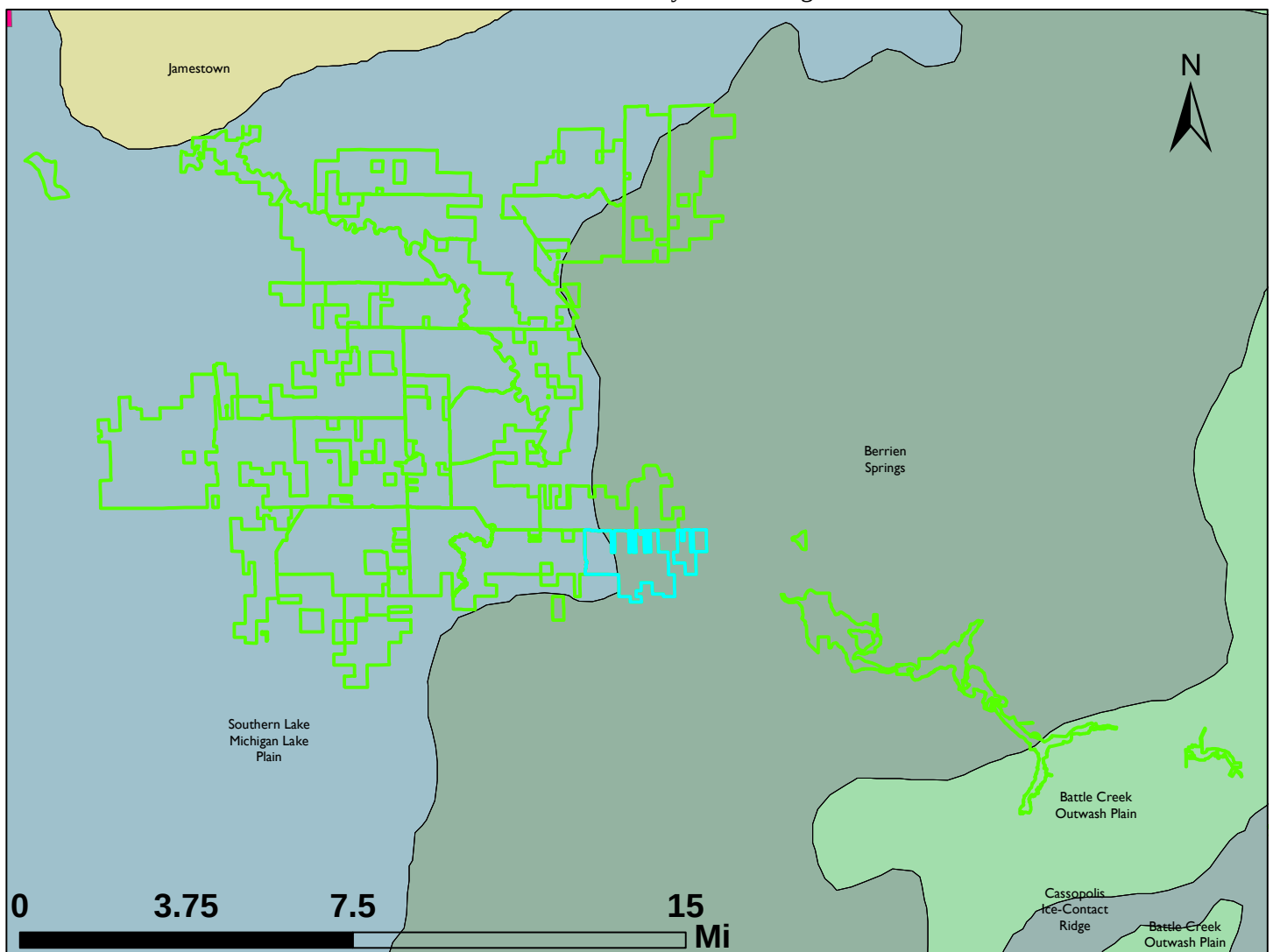
Allegan SGA lies mostly within the Allegan subsection (Subsection VI.3), and within two sub-subsections, the Berrien Springs (Sub-subsection VI.3.1) and Southern Lake Michigan Lake Plain (Sub-subsection VI.3.2). Most of the game area occurs in the Southern Lake Michigan Lake Plain with small portions in the eastern portion of the game area occurring in the Berrien Springs (Figure 2).

The Allegan subsection is bounded by Lake Michigan to the west and the typical land forms are flat lake plain, coastal sand dunes, gently rolling till plain, and rolling to steep end moraines. Several of the state's major rivers cross the subsection, including the Kalamazoo, St. Joseph, Grand and Muskegon (Albert 1995).

Compartment 23 falls mostly Berrien Springs Sub-subsection and partially within the Southern Michigan Lake Plain Sub-subsection.

Berrien Springs consists of a 10-to-20-mile-wide band of ground moraine and endmoraine ridges running parallel to Lake Michigan. The moraines are bounded by flat lake plain to the west and outwash to the east. Most of the ridges are 60 to 100 feet high with moderate to steep slopes. Kettle lakes occur at a low density on the end moraines. There are a few long narrow lakes on the ground moraine. Several small streams originate on the upland ridges of the sub-subsection. Three large rivers, the Paw Paw, St. Joseph, and Kalamazoo, cut through the moraine ridges, creating steep ravines (Albert 1995).

The Southern Lake Michigan Lake Plain is characterized by extensive lake plain features associated with historic levels of Lake Michigan that were higher during periods of glacial recession. Sand dunes inland from present-day lake Michigan shoreline are associated with historic



**Figure 2.** Eco Regions in Allegan State Game Area (Albert 1995).

shoreline. Deep sands were deposited over the lake plain during outwash events that formed the Kalamazoo, Grand, and Muskegon River channels. Coastal sand dunes are concentrated at the mouths of these and other river systems along the extent of the subsubsection.

There are a few small kettle lakes on the sand lake plain. The water level of many of these lakes fluctuates greatly, leaving them almost dry in some summers and inundated in spring. Distinct disjunct flora from the Atlantic and Gulf Coastal Plains are found along the margins of many lakes. The presence of these disjuncts is a result of present day fluctuations, historical Great Lakes fluctuations, and the abundance of migrating waterfowl. Throughout the lake plain, sandy soils are excessively drained and fire prone, while other areas have lenses that restrict drainage and allow for periodic inundation (Albert 1995).

Interpretations of the General Land Office surveyor notes by MNFI ecologists indicate that ASGA contained several distinct vegetation assemblages *circa* 1800 (Comer et al. 1995). Surveyors recorded tree species composition, tree size, and general condition of the region. Historically, much of the game area was a mosaic of oak-pine forest and barrens (savanna) ecosystems characterized by large open-grown oaks and pines with an herbaceous layer consisting of both prairie and forest species (Figure 3).

#### *Natural Communities*

Forests consisted largely of white pine and mixed oak with the white pine forming a supercanopy. Wetlands occurred in kettle depressions, outwash channels, and floodplain forests along the Kalamazoo River. Lakes, marshes, bogs, inundated shrub swamps, intermittent wetlands, coastal plain marshes, and vernal pools occupied the low areas influenced by fluctuating ground-water levels and depressions created by ice blocks from retreating glaciers. Outwash channels formed by glacial melt-waters were occupied by wet prairies, shrub swamps, and forested swamps (Cohen et al. 2014). Due to gaps in surveyor's notes historic vegetation maps may not precisely reflect the extent of some small-scale wetland systems; particularly emergent wetlands and hardwood swamps.

The upland areas of Compartment 23 were dominated by white pine-mixed-hardwood, white pine-white oak forest and oak-pine barrens. There were several inclusions of lowland forest, which included mixed conifer swamp, southern hardwood swamp, bog and coastal plain marsh (Figure 4).

In the early 1800s the dominant forest cover in Compartment 23 was white pine-mixed-hardwood and white pine-white oak forest. Based on *circa* 1800 maps, oak-pine barrens covered the northern half the compartment (Figure 4). Oak-pine barrens likely originated when prairie fires created openings after fire entered surrounding closed forests. Repeated low-intensity fires, periodic drought, frost, and windthrow maintained these barrens ecosystems. The prevalence of barren remnants during the first half of the 20<sup>th</sup> century can be seen in the 1938 aerial photos (Figure 5). Interpretation of 1938 aerial imagery shows most of Compartment 23 was not tilled prior to 1938. Since farming was nearly absent the loss of barrens was largely a result of natural succession and fire suppression. Succession and fire suppression of these historic oak-pine

barrens resulted in the closed canopy forests we see in the compartment today. Currently only a few stands containing patchy oak-pine barrens remain where this community occurred historically.

### **Summary of Compartment 23**

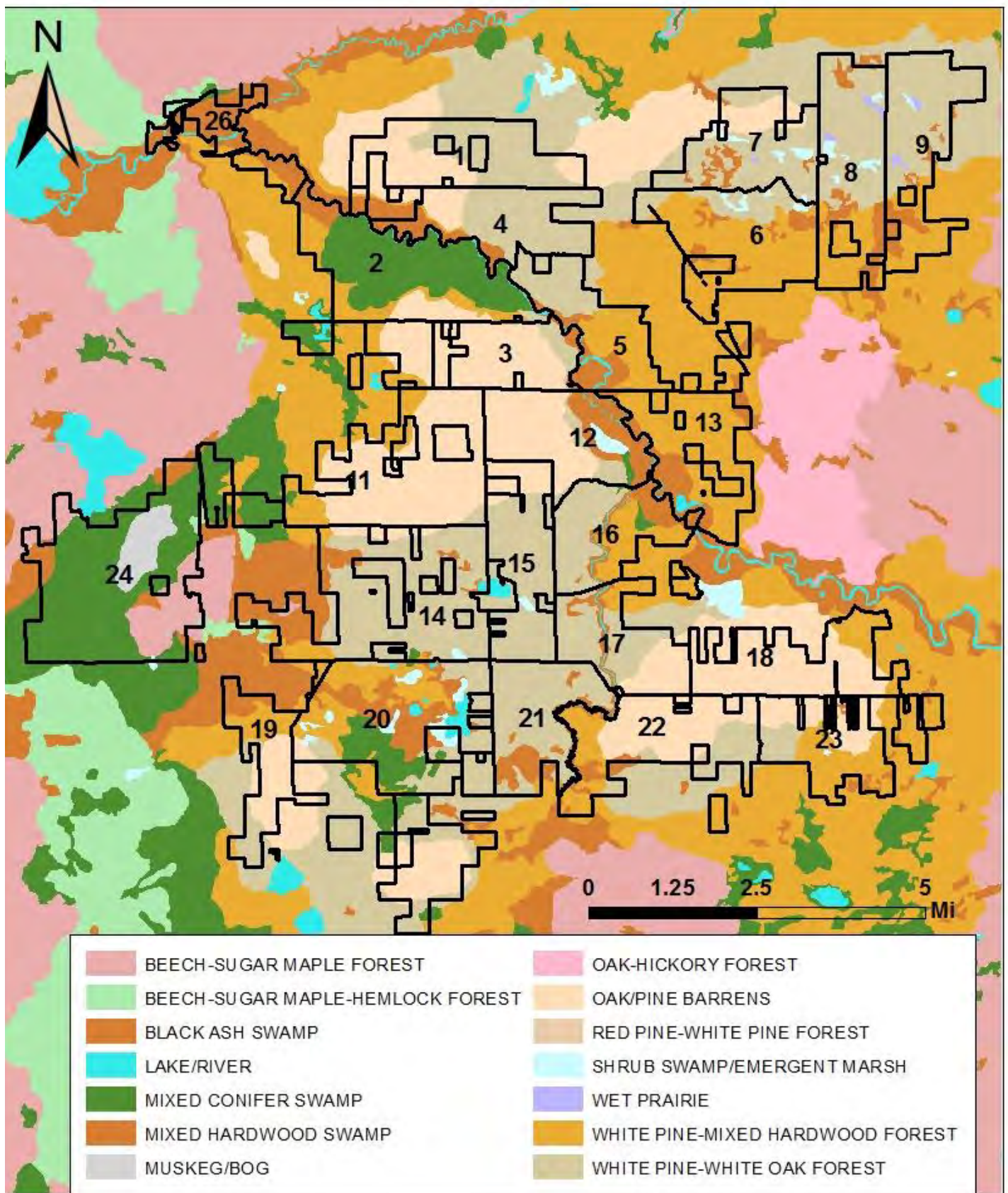
#### ***Important Natural Areas***

There are currently seven MNFI natural community types present in Compartment 23: Oak-Pine Barren, Southern Hardwood Swamp, Mesic Southern Forest, Dry-Mesic Southern Forest, Coastal Plains Marsh and Bog. The other prevalent forest type present resembles Dry-Mesic Northern Forest with the conifer component absent, likely a result of past logging practices.

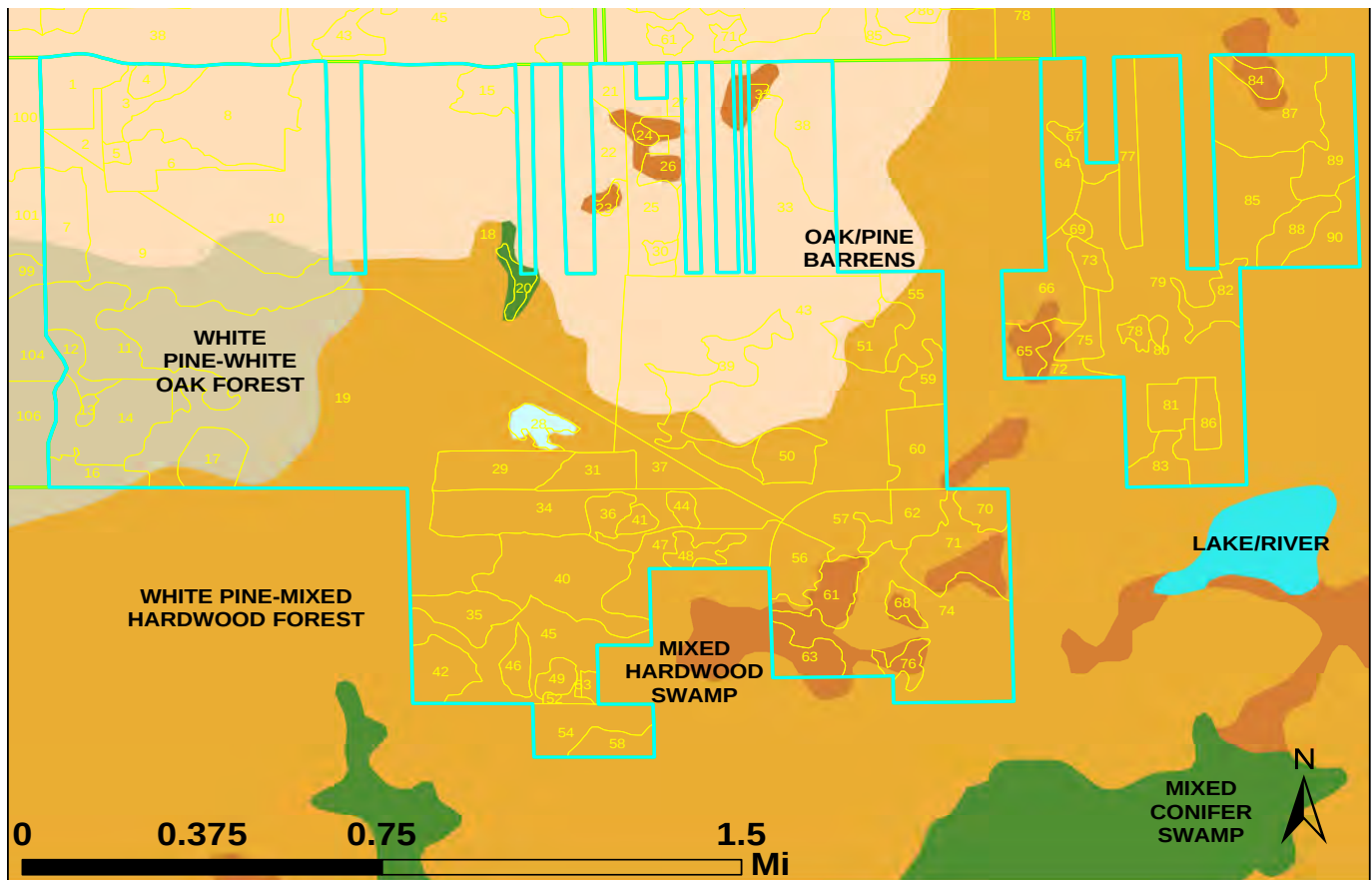
Oak pine barrens can be found in stands 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10. Southern Hardwood Swamp is found in stands 38 and 76. Mesic Southern Forest is found in stands 35, 40, 48, 72, 82, and 90. Dry-Mesic Southern Forest is found in stands 11, 15, 18, 19, 21, 22, 25, 30, 33, 43, 55 and 74. Coastal Plains Marsh was located in stand 28. Bog was located in stand 61.

The dominant forest type in Compartment 23 today is white oak/black oak forest resembling Dry-Mesic Northern Forest. The canopy white pine component once prevalent in compartment pre-European settlement is nearly absent. White pines persist in the sub-canopy. Most forests in this compartment are characterized by white oak (*Quercus alba*), black oak (*Q. velutina*), red oak (*Q. rubra*), and red maple (*Acer rubrum*) as canopy dominants. Bracken fern (*Pteridium aquilinum*), huckleberry (*Gaylussacia bccata*) and greenbrier (*Smilax spp.*) often dominate the shrub layer. Species less prevalent in the shrub layer include serviceberries (*Amelanchier spp.*), witch hazel (*Hamamelis virginiana*), flowering dogwood (*Cornus florida*), and blueberries (*Vaccinium spp.*). Some of these forested stands have small open areas containing little bluestem (*Schizachyrium scoparium*), black oatgrass (*Piptochaetium avenaceum*), and goat's rue (*Tephrosia virginiana*). The lowland forests in Compartment 23 were Southern Hardwood Swamp historically. Some of these areas retain mature Southern Hardwood Swamp with a canopy dominance of red maple (*Acer rubrum*), swamp white oak (*Q. bicolor*), tulip poplar (*Liriodendron tulipifera*) and sycamore (*Platanus occidentalis*). The ash component in these swamp forests has been eliminated by emerald ash borer. Mesic areas in Compartment 23 have some of the best examples of Mesic Southern Forest in ASGA. Several forested areas in Compartment 23 exhibit pit-mound topography which is an indicator that the soil has remained untilled for several hundred years.

There are no documented forested element occurrence (EO) natural communities in Compartment 23, however there are several high quality mature forests that provide enormous benefit to wildlife. Maintaining these areas of mature forest in a mosaic of early successional forests is beneficial to both game and non-game species. These mature forests provide mast trees which are critical for white-tailed deer, fox squirrel and wild turkey during the fall as they increase their fat building caloric intake of acorns and beechnuts in preparation for winters scarcity. In spring and summer these forests provide essential nesting habitat for numerous migratory songbirds as well as tree cavities for nesting fox squirrel and wood duck.



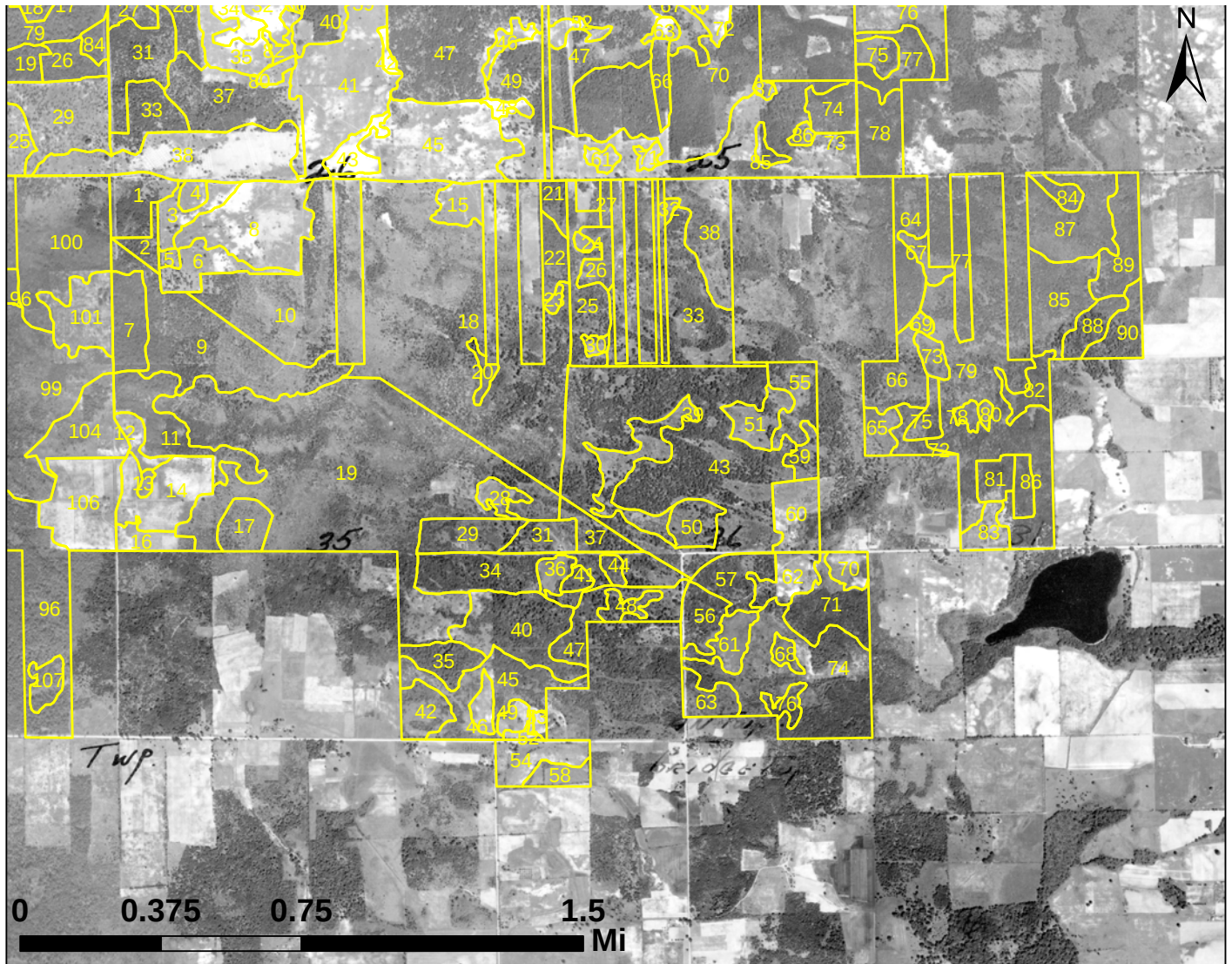
**Figure 3.** Circa 1800s Vegetation cover of of Alleghen State Game Area (Cormer et al, 1995).



**Figure 4.** Approximate vegetation cover of Compartment 23 circa 1800 (Comer et al. 1995).



**Photo 1.** Oak-Pine Barrens in Stand 8, one of the few barrens areas still present from those seen in 1938 aerial photos.



**Figure 5.** Imagery from 1938 provides valuable insight into changes within Compartment 23 over the past 80 years. Many areas that were historically barrens are now closed canopy forest except for the northeast corner of the compartment. The transition from barrens to forested is exemplified in Photo 2 below where oak seedlings are well established.



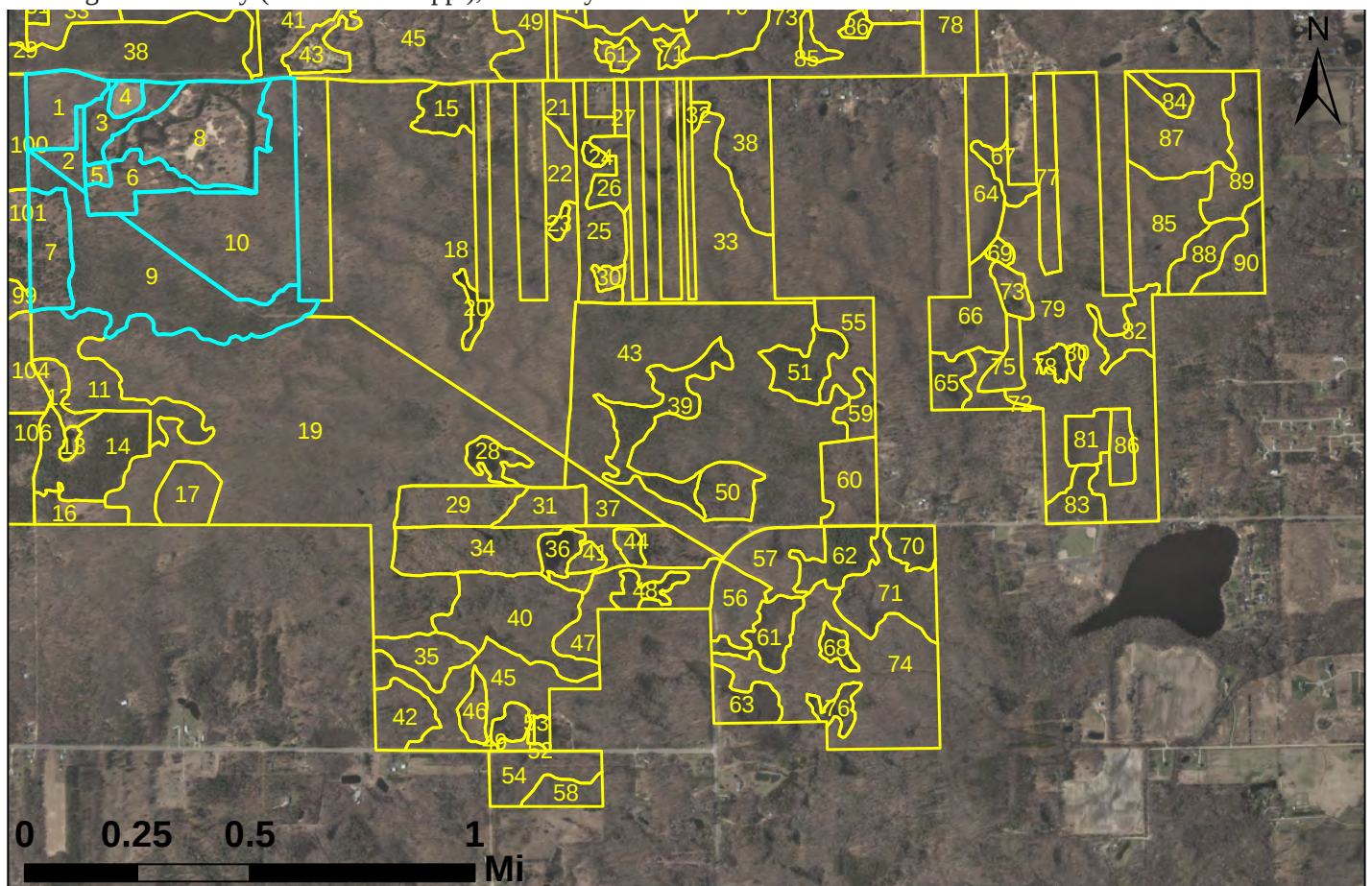
**Photo 2.** Remnant Oak-Pines Barrens with woody encroachment in Stand 8.

### Oak-Pine Barrens

Oak-pine barrens has a state rank of S2, designating it as imperiled due to restricted range and limited occurrences (less than 20 sites). The oak-pine barrens in Michigan have faced decline over the last 150 years. This decline is due to agricultural and forestry practices and the lack of fire in the landscape. Fire is a critical factor in preserving oak-pine barrens landscapes (Cohen 2000). The absence of fire and the process of natural succession has led to barrens in the area becoming closed canopy forests. Ten stands in Compartment 23 contain features of oak-pine barrens, stands: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 (Figure 6). Stands 11, 15, 18, 19, 21, 22, 25, 30, 33, 38, 39 and 43 were historically oak-pine barrens and harbor relic barrens species but are now closed canopy forest (Figure 7). Most barrens in this compartment that had less than 50% canopy in the 1930s have over 80% canopy currently (Figure 8).

Overview: The canopy layer in oak-pine barrens varies from 5 to 60% and is dominated or co-dominated by the following trees: white oak (*Quercus alba*), black oak (*Q. velutina*), northern pin oak (*Q. ellipsoidalis*), bur oak (*Q. macrocarpa*), white pine (*Pinus strobus*), red pine (*P. resinosa*), and jack pine (*P. banksiana*). These pine and oak species are also prevalent in the subcanopy as multi-stemmed shrubs of stump-sprout origin, especially where fire intensity is high. Additional tree species found in the overstory and subcanopy include red maple (*Acer rubrum*), black cherry (*Prunus serotina*), big-toothed aspen (*Populus grandidentata*), and quaking aspen (*P. tremuloides*). Characteristic shrubs include the following: serviceberry (*Amelanchier* spp.), bearberry

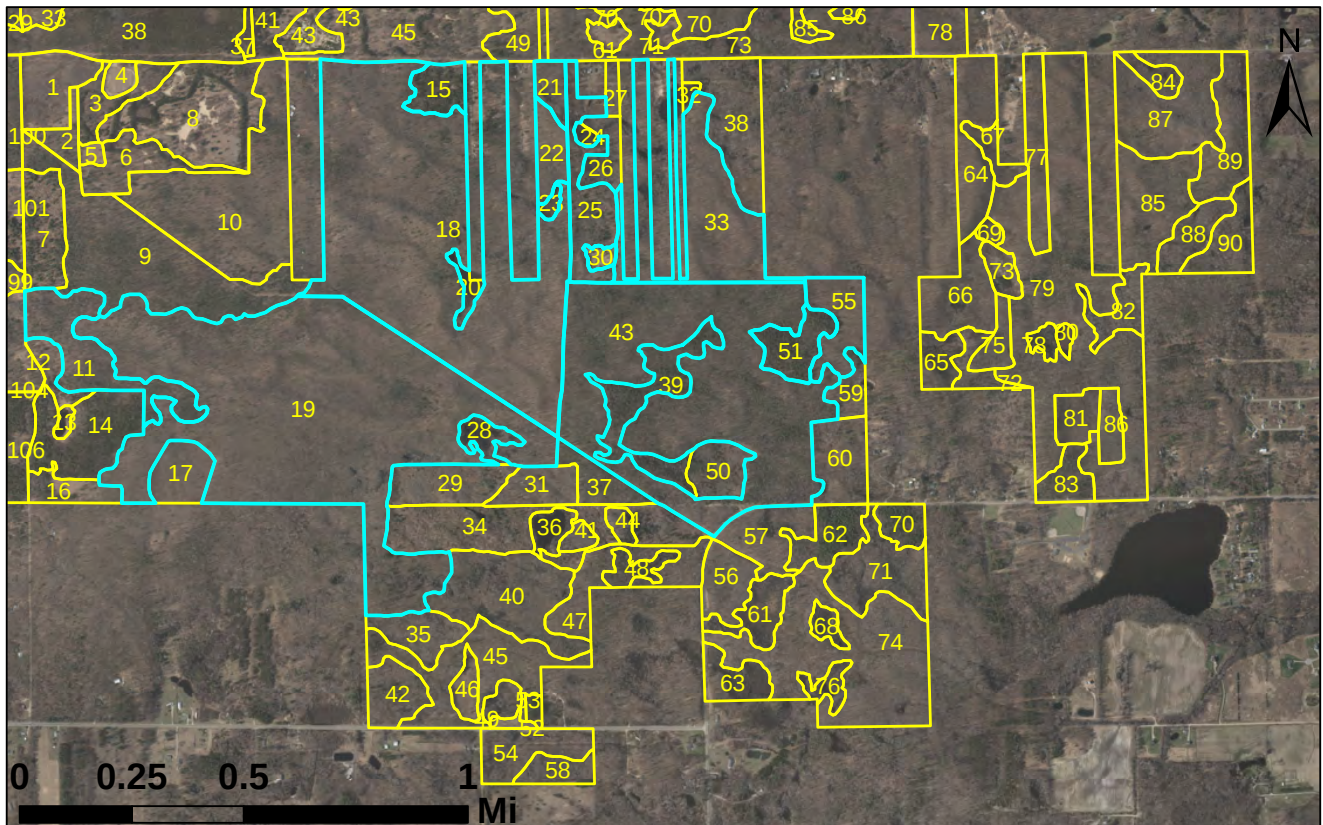
(*Arctostaphylos uva-ursi*), New Jersey tea (*Ceanothus americanus*), sweetfern (*Comptonia peregrina*), alternate-leaved dogwood (*Cornus alternifolia*), flowering dogwood (*C. florida*), American hazelnut (*Corylus americana*), beaked hazelnut (*C. cornuta*), hawthorn species (*Crataegus* spp.), huckleberry (*Gaylussacia baccata*), wild plum (*Prunus americana*), choke cherry (*P. virginiana*), sand cherry (*P. pumila*), dwarf chinquapin oak (*Quercus prinoides*), pasture rose (*Rosa carolina*), northern dewberry (*Rubus flagellaris*), prairie willow (*Salix humilis*), and low sweet blueberry (*Vaccinium angustifolium*). The ground layer is dominated by graminoids and forbs. Dominant species include little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), and Pennsylvania sedge (*Carex pensylvanica*). Pennsylvania sedge often replaces the bluestems in shaded areas and fire-suppressed communities, especially north of the transition zone. Other prevalent herbs of oak-pine barrens include false foxglove (*Aureolaria* spp.), hair grass (*Avenella flexuosa*), tickseed (*Coreopsis lanceolata*), poverty grass (*Danthonia spicata*), flowering spurge (*Euphorbia corollata*), woodland sunflower (*Helianthus divaricatus*), white pea (*Lathyrus ochroleucus*), hairy bush clover (*Lespedeza hirta*), dwarf blazing star (*Liatris cylindracea*), wild lupine (*Lupinus perennis*), wild bergamot (*Monarda fistulosa*), wood betony (*Pedicularis canadensis*), black oatgrass (*Piptochaetium avenaceum*), and prairie heart-leaved aster (*Symphyotrichum oolentangiense*). The flora of this community is a mixture of prairie and forest species, with prairie forbs and grasses more abundant in open areas and forest forbs and woody species more common in shaded areas.



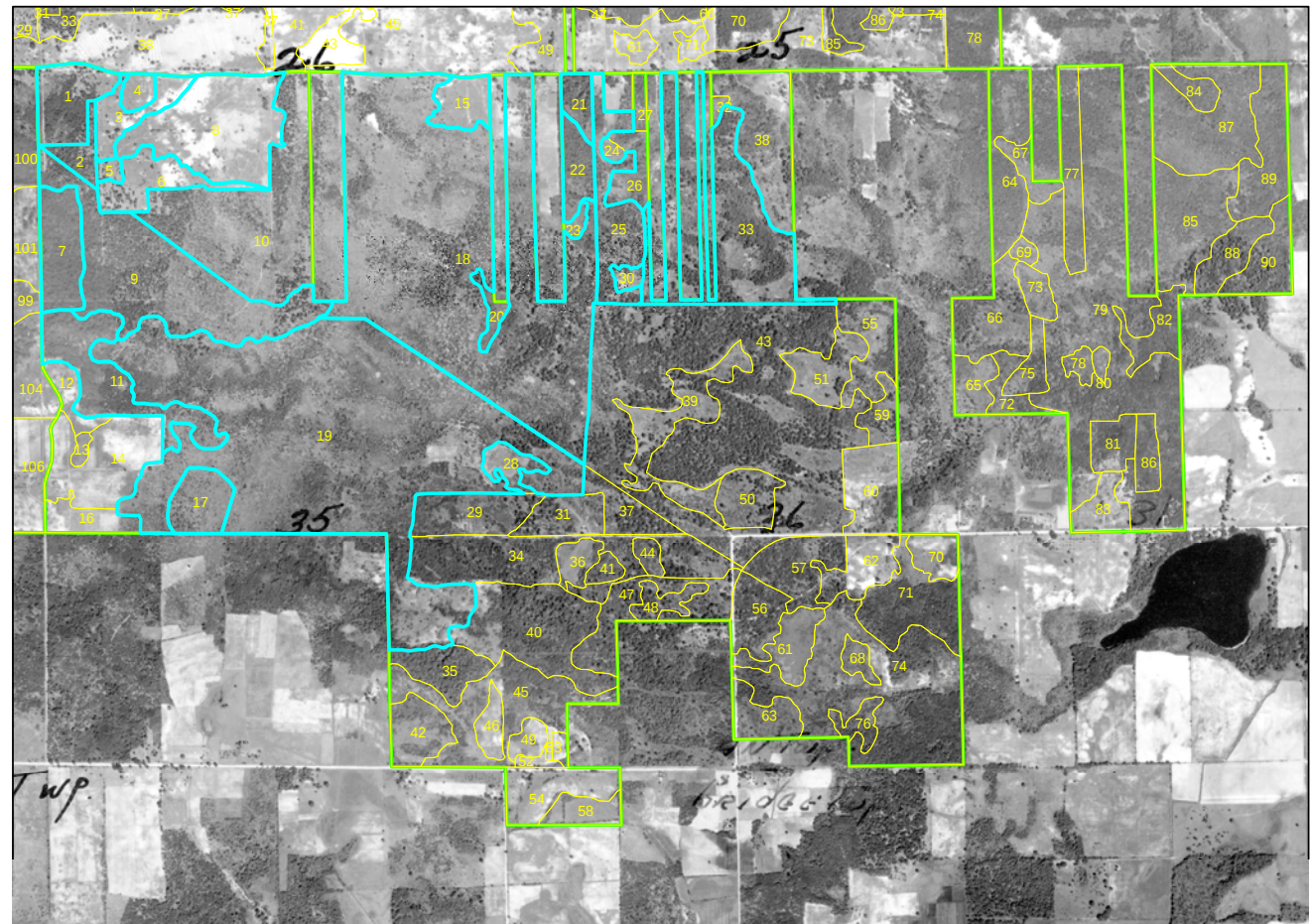
**Figure 6.** The highlighted stands are areas which contain Oak-Pine Barrens.



**Photo 3 and 4.** Characteristic Oak-Pine Barren structure in Compartment 23 showing young trees with areas of woody encroachment. Woody encroachment in the top photo could be mowed back.



**Figure 7.** The highlighted stands were historically Oak-Pine Barrens but are now closed canopy Dry-Mesic Northern Forest. Canopy cover is noticeably greater than in the 1938 aerial photo in Figure 8.



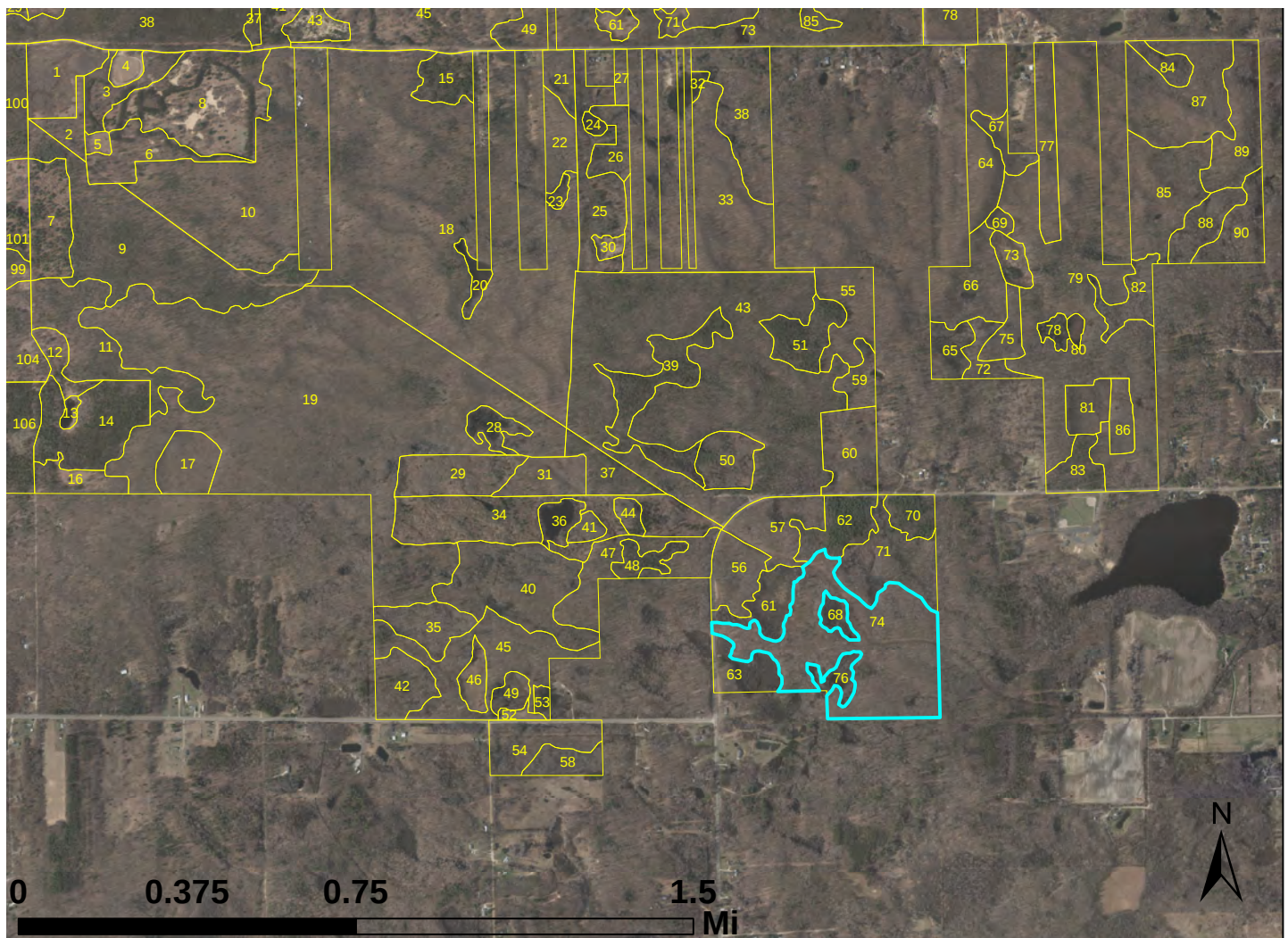
**Figure 8.** The highlighted stands are areas that were historic Oak-Pine Barrens.

### *Dry-Mesic Southern Forest*

Dry-Mesic Southern Forest exhibiting moderate to high canopy diversity in Allegan SGA is uncommon. Stand 74 is one of the better examples of this forest type in the SGA (Figure 9). The canopy dominance in this stand is red oak, white oak, tulip poplar, red maple and a sparse distribution of black cherry. Red oaks more than 24 inches in DBH and over 90 years old are not uncommon in Stand 74. This is the only upland oak forest in Compartment 23 where red oaks equaled black oaks in density.

**Overview:** The canopy layer in Dry-Mesic Southern Forest is generally dominated or codominated by white oak (*Quercus alba*) and black oak (*Quercus velutina*), with white oak being the more frequent dominant. Red oak (*Q. rubra*) can occur as a canopy codominant, especially where soils and topographic position favor less droughty conditions such as north- to east-facing slopes and footslopes. Hickories such as pignut hickory (*Carya glabra*), shagbark hickory (*C. ovata*), and bitternut hickory (*C. cordiformis*) are often canopy codominants. Prevalent canopy associates may include red maple (*Acer rubrum*), white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), Hill's oak (*Quercus ellipsoidalis*),

basswood (*Tilia americana*), and sassafras (*Sassafras albidum*). Prevalent species of the subcanopy include red maple, hickories, alternate-leaved dogwood (*Cornus alternifolia*), flowering dogwood (*C. florida*), ironwood (*Ostrya virginiana*), cherries (*Prunus* spp.), and sassafras. Characteristic shrubs include serviceberries (*Amelanchier* spp.), witch hazel (*Hamamelis virginiana*), and choke cherry (*Prunus virginiana*). In fire-suppressed systems, mesophytic trees and shrubs are often dominant in the subcanopy and shrub layers. Typical herbaceous species include doll's eyes (*Actaea pachypoda*), hog peanut (*Amphicarpaea bracteata*), jack-in-the-pulpit (*Arisaema triphyllum*), bearded shorthusk (*Brachyelytrum erectum*), hairy woodland brome (*Bromus pubescens*), white bear sedge (*Carex albursina*), rosy sedge (*C. rosea*), enchanter's nightshade (*Circaea canadensis*), spotted coral-root (*Corallorhiza maculata*), pointed-leaf tick-trefoil (*Hylodesmum glutinosum*), naked-flower tick-trefoil (*H. nudiflorum*), fragrant bedstraw (*Galium triflorum*), black snakeroot (*Sanicula marilandica*), and bristly greenbrier (*Smilax hispida*).



**Figure 9.** Mature Dry-Mesic Southern Forest in Stand 74 provides an opportunity for protecting late-succession forest and providing habitat for salamanders and a myriad of bird species.



**Photo 5.** Dry-Mesic Southern Forest in Stand 74 provides ideal salamander and warbler habitat given the abundance of large fallen trees, vernal pools, shrub swamps and large canopy trees.



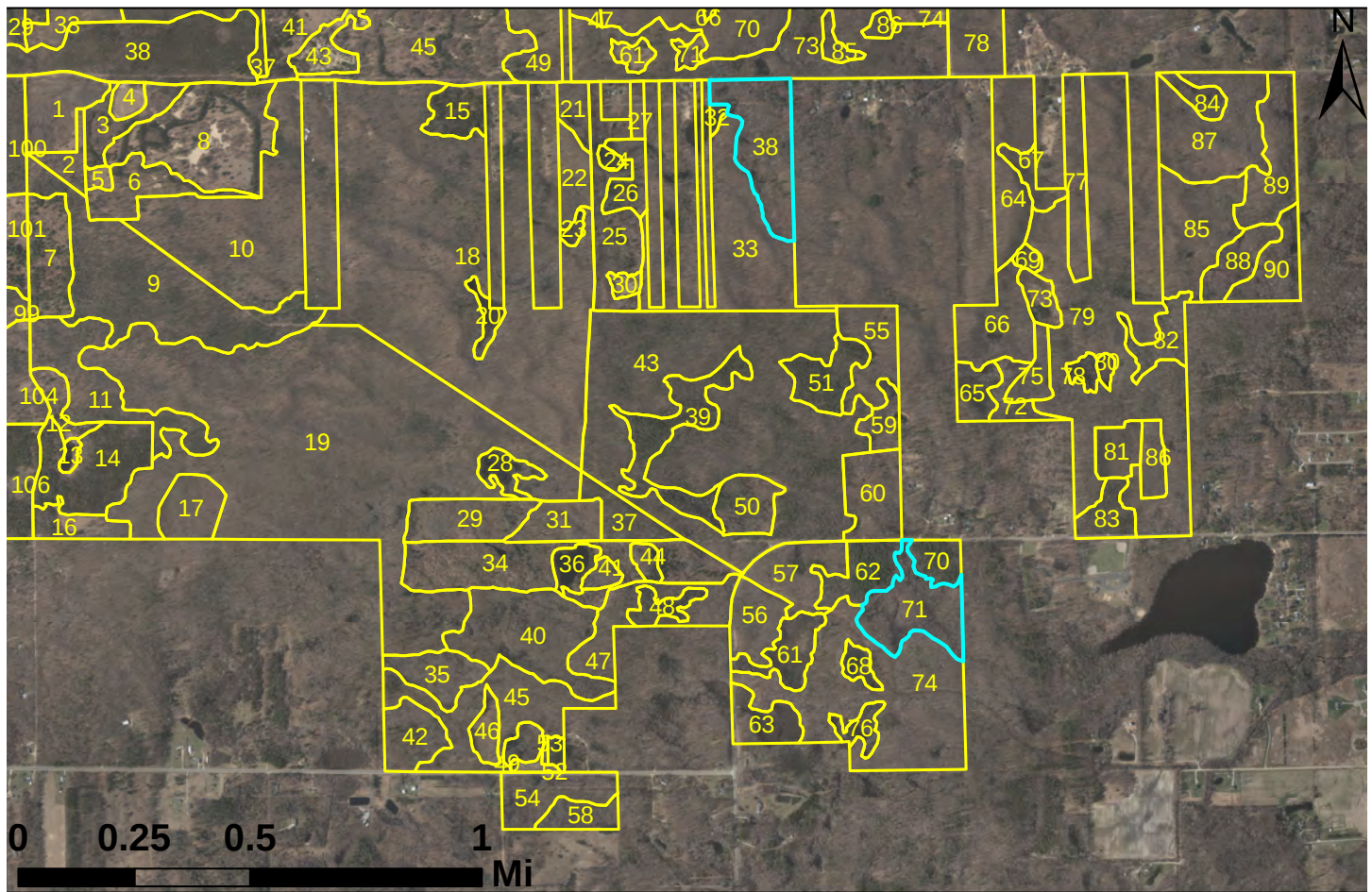
**Photo 6.** Dry-Mesic Southern Forest in Stand 74 with a dry vernal pool in the background.

### Southern Hardwood Swamp

The distribution of Southern Hardwood Swamps is sporadic in ASGA. Stand 38 and 71 are excellent examples of this natural community (Figure 10). Southern hardwood swamp provides critical habitat for a variety of animal species. The community provides breeding and foraging habitat for amphibians, and reptiles, including the state-listed spotted turtle (*Clemmys guttata*), Kirtland's snake (*Clonophis kirtlandii*), and Blanding's turtle (*Emydoidea blandingii*), red-shouldered hawk (*Buteo lineatus*). Indiana bat (*Myotis sodalist*, Federally listed) also nest and roost in southern hardwood swamps.

Overview: Vegetation dominance varies based largely on substrate characteristics, hydrology, and regional floristic distribution patterns. Sites on mineral soil that experience significant periods of inundation and seasonal water level fluctuation are typically dominated by silver maple (*Acer saccharinum*) and green ash (*Fraxinus pennsylvanica*), with red maple and pin oak (*Quercus palustris*) often as important subdominants. Tree species typical of floodplain forest are often present, including hackberry (*Celtis occidentalis*), sycamore (*Platanus occidentalis*), and cottonwood (*Populus deltoides*). Other associates include sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), black ash (*F. nigra*), tulip tree (*Liriodendron tulipifera*), quaking aspen (*Populus tremuloides*), swamp

white oak (*Quercus bicolor*), bur oak (*Q. macrocarpa*), red oak (*Q. rubra*), basswood (*Tilia americana*), and American elm (*Ulmus americana*). Prior to the introduction and spread of Dutch elm disease, American elm was an important canopy constituent, but is now largely relegated to the subcanopy and sapling layers. Other common understory species include saplings of canopy tree species (especially silver and red maple), musclewood (*Carpinus caroliniana*), and witch hazel (*Hamamelis virginiana*). Characteristic shrub species include spicebush (*Lindera benzoin*), elderberry (*Sambucus canadensis*), winterberry (*Ilex verticillata*), and buttonbush (*Cephalanthus occidentalis*). The ground layer is characteristically sparse due to prolonged inundation during the early growing season. Commonly encountered species include false nettle (*Boehmeria cylindrica*), marsh marigold (*Caltha palustris*), spring cress (*Cardamine bulbosa*), pink spring cress (*C. douglassii*), fowl manna grass (*Glyceria striata*), jewelweed (*Impatiens capensis*), swamp buttercup (*Ranunculus hispidus*), bishop's cap (*Mitella diphylla*), wild geranium (*Geranium maculatum*), dwarf raspberry (*Rubus pubescens*), spinulose woodfern (*Dryopteris carthusiana*), cinnamon fern (*Osmundacinnamomea*), sedges (*Carex gracillima*, *C. intumescens*, *C. radiata*, and *C. stipata*), poison ivy (*Toxicodendron radicans*), and Virginia creeper (*Parthenocissus quinquefolia*).



**Figure 10.** Mature Southern Hardwood Swamp in the highlighted stands provides an opportunity for protecting late-succession forest and providing amphibian and avian habitat for SGCN species.



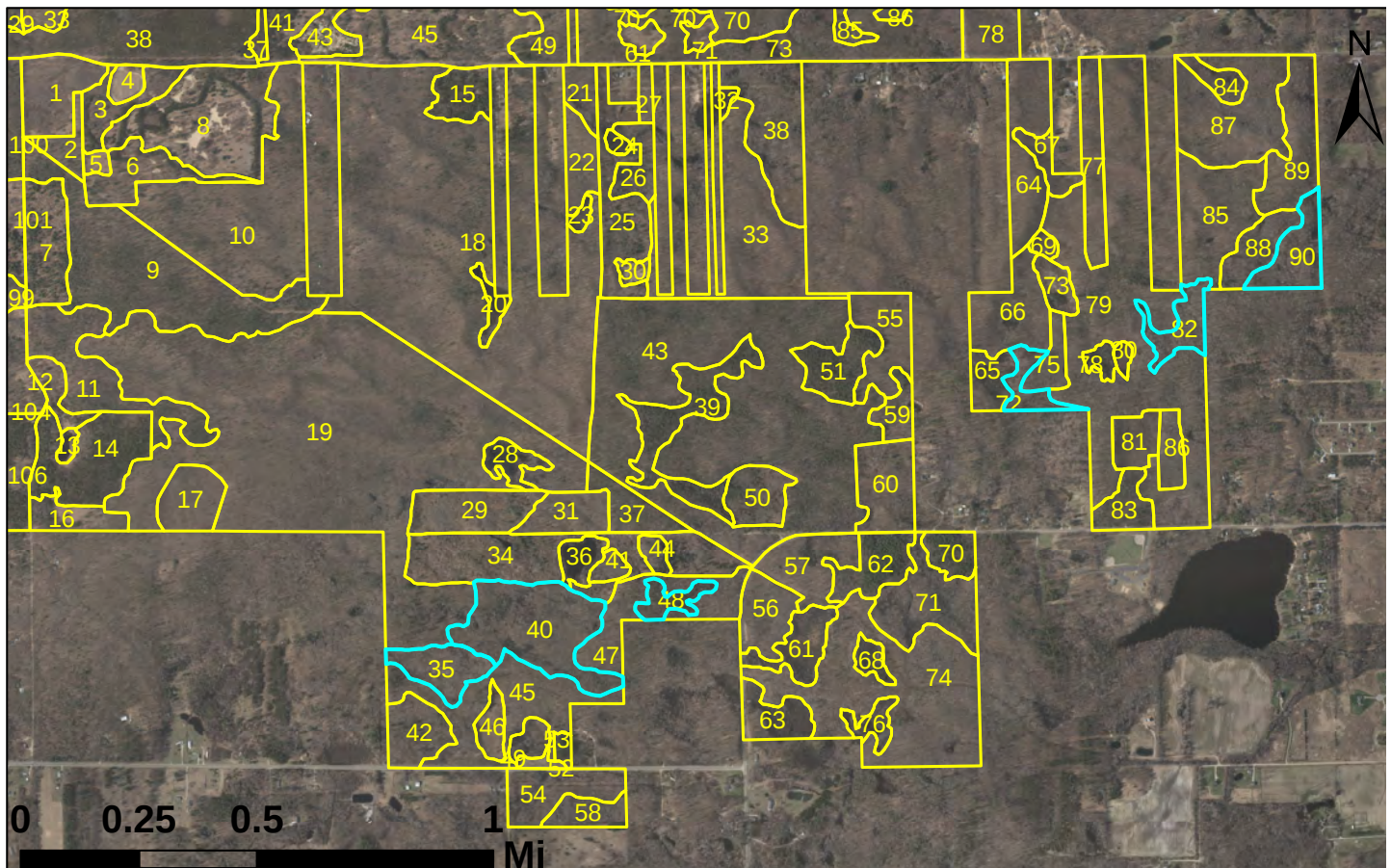
**Photos 7 and 8.** Mature Southern Hardwood Swamp in Stand 71 and in a small pocket in the center of Stand 90 offering ideal habitat for both rare amphibian and bird species as well as summer thermal cover for game species.

### Mesic Southern Forest

Mesic southern forests are uncommon in Allegan State Game Area. Compartment 23 contains some excellent examples of this forest type in stands 35, 40, 48, 72, 82 and 90 and noteworthy given their importance for hooded warbler (*Setophaga citrina*, State Special Concern) and cerulean warbler (*Setophaga cerulea*, State Threatened) (Figure 11). Stand 90 may be the only forest in ASGA approaching multistory forest status with some canopy trees 140+ years old.

Overview: Principal dominants of the canopy are American beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*), which together often make up over 80% of the canopy composition. Canopy associates include bitternut hickory (*Carya cordiformis*), white ash (*Fraxinus americana*), tulip tree (*Liriodendron tulipifera*), white oak (*Quercus alba*), red oak (*Q. rubra*), and basswood (*Tilia americana*). American elm (*Ulmus americana*) and ironwood (*Ostrya virginiana*) are common in the subcanopy. Sugar maple is the overwhelming dominant within the understory layer and often the ground layer. American beech, elm, and ironwood are also common saplings. Common shrub species include pawpaw (*Asimina triloba*), musclewood (*Carpinus caroliniana*), alternate-leaved dogwood (*Cornus alternifolia*), flowering dogwood (*Cornus florida*),

leatherwood (*Dirca palustris*), witch hazel (*Hamamelis virginiana*), spicebush (*Lindera benzoin*), American fly honeysuckle (*Lonicera canadensis*), prickly gooseberry (*Ribes cynosbati*), red elderberry (*Sambucus racemosa*), and maple-leaved arrow-wood (*Viburnum acerifolium*). Common vines include Virginia creeper (*Parthenocissus quinquefolia*), green briar (*Smilax* spp.), and poison ivy (*Toxicodendron radicans*). The ground flora is characterized by a prevalence of spring ephemerals, high diversity, and high degree of compositional similarity across its range. Common ground flora include spring beauty (*Claytonia virginica*), cut-leaved toothwort (*Cardamine concatenata*), squirrel corn (*Dicentra canadensis*), Dutchman's breeches (*D. cucullaria*), white trout lily (*Erythronium albidum*), yellow trout lily (*E. americanum*), false rue anemone (*Enemion biternatum*), doll's eyes (*Actaea pachypoda*), jack-in-the-pulpit (*Arisaema triphyllum*), wild ginger (*Asarum canadense*), blue cohosh (*Caulophyllum thalictroides*), wild geranium (*Geranium maculatum*), sharp-lobed hepatica (*Hepatica acutiloba*), Virginia waterleaf (*Hydrophyllum virginianum*), may apple (*Podophyllum peltatum*), bloodroot (*Sanguinaria canadensis*), common trillium (*Trillium grandiflorum*), large-flowered bellwort (*Uvularia grandiflora*), maidenhair fern (*Adiantum pedatum*), wild leek (*Allium tricoccum*), sedges (*Carex albursina* and *C. plantaginea*), enchanter's nightshade (*Circaea canadensis*), beech drops (*Epifagus virginiana*), and running strawberry bush (*Euonymus obovata*).



**Figure 11.** The highlighted stands are mature Mesic Southern Forest.



**Photo 9.** Mature Mesic Southern Forest in Stand 90 providing and abundance of tree cavities for cavity nesting birds and mammals.



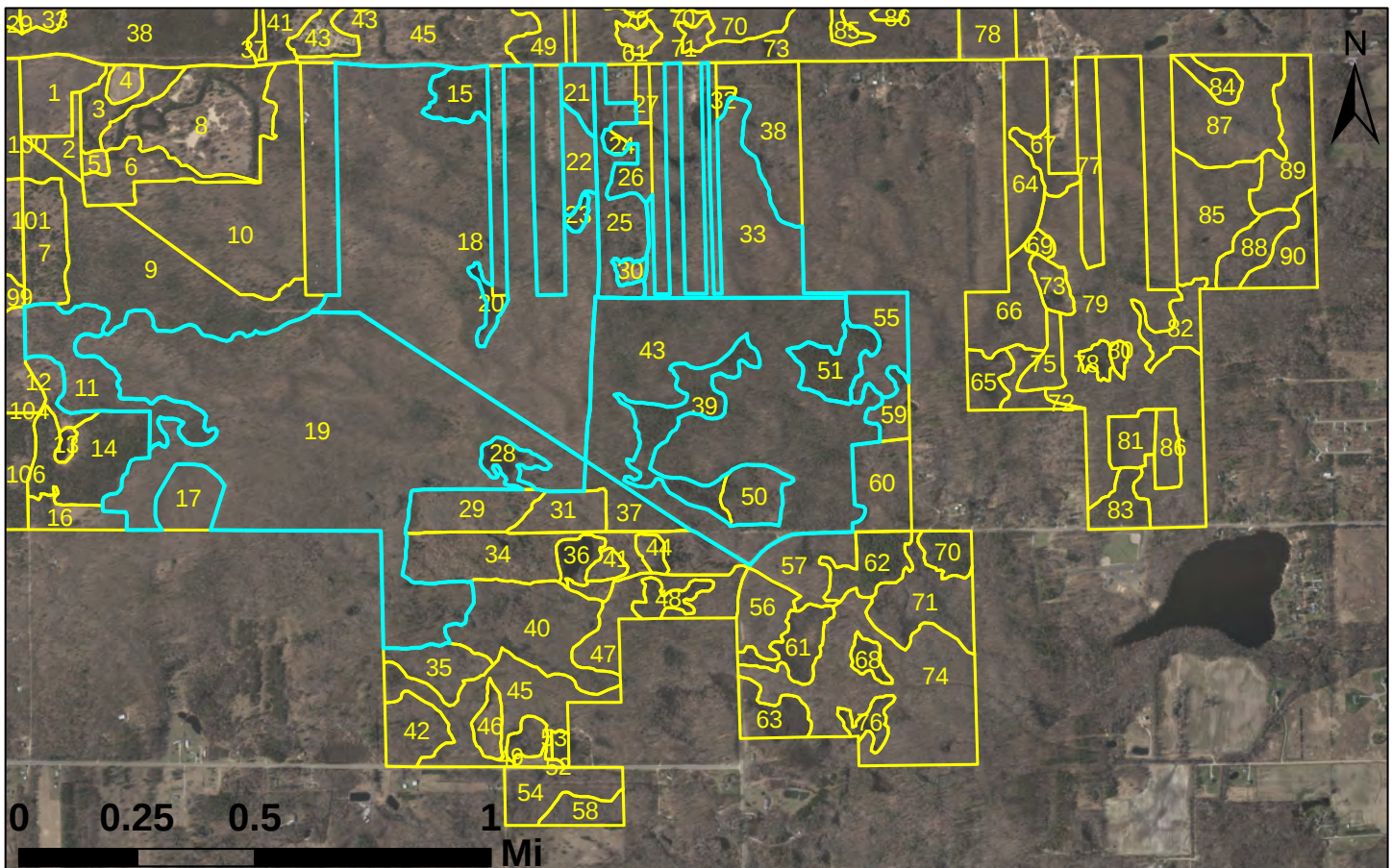
**Photo 10.** A large red elm in Compartment 23, likely the largest elm in Allegan SGA outside the Kalamazoo River floodplain.

### Dry-Mesic Northern Forest

Dry to dry-mesic northern forest was the prevalent cover type within Compartment 23 and in this SGA. The proximity of the game area to Lake Michigan provides a buffer from extreme temperatures and forests here are a regional variant of the dry-mesic northern forest community with components that are typical of both northern and southern systems. Protracted fire suppression and past logging have altered the succession of the area from one in which oak-pine barrens were prevalent to a predominantly closed-canopy oak forest system. For simplicity we are describing the community type as dry-mesic northern forest. Stands 11, 15, 18, 19, 21, 22, 25, 30, 33, 38, 43 and 55 in Compartment 23 are Dry Mesic Northern Forest (Figure 12). All these stands would benefit from periodic, low-intensity ground fires which would stimulate oak and pine regeneration while reducing the dominance of mesophytic species (i.e. red maple and black cherry) in the subcanopy.

Overview: Principal hardwood associates of dry-mesic northern forest include white oak (*Quercus alba*), black oak (*Q. velutina*), red oak (*Q. rubra*), and red maple (*Acer rubrum*) with white pine (*Pinus strobus*) an important constituent, often forming a supercanopy. Hemlock (*Tsuga canadensis*) was historically present as a codominant in

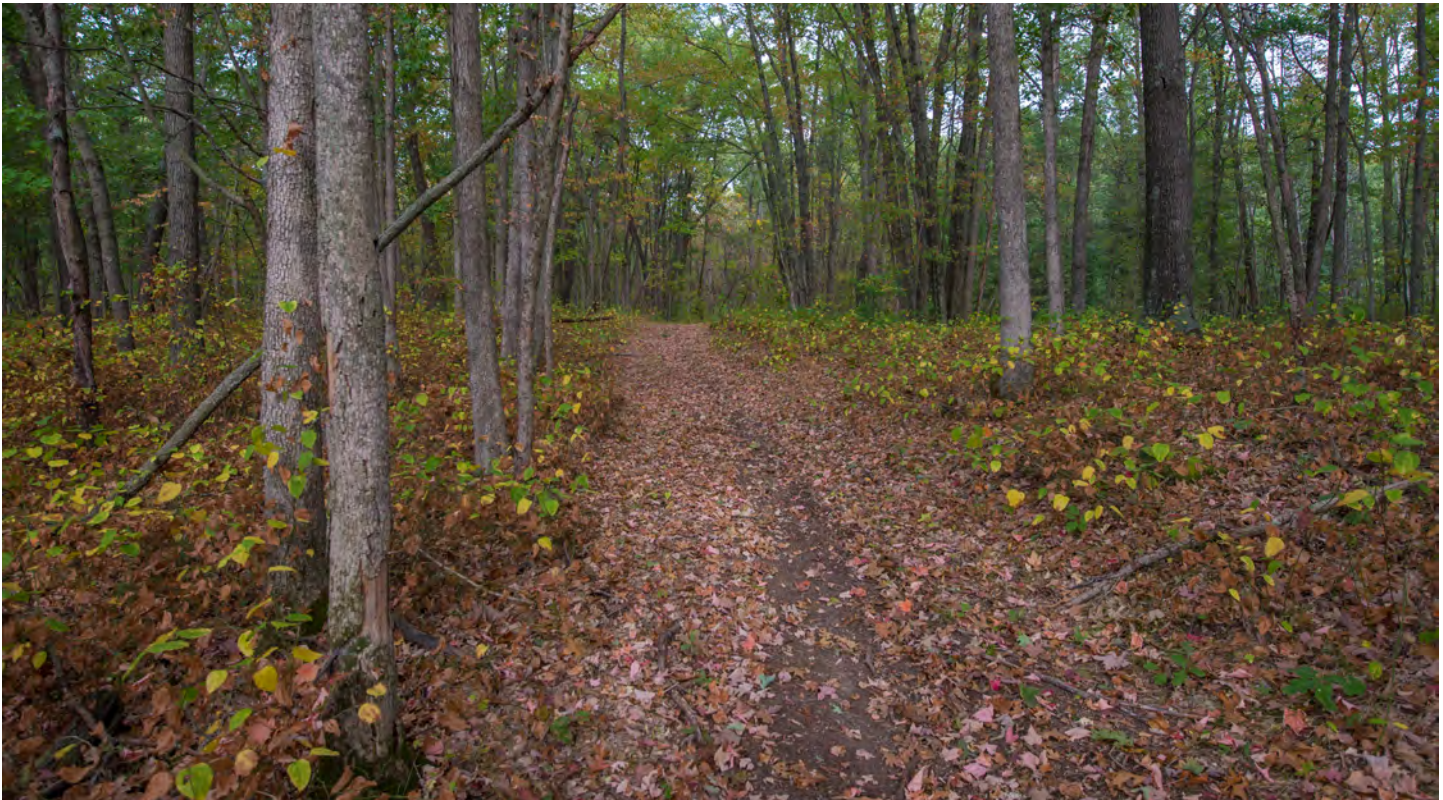
the canopy or supercanopy, especially along steep, north-facing slopes and mesic areas that were less fire prone. Characteristic species of the shrub layer of this forest type include serviceberries, sassafras (*Sassafras albidum*), bush honeysuckle (*Diervilla lonicera*), huckleberry, witch hazel (*Hamamelis virginiana*), American fly honeysuckle (*Lonicera canadensis*), chokecherry, and blueberries (*Vaccinium* spp.). The ground layer of dry-mesic northern forests is often dominated by bracken fern (*Pteridium aquilinum*). Additional species include, wild sarsaparilla (*Aralia nudicaulis*), pipsissewa (*Chimaphila umbellata*), goldthread (*Coptis trifolia*), bunchberry (*Cornus canadensis*), trailing arbutus (*Epigaea repens*), wintergreen (*Gaultheria procumbens*), partridge berry (*Mitchella repens*), gay wings (*Polygala paucifolia*), and starflower (*Trientalis borealis*). The presence of chlorophyll-free, parasitic and saprophytic seed plants such as Indian pipes (*Monotropa* spp.), and coral root orchids (*Corallorhiza* spp.) is a common feature of dry-mesic northern forest. Dry-mesic northern forests provide summer nesting habitat for many neotropical migrants, especially interior forest obligates such as black-throated blue warbler (*Dendroica caerulescens*), black-throated green warbler (*Dendroica virens*), scarlet tanager (*Piranga olivacea*), and ovenbird (*Seiurus aurocapillus*) (Cohen 2000; Kost et al. 2007).



**Figure 12.** The highlighted stands are disturbed Dry-Mesic Northern Forest that would benefit from prescribed burns.



**Photo 11.** Greenbrier, which chokes out other native vegetation, responds positively to disturbance and in this transition from undisturbed Mesic Southern Forest to disturbed Dry-Mesic Northern Forest greenbrier becomes more abundant as you move from one forest type to the other.



**Photo 12.** Dry-Mesic Northern Forest with heavy greenbrier ground cover choking out other ground cover species that serve as deer browse.

### Coastal Plain Marsh

While the majority of Compartment 23 was forested, one non-forested lowland area was occupied by coastal plain marsh (Figure 13). Stand 28 is known coastal plain marsh EO.

**Overview:** This unique natural community type has a state rank of S2, designating it as imperiled due to: a restricted range, limited occurrences, fire suppression and hydrologic alteration. Coastal plain marsh is a graminoid dominated wetland that contains numerous plant disjuncts from the Atlantic and Gulf coastal plains. Coastal plain marshes occur in few areas in our state with the majority occurring in Allegan, making them one of the more unique ecological communities in Lower Michigan. Their importance to wildlife is evident in the number of animals encountered in and around them. During surveys wood ducks were regularly seen in coastal plain marshes. Coastal plain marshes in proximity to oak forest provide ideal wood duck habitat. Coastal plain marshes also provide excellent amphibian and herptile habitat. Encroachment of woody vegetation and invasive species (particularly reed canary grass) are a major threat to the long-term viability of the coastal plain marsh in Compartment 23.

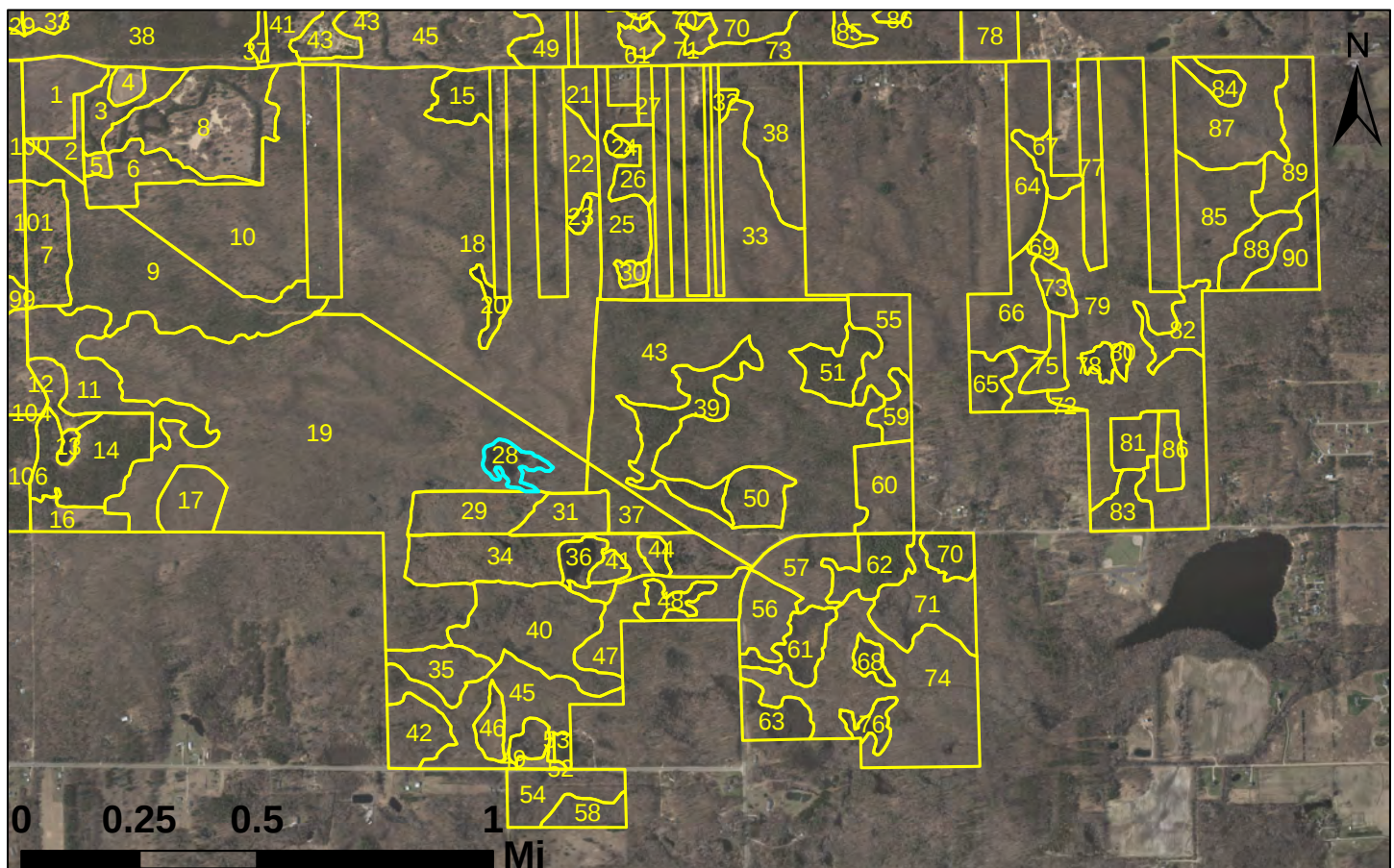
The dominant natural processes in coastal plain marshes exhibit seasonal and yearly water level fluctuations. Seasonally, water levels tend to be highest during the winter and spring and lowest in late summer and early autumn. Yearly water level fluctuations are less predictable. Fluctuating water levels facilitate seed germination by drawing down water levels and thus allowing direct sunlight to penetrate the exposed pond shore and trigger

seed germination. Fluctuating water levels also limit competition from woody plants and are an important mechanism for seed and nutrient dispersal to the outer margins of the wetland basin.

Historically, during low-water years, fire carried from adjacent uplands into coastal plain marshes. Because fire has been shown to increase seed germination, enhance seedling establishment, and bolster flowering, it likely acted as an important mechanism for maintaining plant diversity and replenishing seed banks.

Long distance seed dispersal among Midwest coastal plain marshes and between the Midwest and Atlantic and Gulf coastal plains is thought to be facilitated by migratory waterfowl. Waterfowl moving among nearby wetlands may also restore species which have been depleted from a site's seed bank.

Coastal plain marshes typically contain four distinct vegetation zones, often occurring as concentric bands around the open water portions of depressions, lakes, and ponds. The deepest portion of the depression is usually inundated and supports submergent marsh with floating aquatic plants such as water shield (*Brasenia schreberi*), sweet-scented water-lily (*Nymphaea odorata*), pondweeds (*Potamogeton* spp.), and bladderworts (*Utricularia* spp.). Along the shoreline is a seasonally flooded zone that supports a sparse graminoid cover of species such as tall beak-rush (*Rhynchospora macrostachya*, state special concern) and autumn sedge (*Fimbristylis autumnalis*). In the saturated soils further from shore is a dense graminoid-dominated zone of bluejoint grass (*Calamagrostis canadensis*), twig-rush (*Cladium mariscoides*), coastal



**Figure 13.** The highlighted stand is a Coastal Plain Marsh element occurrence.



**Photos 13 and 14.** Coastal Plain Marsh in Stand 28 showing oaks encroaching on open sedge areas in the flood zone. Ideally some of these trees should be girdled to maintain openings which are frequented by wood ducks.

flat-topped goldenrod (*Euthamia caroliniana*), beak-rush (*Rhynchospora capitellata*), and others.

Many coastal plain marshes contain a temporarily flooded shrub and tree zone with black chokeberry (*Aronia prunifolia*), buttonbush (*Cephalanthus occidentalis*), dogwoods (*Cornus* spp.), and steplebush (*Spiraea tomentosa*). Characteristic coastal plain marsh species include: three-awned grass (*Aristida necopina*), bushy aster (*Symphyotrichum dumosum*), sedge (*Bulbostylis capillaris*), umbrella sedge (*Cyperus bipartitus*), Robin's spike-rush (*Eleocharis robbinsii*), pipewort (*Eriocaulon aquaticum*), dwarf bulrush (*Lipocarpa micrantha*, state special concern), Canadian St. John's-wort (*Hypericum canadense*), two-flowered rush (*Juncus biflorus*), brown-fruited rush (*J. pelocarpus*), round-headed rush (*J. scirpoides*, state threatened), bog clubmoss (*Lycopodiella inundata*), panic grass (*Dichanthelium spretum*), beak-rush (*Rhynchospora capitellata*), tooth-cup (*Rotala ramosior*), tall nutrush (*Scleria triglomerata*, state special concern), bulrushes (*Schoenoplectus purshianus* and *S. smithii*), little ladies'-tresses (*Spiranthes tuberosa*), Virginia marsh St. John's-wort (*Triadenum virginicum*), lance-leaved violet (*Viola lanceolata*), and yellow-eyed-grass (*Xyris torta*) (Kost and Penskar 2000).

Major threats to coastal plain marshes include: invasive species, altered hydrology, and encroaching woody vegetation. In stands where big-tooth aspen (*Populus grandidentata*) is encroaching trees should be girdled. Establishing buffer zones around coastal plain marshes will eliminate

heavy tire/track grooves when heavy equipment is used in the vicinity. These grooves act like ditches and can alter hydrology. These buffer zones should be 100 meters wide or more to create adequate protection. Coastal plain marshes will benefit most from late season prescribed burns.

#### Bog

Stand 61 is a treed bog with a rich shrub layer (Figure 14). Highbush blueberry is the dominant shrub. This stand provides an excellent food source, cover and nesting habitat for a myriad of species. There are few bogs in ASGA. The primary threat to bogs is altered hydrology and encroaching woody vegetation. Establishing buffer zones around bogs will eliminate heavy tire/track grooves when heavy equipment is used in the vicinity. These grooves act like ditches and can alter hydrology. These buffer zones should be 100 meters wide or more to create adequate protection.

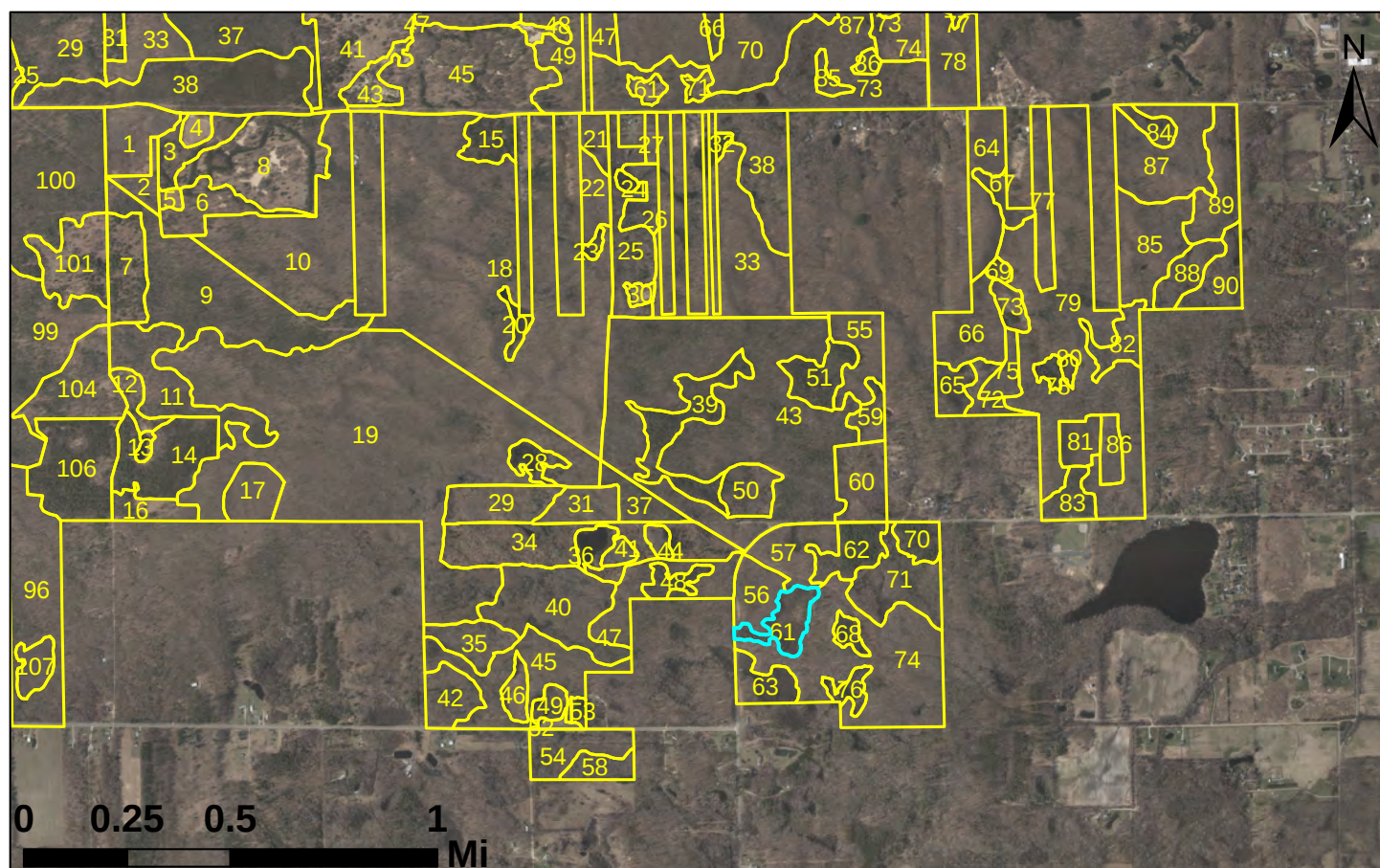
Overview: Bog is a nutrient-poor peatland characterized by acidic, saturated peat and the prevalence of sphagnum mosses and ericaceous shrubs. Bogs occur in kettle depressions on pitted outwash and moraines and in flat areas and shallow depressions on glacial outwash and glacial lakeplain and characterized by a continuous carpet of sphagnum moss, a species-poor herbaceous layer, low ericaceous, evergreen shrubs, and widely scattered and stunted conifer trees. The ubiquitous moss layer of bogs is dominated by sphagnum mosses, especially *Sphagnum magellanicum*, *S. angustifolium*,



**Photo 15.** A great crested fly-catcher hawking insects near a coastal plain marsh opening is one of many bird species that frequent these wetland openings.

and *S. fuscum*. The shrub layer is dominated by low, ericaceous shrubs with leatherleaf (*Chamaedaphne calyculata*) as the most prevalent species. The following heath shrubs are important components of bogs: bog rosemary (*Andromeda glaucophylla*), huckleberry (*Gaylussacia baccata*), sheep-laurel (*Kalmia angustifolia*), bog laurel (*K. polifolia*), Labrador tea (*Rhododendron groenlandicum*), low sweet blueberry (*Vaccinium angustifolium*), Canada blueberry (*V. myrtilloides*), large cranberry (*V. macrocarpon*), and small cranberry (*V. oxycoccos*). The tall shrub layer of bogs is less dense than the low shrub layer and is often restricted to the periphery of the bog. Tall shrubs typical of bogs include black chokeberry (*Aronia prunifolia*), mountain holly (*Ilex mucronata*), bog willow (*Salix pedicellaris*), steeplebush (*Spiraea tomentosa*), smooth highbush blueberry (*Vaccinium corymbosum*), and wild-raisin (*Viburnum cassinoides*). South of the climatic tension zone, buttonbush (*Cephalanthus occidentalis*), poison sumac (*Toxicodendron vernix*), and highbush blueberry frequently occur within

bogs or along their margins. The herbaceous layer of bogs is dominated by cyperaceous plants. Sedges that are characteristic of bogs include few-seed sedge (*Carex oligosperma*), few-flower sedge (*C. pauciflora*), and wiregrass sedge (*C. lasiocarpa*). Additional graminoids include twig-rush (*Cladium mariscoides*), three-way sedge (*Dulichium arundinaceum*), cotton-grasses (*Eriophorum* spp.), white beak-rush (*Rhynchospora alba*), and bulrushes (*Scirpus* spp.). Insectivorous plants are common features of bogs and may include round-leaved sundew (*Drosera rotundifolia*), spoon-leaf sundew (*D. intermedia*), pitcher-plant (*Sarracenia purpurea*), and flat-leaved bladderwort (*Utricularia intermedia*). Trees within bogs are widely scattered and stunted. Commonly occurring trees are black spruce (*Picea mariana*) and tamarack (*Larix laricina*), with jack pine (*Pinus banksiana*), white pine (*Pinus strobus*), and red maple (*Acer rubrum*) as occasional associates and the latter being more prevalent south of the climatic tension zone.



**Figure 14.** The highlighted stand is one of the few bogs in ASGA with an extremely diverse shrub component offering excellent winter and summer thermal cover for game species.



**Photo 16.** Female common yellowthroat, a species frequently encountered nesting in bogs.



**Photo 17.** Leatherleaf, a common bog species often forming a dense shrub layer in Michigan bogs.

## Rare Plants and Animals

Compartment 23 contains one natural community EOs, one avian EO, one amphibian EO, three invertebrate EOs and three plant EOs (Table 1 and Figure 15, Figure 16).

### Rare Plants

Three rare plant species, meadow beauty (*Rhexia virginica*) and Missouri rock-cress (*Boechera missouriensis*) and Black-fruited spike-rush (*Eleocharis melanocarpa*) have been documented in Compartment 23. These plants are found in coastal plain marshes, but are not limited to this habitat. Missouri rock-cress is also associated with oak-pine barrens and savanna habitat.

### Insects

Compartment 23 is a Karner blue (*Lycaeides melissa samuelis*, State threatened, federally endangered) strong hold. Karner blue has been identified as a featured species by the WLD to promote savanna habitats in Southwestern Michigan. The Karner blue utilizes oak and oak pine savannas and are dependent on wild lupine (*Lupinus perennis*) which is the only food source for their larvae. Throughout much of their range in Michigan Karner Blue habitat suffers from fire suppression (Rabe 2001). The planned burns in Compartment 23 will greatly enhance current Karner Blue habitat by converting forested areas to suitable habitat and promoting the establishment of wild lupine.

Otto Skipper (*Hesperia ottoe*, State Threatened) and frosted elfin (*Incisalia irus*, State Threatened) have been recorded in Compartment 23. Habitat requirements for the Otto skipper and frosted elfin are very similar to those of

the Karner blue and managing for open savanna systems will benefit both species.

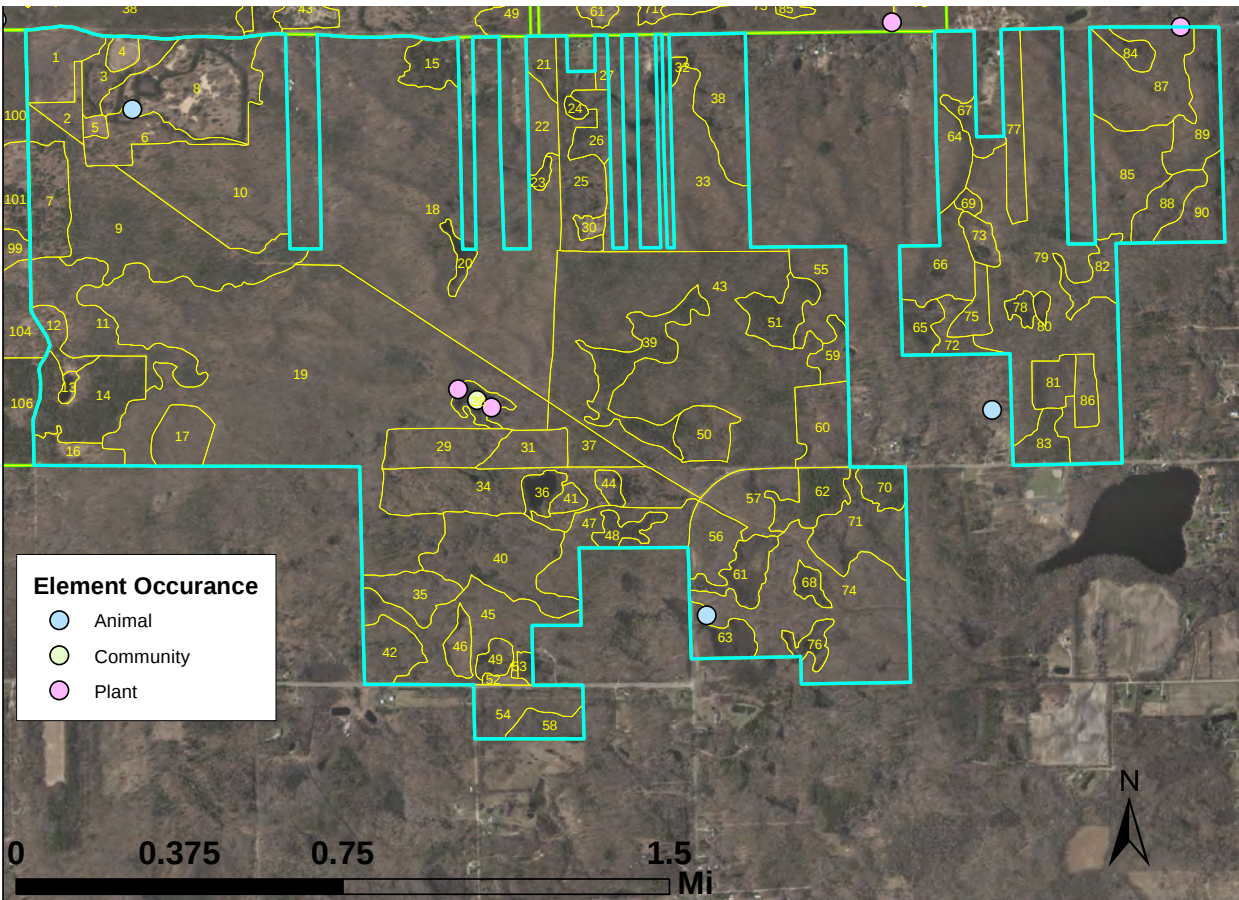
### Herptiles

During 2012 IFMAP surveys two eastern box turtles (*Terrapene carolina carolina*), were seen mating in Stand 38. Aside from these two turtles, few herptiles were recorded during IFMAP surveys in Compartment 23. Most of the compartment provides habitat for eastern box turtle. Eastern box turtle has been identified as a Focal Species by WLD. The eastern box turtle is Michigan's only truly terrestrial turtle. It typically occurs in forested habitats with sandy soils near a source of water such as a stream, pond, lake, marsh or swamp. Access to unshaded nesting sites in sandy, open areas, is critical for successful reproduction. This compartment falls within the area identified by MNFI as a potential Focal Area for management for eastern box turtle (Cohen et al. 2014).

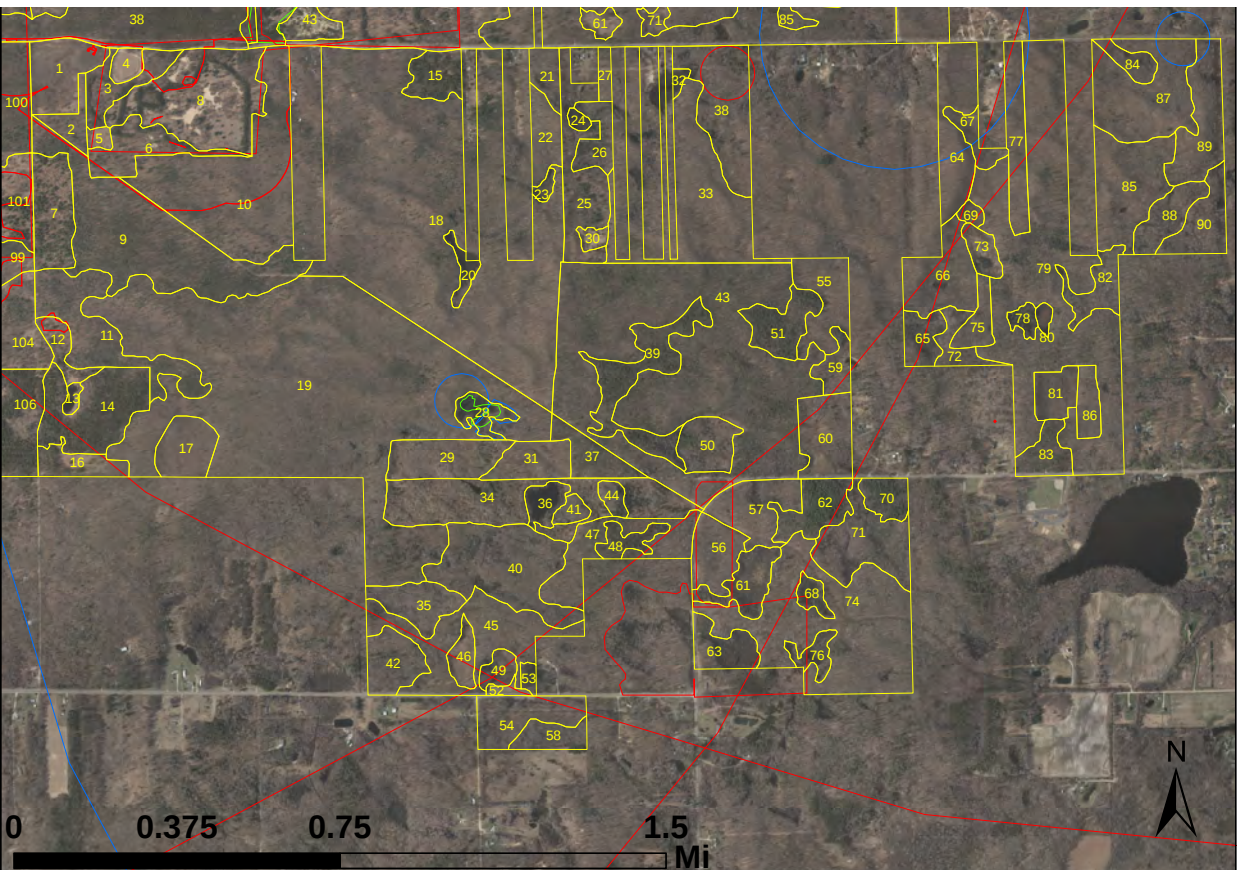
Compartment 23 has two records for marbled salamander (*Ambystoma opacum*, State Endangered). These records are in the southeastern portion of the compartment encompassing stands 56, 61 and 63. In Michigan marbled salamanders are confined to moist lowland forests in the southwestern counties. The sites in Michigan are described as wooded ravines, bottomland, wet sugar maple/beech woods with some oaks and black cherry, second growth lowland wet woods with seasonal ponding, lowland hardwoods (oak and aspen) with dense brush with many decaying logs nearby ponds and shallow marshes (Cuthrell 2010).

**Table 1.** Element occurrences documented in Compartment 23, EO Rank abbreviations: A = Excellent estimated viability, B = Good estimated viability, C = Fair estimated viability, D = Poor estimated viability, E = Extant, viability not assessed, H = Historical Record. Status abbreviations: SC = Special Concern, T = Threatened, E = Endangered, L denotes federal status.

| Common Name                 | Scientific Name                    | EOID  | EO Rank | Status | First Observed | Last observed | Stands                        |
|-----------------------------|------------------------------------|-------|---------|--------|----------------|---------------|-------------------------------|
| <b>Birds</b>                |                                    |       |         |        |                |               |                               |
| Red-shouldered hawk         | <i>Buteo lineatus</i>              | 14520 | E       | T      | 06/06/2002     | 05/16/03      | 79                            |
| <b>Insects</b>              |                                    |       |         |        |                |               |                               |
| Karner blue                 | <i>Lycaeides melissa samuelis</i>  | 6166  | E       | T      | 1970           | 07/19/17      | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 |
| Karner blue                 | <i>Lycaeides melissa samuelis</i>  | 4148  | AB      | T      | 07/27/1995     | 07/07/05      | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 |
| Otto skipper                | <i>Hesperia ottoe</i>              | 7911  | E       | T      | 1959           | 07/14/01      | 8                             |
| Frosted elfin               | <i>Callophrys irus</i>             | 8829  | H       | T      | 1989           | 06/11/05      | 8                             |
| <b>Herptiles</b>            |                                    |       |         |        |                |               |                               |
| Marbled salamander          | <i>Ambystoma opacum</i>            | 10654 | H       | E      | 1981           | 09/01/87      | 56,61,63,74                   |
| Marbled salamander          | <i>Ambystoma opacum</i>            | 12272 | H       | E      | 1981           | 09/29/89      | 38                            |
| Eastern box turtle          | <i>Terrapene carolina carolina</i> | 21354 | E       | SC     | 07/18/2012     | 07/18/02      | 32, 38                        |
| <b>Plants</b>               |                                    |       |         |        |                |               |                               |
| Hollow-stemmed Joe-pye weed | <i>Eutrochium fistulosum</i>       | 18618 | C       | T      | 09/20/2009     | 09/20/09      | 89                            |
| Black-fruited spike-rush    | <i>Eleocharis melanocarpa</i>      | 1151  | AB      | SC     | 08/18/1989     | 08/18/89      | 28                            |
| Meadow beauty               | <i>Rhexia mariana</i>              | 12201 | BC      | T      | 08/18/1989     | 08/18/89      | 28                            |
| Coastal Plain Marsh         |                                    | 1397  | C       | NA     | 1989           | 10/03/17      | 28                            |



**Figure 15.** Element Occurance Locations in Compartment 23.



**Figure 16.** Element Occurrence polygons for Compartment 23. Plants are outlined in blue, ecological communities are green, and animals are red.

### Avifauna

There is one red-shouldered hawk EO on the periphery of Compartment 23. Several avian species on Michigan's featured species list for habitat management were recorded in Compartment 23 during IFMAP surveys. Featured species that were seen or heard during the survey include: red-shouldered hawk (*Buteo lineatus*), pileated woodpecker (*Dryocopus pileatus*), American woodcock (*Scolopax minor*), wood thrush (*Hylocichla mustelina*) and wild turkey (*Meleagris gallopavo*). Several species of greatest conservation need were recorded. These include: Cooper's hawk (*Accipiter cooperii*), yellow-billed cuckoo (*Coccyzus americanus*), northern flicker (*Colaptes auratus*), Acadian fly-catcher and (*Empidonax virescens*), eastern kingbird (*Tyrannus tyrannus*).

Compartment 23 has several stands that provide ideal habitat for hooded and cerulean warblers. Hooded and cerulean warblers nest in forests with mature forest canopy and a dense understory of small trees and shrubs. Management should focus on preserving these characteristics in large forest blocks to reduce the threat of brood parasitism by brown-headed cowbirds and nest predation by small mammals like raccoons. Occasionally overstory trees may be selectively logged to encourage shrub or sapling growth where the birds nest, but this activity should be conducted in the fall or winter when the warblers are on their wintering grounds to avoid impacting nesting birds (MNFI 2007).

### Mammals

Except for white-tailed deer, chipmunks, and fox squirrels, few mammals were observed during the survey of Compartment 23. We recommend small mammal surveys be conducted in this compartment. We recommend that bat surveys are conducted in select areas to determine if northern long-eared bats (*Myotis septentrionalis* state threatened/S1), eastern pipistrelle (*Perimyotis subflavus* state special concern/S2) or Indiana bat (*Myotis lucifugus* state endangered/S1) are present.

Northern long-eared bats generally roost in trees but have been known to roost in man-made structures. This species frequently roosts under bark in tree trunk crevices. They favor maples and ashes (Foster and Kurta 1999). Northern long-eared bats favor tall trees for roosting in forests with heterogeneous forest structure including old growth and some young trees (Foster and Kurta 1999). Northern long-eared bats frequently forage within the forest and below the canopy in upland forests on hillsides and ridges, but also forage along paths, ponds and streams. All roost reported by Foster and Kurta (1999) were near wetlands.

Northern long-eared bat has been identified as Focal Species by WLD. This compartment falls within the area identified by MNFI as a potential Focal Area for management for northern long-eared bat (Cohen et al. 2014).



**Photo 18.** Eastern box turtle in an Oak-Pine Barren.

## Management Recommendations

### ***Oak-Pine Barrens***

Fire suppression in Compartment 23 has led to most of the historic barrens areas converting to closed canopy forest. The primary management recommendation for 23 is to continue current prescribed burn plans and each subsequent year adding as many additional burn areas as resources allow. Frequent burns will help diversify the forb layer and aide in establishing graminoid species. In addition to burns, active thinning will speed up the process of converting closed canopy forest to barrens habitat. Considering the state of Karner blue butterflies and their dependence on barrens habitat, it is vital to create as much Karner blue habitat as possible in Compartment 23. Establishing more barrens habitat will help connect individual sites potentially leading to a larger Karner blue population in the SGA.

Barrens management will also benefit other rare savanna species including Ottoe Skipper and frosted elfin. The areas in Compartment 23 that were historically oak-pine barrens and are now closed canopy forest could be thinned and burned to expand barrens habitat. Stands 11,15, 18, 19, 21, 22, 25, 30, 33, 38, 43 and 55 are candidates for conversion from oak forests to oak-pine barrens. These stands all provide excellent opportunity to increase Karner blue habitat in the compartment. Target canopy closure for restored barrens should be between 5 and 60 %. This can be achieved by leaving individual trees and scattered clumps of mature oaks. We recommend leaving wooded buffers around current openings to avoid damaging intact barrens vegetation and ant mounds in these openings. These buffers will emulate the structure of natural oak barrens with both senescing trees and potential tree recruitment. We also recommend cutting trees close to the ground to facilitate mowing. The survivorship of butterflies is often increased by the presence of ants. Consequently, the large ant colonies that exist in the area should be protected and care should be taken to avoid damaging them with logging equipment.

Understory trees and shrubs will flourish after canopy tree removal. This creates potential for accelerated loss of barrens areas unless prescribed burns are implemented to control the encroachment of woody shrubs. For five to ten years after thinning fire must be considered a critical management tool to prevent further loss of barrens through woody encroachment. Repeated fires will be required to prevent formation of dense undergrowth. Burning during the growing season will help limit woody vegetation from establishing. Additional mowing and herbicide application may be needed if fire fails to stop woody vegetation growth.

The restriction of burning to spring is a management concern. Fires have the greatest impact on plants that are actively growing at the time of the burn. Repeated fires at the same time of year impacts the same species year after year, and over time can lower floristic diversity. For example, forbs that flower in early spring often overwinter as a green rosette or may have buds very close to the soil surface and in the litter layer. Repeated burns in early spring can be detrimental to such species. Historically fires varied in seasonality and burned during spring, summer, and fall. Many of the natural communities in ASGA including oak-pine barrens and dry-mesic northern forest likely burned in late summer and early fall. Varying the seasonality of prescribed burns to match the full range of historical

variability mimics the natural disturbance regime and leads to higher biodiversity: pyrodiversity facilitates biodiversity.

Repeated early spring burns are of concern in oak-pine barrens and dry-mesic northern forest where the goal for prescribed burning is to control woody species. Prior to bud break and leaf-out, most energy in a woody plant is stored in roots as carbohydrate reserves. As plants expend energy to make leaves, flowers, and fruits, these carbohydrate reserves diminish, reaching a seasonal low during flowering and fruiting. As fall approaches, energy root reserves are replenished. Thus, when woody species are top-killed by early spring fires, they can resprout vigorously using large energy stores, a phenomenon seen frequently with sassafras, black cherry, red maple, and oaks. However, if burns are conducted later in the spring after leaf-out, or during the growing season, energy reserves are partially depleted, and resprouting vigor is lower, particularly for clonal species like sassafras.

Resource managers restrict prescribed fire to the early spring for numerous reasons. These reasons include: ease of controlling burns, greater windows of opportunity for conducting burns because suitable burning conditions are often prevalent this time of year, and the belief that doing so reduces the impact on fire-sensitive animal species like the eastern box turtle. While these are all legitimate reasons, we feel that the long-term benefits of diversifying burn seasonality outweigh the costs. Ultimately, successful restoration of oak-pine barrens ecosystems depends on expansion of the burn season beyond early spring. Techniques for reducing the risk to fire-sensitive species can be employed during burns throughout the year and include avoiding burning around known hibernacula and establishing refugia within large burn units (Cohen et al. 2009).

The major threat to barrens restoration preprojects is illegal off-road vehicle use. The current management practice of placing signs and stumps in areas where ORV gain access to stands has been observed has proven to be an effective course of action.

We recommend allowing natural processes take course in the remaining natural community types in the compartment: Dry Mesic Southern forest, Mesic Southern Forest, Southern Hardwood Swamp, and Bog. We recommend these communities be monitored for invasive species and if resources allow, targeted removal of autumn olive and multiflora rose would be good for the native herbaceous and shrub layers. These natural community types are unique for ASGA. Given the prevalence of aspen stands in Compartment 23 there is little need to expand aspen into neighboring stands as these non-aspen areas provide critical habitat for game species that utilize nearby aspen stands.

Care should be given to not alter the hydrology in the three wetland natural communities: Southern Hardwood Swamp, Coastal Plain Marsh and Bog. Change in hydrology leads to tree die-off and establishment of invasive species. Allow fire from adjacent upland areas to extinguish naturally; this will create transition zones that wildlife will utilize for browse and cover. Such transition zones will provide foraging grounds for insectivorous birds including hooded warbler and cerulean warbler and wild turkey. Fresh leaf-out in these transitions zones will provide high nutrient browse for white-tailed deer.

### ***Specific Recommendations***

Because of the limited nature of management resources and the abundance of important natural resources, prioritization of management actions is necessary when dealing with an area the size of ASGA. The following management recommendations for Compartment 23 are provided for your consideration:

- Important oak-pine barrens habitat:
  - o Burn Stands 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
  - o Add winter mowing to Stands 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
  - o Avoid damaging ant hills in these stands.
  - o Vary seasonality and intensity of burns.
  - o Employ landscape-scale prescribed fire and allow fire to carry into adjacent forests and extinguish naturally.
  - o Allow for refugia for Karner blue butterflies and other sensitive species.
  - o Vary seasonality and intensity of burns.
  - o Actively seed burned areas with lupine.
  - o Conduct rare plant surveys.
- o Closed-canopy dry forest (degraded oak-pine barrens):
  - o Thin and burn stands 11,15, 18, 19, 21, 22, 25, 30, 33, 38, 39 and 43 as resources permit.
  - o Thin closed-canopy forest to 20 to 60% canopy coverage to connect and expand barrens habitat.
  - o Avoid disturbing soil in barrens area with logging equipment; don't use openings. with characteristic vegetation as staging areas.
  - o Vary seasonality and intensity of burns.
  - o Employ landscape-scale prescribed fire and allow fire to carry into adjacent forests and extinguish naturally.
  - o Allow for refugia for Karner blue butterflies and other sensitive species.
  - o Vary seasonality and intensity of burns.
  - o Actively seed burned areas with lupine.
  - o Conduct rare plant surveys.
- Important forested areas
  - o Prevent alterations to hydrology.
  - o Allow fire to carry into forest.
  - o Allow forests to mature and avoid fragmentation.
  - o Provide buffer around mature forests to reduce fragmentation of quality forests.
  - o Maintain large diameter trees to function as nesting and roosting locations for red-shouldered hawk and Indiana bat.
  - o Survey for cerulean warbler, hooded warbler, and listed bats.
  - o Monitor for invasive species.
- Important non-forested areas
  - o Prevent alterations to hydrology.
  - o Allow fire to carry into wetlands.
  - o Avoid fragmentation.
  - o Monitor for invasive species.



**Photo 19.** One of several areas in Compartment 23 with significant ORV damage. This particular spot is located in Stand 8.

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