

NATURAL FEATURES SUMMARY OF COMPARTMENT 13 ALLEGAN STATE GAME AREA



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Cover Photo: The floodplain forest along the Kalamazoo River is a prominent feature of Compartment 13 and supports a myriad of biodiversity. September 2017. Photos throughout the document by Jesse M. Lincoln unless stated.

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INTRODUCTION

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

Ongoing survey efforts of state game areas have improved knowledge about the location and integrity of a variety of important natural areas. High-quality ecosystems provide myriad benefits to wildlife and protecting existing systems is more feasible than intensive restoration of degraded systems or the creation of a new ecosystem. 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. The survey collected information on basic stand data and also helped target the locations of previously undocumented exemplary natural community Element Occurrences (EOs).

This game area is in the central portion of Allegan County. There are 25 compartments in ASGA (Figure 1). Compartment 13 consists of 1,966 acres in the central portion of the game area. This review of Compartment 13 is intended to complement the management plans already underway by WLD. This report will provide an overview of the historical and ecoregional context of ASGA and Compartment 13, an overview of the known EOs and significant natural communities in Compartment 13, and management recommendations for the significant natural features therein. Much of the information in this report was synthesized from MNFI's Biotics database and the MNFI website, which provides descriptions of natural communities and rare plants and animals.

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.

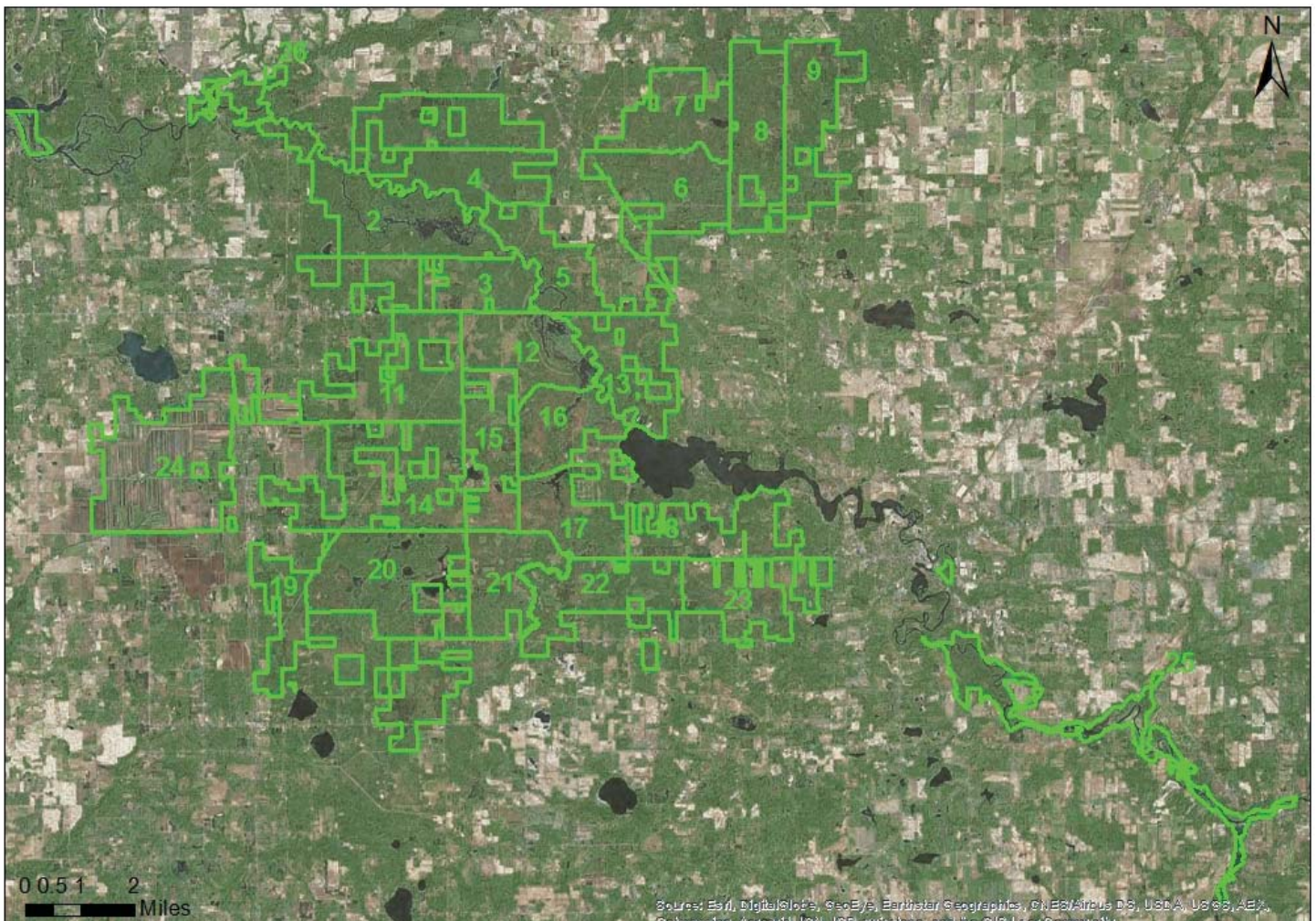


Figure 1. Compartment boundaries and land cover and in and around Allegan State Game Area.

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.

The classification is hierarchically structured with three levels in a nested series, from broad landscape regions called sections, down to smaller subsections and sub-subsections. ASGA lays within the Allegan subsection

(Subsection VI.3), and within two sub-subsections, the Southern Lake Michigan Lake Plain (Sub-subsection VI.3.2) and the Berrien Springs (Sub-subsection VI.3.1). The majority of the game area occurs in the Southern Lake Michigan Lake Plain and small portions of the eastern game area occur 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).

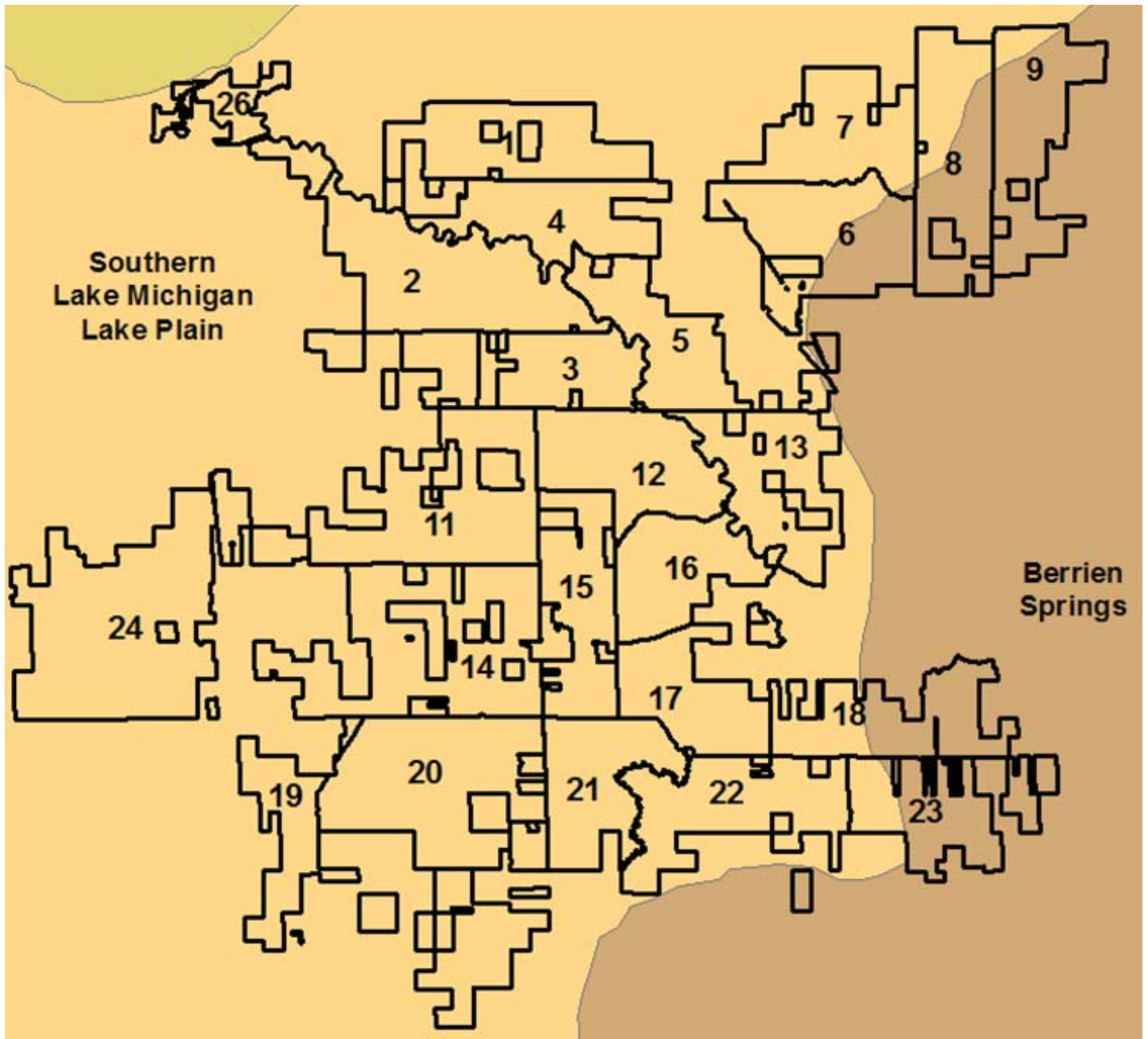


Figure 2. Ecoregions of Allegan State Game Area (Albert 1995).

Compartment 13 falls entirely within the Southern Lake Michigan Lake Plain (Figure 2). The sub-subsection is characterized by extensive lake plain features associated with historic levels of Lake Michigan that were much higher during periods of glacial recession. Sand dunes inland from present-day Lake Michigan shoreline are associated with historic 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 totally inundated in spring. These fluctuations, the fluctuations of the Great Lakes historically, and the abundance of migrating waterfowl result in a distinctive disjunct flora from the Atlantic and Gulf Coastal Plains along the margins of many lakes. 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 indicated that the ASGA contained several distinct vegetation assemblages circa 1800 (Comer et al. 1995, Figure 3). 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. Forests consisted largely of white pine and mixed oak with the white pine forming a supercanopy. Wetlands occurred in kettle depressions, outwash channels, and extensive tracts of floodplain forests associated with the Kalamazoo River. Lakes, marshes, bogs, inundated shrub swamps, intermittent wetlands, coastal plain marshes, and vernal pools would have occupied the low areas influenced by fluctuating ground-water levels or depressions created by blocks of ice left by the retreating glaciers. Outwash channels formed from glacial melt-waters were occupied by wet prairies, shrub swamps, and forested swamps (Cohen et al. 2015).

Natural Communities

Vegetation of Compartment 13 circa 1800 was predominantly forest. Extensive floodplain forests occur along the Kalamazoo River outwash channel. The river valley is flanked by steep slopes that transition in oak-pine forest. Given the historical prevalence of fire and barrens within the surrounding landscape, these oak pine forests likely had pockets of savanna. Areas with a legacy of agriculture tend to have been recolonized with a subset of barrens species, supporting the notion that barrens were part of the composition. Zones of mesic forest and swamp occur within areas of the uplands, thereby creating a mosaic of upland and lowland forests.

Today, Compartment 13 is characterized by extensive forest and much of the historic coetype remains, despite extensive logging and localized attempts at agriculture. Brief descriptions of the community types are included below as is a list of stands where the highest quality examples of natural community remain.

Dry-Mesic Northern Forest

Dry-mesic northern forest was the most prevalent coetype within Compartment 13 and a common community type in this region. The relatively close 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 type with components that are typical of both northern and southern systems. Protracted fire suppression and a history of aggressive logging have altered the successional trajectory of the entire area from one that includes abundant oak-pine barrens to a predominantly closed-canopy oak forest with scattered pine. For the sake of simplicity, we are describing the community type as dry-mesic northern forest while acknowledging the variability of the community type.

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 (*Dier-villa lonicera*), huckleberry (*Gaylussacia baccata*), witch hazel (*Hamamelis virginiana*), American fly honeysuckle (*Lonicera canadensis*), choke cherry (*Prunus virginiana*), 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*), winter-green (*Gaultheria procumbens*), partridge berry (*Mitchella repens*), 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*) (Kost et al. 2007).

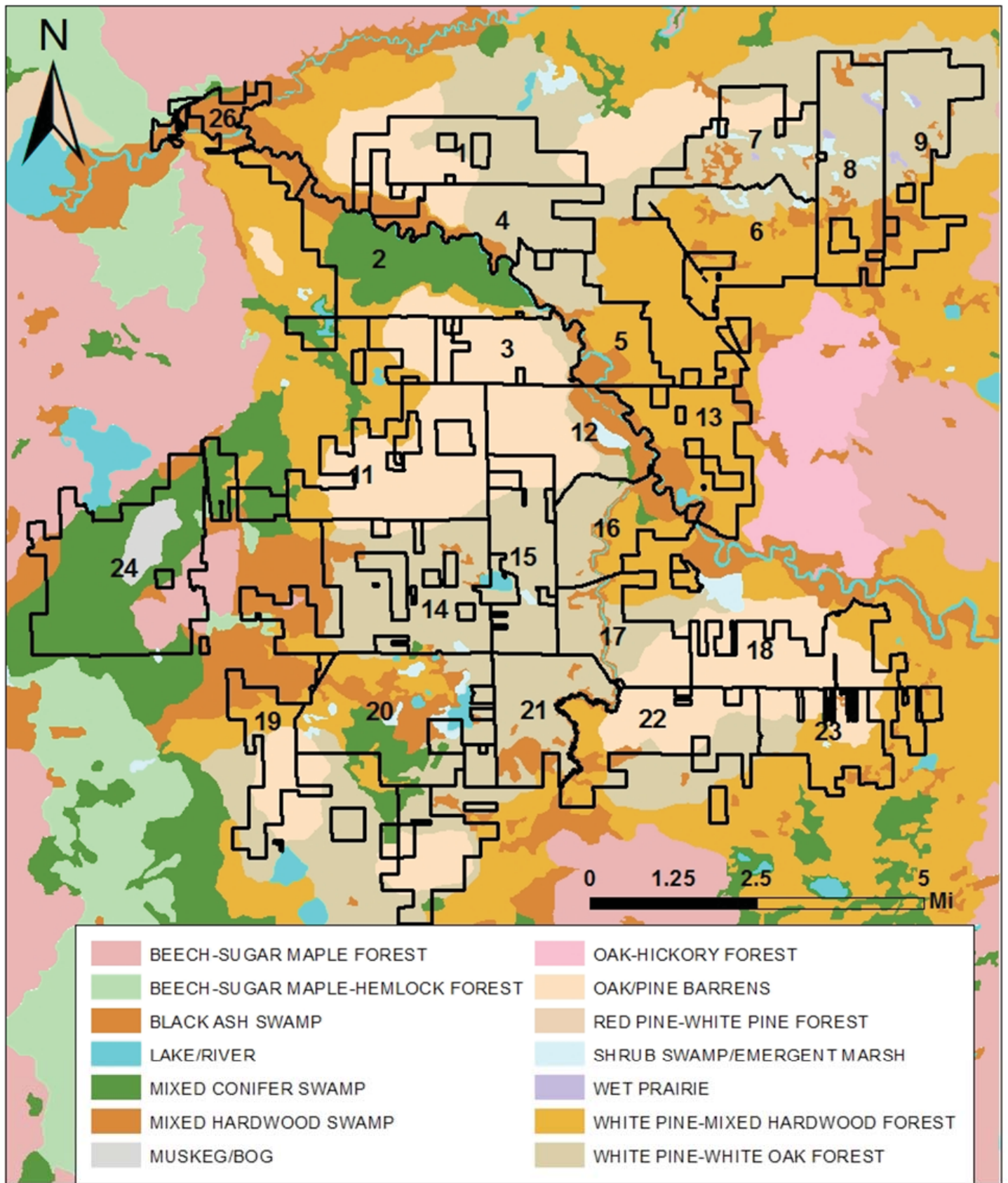


Figure 3. Circa 1800 vegetation cover of Alleghen State Game Area (Comer 1997).

Forested Wetlands

The Kalamazoo River is a dominant feature of ASGA and is part of a large and important corridor of natural area protecting water quality of the river and providing significant contiguous forest habitat within the county. Within the floodplain forests that flank the Kalamazoo River, the natural levee and first bottom are dominated by silver maple (*Acer saccharinum*) and green ash (*Fraxinus pennsylvanica*), but a variety of additional tree species are also locally abundant, including basswood (*Tilia americana*), swamp white oak (*Quercus bicolor*), bur oak (*Q. macrocarpa*), sycamore (*Platanus occidentalis*), red maple (*A. rubrum*) and box elder (*A. negundo*). New soil deposits immediately adjacent to the stream channel are dominated by black willow (*Salix nigra*) and cottonwood (*Populus deltoides*). Elm (*Ulmus americana*) is locally abundant and sycamore (*Platanus occidentalis*), hackberry (*Celtis occidentalis*), and black ash (*F. nigra*) occur throughout.

The levee is characterized by dense cover of shrubs and small trees such as musclewood (*Carpinus caroliniana*), gray dogwood (*Cornus foemina*), prickly ash (*Zanthoxylum americanum*), hawthorns (*Crataegus* spp.), spicebush (*Lindera benzoin*), nannyberry (*Viburnum lentago*), elderberry (*Sambucus canadensis*), bladdernut (*Staphylea trifolia*), and raspberry species (*Rubus* spp.). Adjacent to the levee, the first bottom flat is flooded more frequently and for a longer period, limiting the tree canopy to silver maple, green ash, and American elm. Shrubs are typically rare within the first bottom flat, but vines including riverbank grape (*Vitis riparia*), poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and

moonseed (*Menispermum canadense*) are locally abundant. Small depressions and swales where tree canopy coverage is low are often dominated by buttonbush (*Cephalanthus occidentalis*).

Prior to the introduction and spread of Dutch elm disease, American elm was an important canopy constituent in swamps and moist forests, but is now largely relegated to the subcanopy and sapling layers. Likewise, ash numbers have been reduced by emerald ash borer and mortality of canopy ash is near-total, though many small individuals persist in the subcanopy. The data collected from the 2011 MiFI surveys may not reflect the current composition of ash as the invasion was only in the early stages and the ash were not yet visibly affected. The recent mortality of canopy ash as a result of emerald ash borer has locally eliminated much of the canopy and increased the light to lower levels of the forest.

These communities provide important breeding and foraging habitat for several rare amphibians, reptiles, and birds; including state-listed species, such as spotted turtle (*Clemmys guttata*; State Threatened), and Blanding's turtle (*Emydoidea blandingii*, State Special Concern), cerulean warbler (*Steophaga cerulean*, State Threatened), Prothonotary warbler (*Protonotaria citrea*, State Special Concern), Red-shouldered hawk (*Buteo lineatus*, State Threatened). Additional species of greatest conservation need that utilize these habitats include, barred owl (*Strix varia*) pileated woodpecker (*Dryocopus pileatus*), and Indiana bat (*Myotis sodalists*, Focal Species). These species nest and/or roost in forested wetlands, where they utilize large, mature trees and snags.



Photo 1. Mature floodplain forest along the Kalamazoo River. Silver maple is the dominant canopy species.

SUMMARY OF COMPARTMENT 13

Landuse History

Similar to much of southern Michigan, Compartment 13 has been dramatically altered by European settlement. Logging, agriculture, and alterations to hydrology have had lasting legacies to the landscape. Imagery from 1938 (Figure 4) allows us to identify areas impacted by agriculture, wetlands influenced by altered hydrology, and also provides insight into the age of forests.

Many areas cleared for agriculture were unproductive as a result of poor sandy soils. These places were often converted to pine plantations (e.g. Stands 32, 61, 62, and 73). In other places, these agricultural areas were

abandoned and converted to forest or remained in an early stage of succession.

Areas of abandoned agricultural land that are still open tend to have the greatest concentration of barrens flora as well as a significant component of invasive non-native vegetation. The best examples are Stands 11 and 17. Barrens species readily colonize areas of abandoned agriculture in this region and their presence likely indicates a local occurrence of this community type historically. Because of the prevalence of high-quality barrens areas in other portions of ASGA, we do not recommend focusing any barrens restoration efforts in Compartment 13.

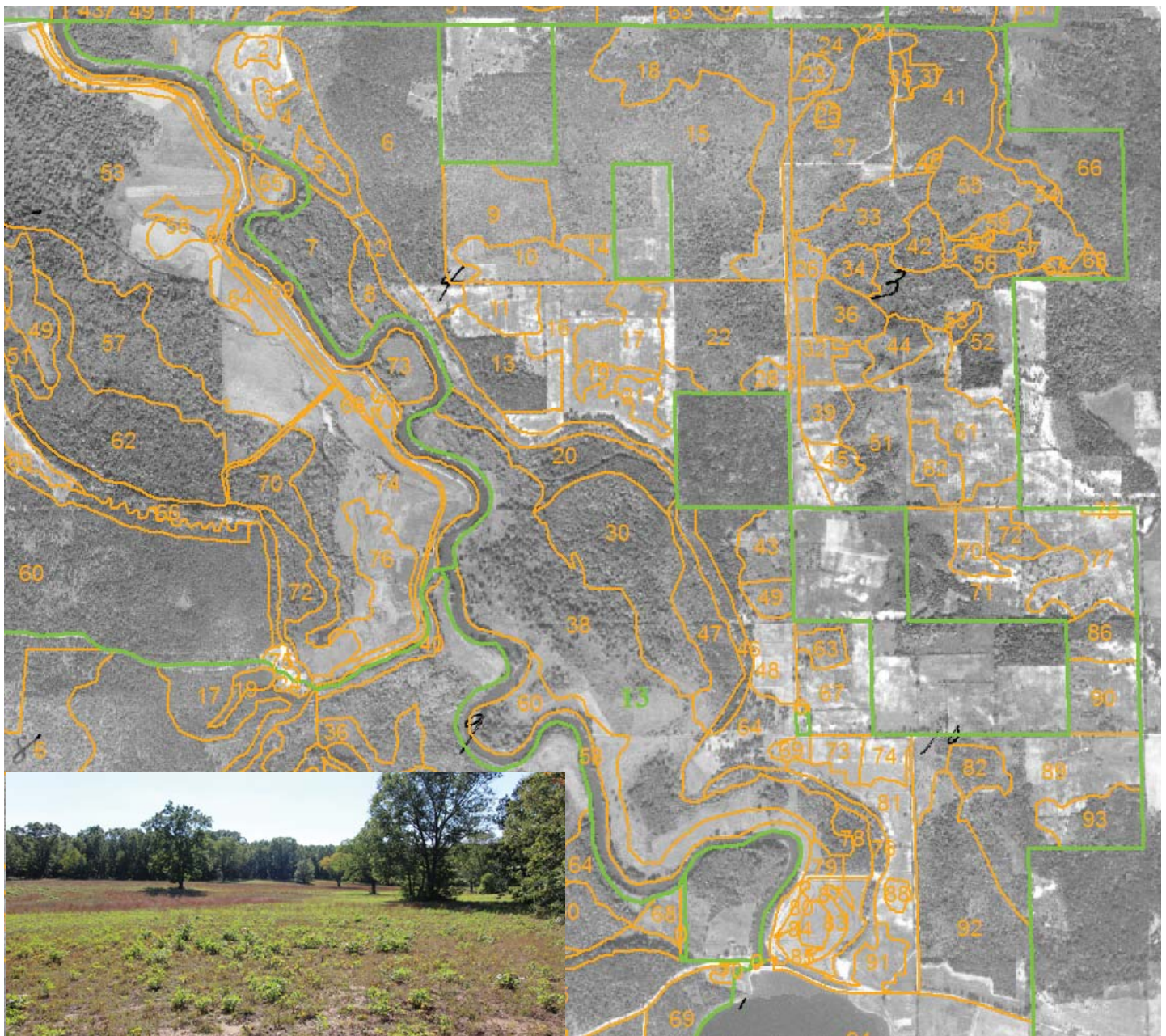


Figure 4. Imagery from 1938 provides valuable insight into changes within Compartment 16 over the past 80 years. Many of the areas historically cleared for agriculture have been recolonized by barrens species and remain in a non-forested state; such as in Stand 17 (Inset).

Important Natural Areas

Though none of the areas within Compartment 13 are considered exemplary natural communities, many of the stands within the compartment are significant, in terms of their contribution to local biodiversity. The stands mentioned here for your consideration may best contribute to native biodiversity by being maintained as mature and maturing forest with limited fragmentation.

Upland Forest

Large areas of contiguous mature upland forest have been identified within this compartment. In general, ASGA tends to be significantly more forested than the surrounding county. While much of the forests in ASGA were historically barrens that have converted to closed-canopy forest as a result of fire suppression, the upland forests in this compartment likely only had a minor component of barrens, based on circa 1800 vegetation maps.

The concentration of these mature forested stands within this compartment creates a nearly contiguous corridor of mature forest along the Kalamazoo River and adjacent uplands. The extensive nature of this block of mature forest, the rarity of such a large area of this dry-northern forest in the region, and the relative scarcity of such systems in southern Michigan indicates that this may

be a forest of significance for the region, particularly for neotropical migrants and forest interior obligates. In addition to providing benefits to migrating birds, these forests also mitigate flood events and protect water quality of the Kalamazoo River. The steep forested slopes are particularly important to protect from intensive tree removal in order to prevent erosion and sedimentation of the creek. Management decisions should apply best management practices and provide a significant buffer of at least 150 ft. of natural cover from the top of the slope and intensive mechanical tree removal in order to protect water quality of the Kalamazoo River.

The most important upland forests in this compartment are in Stands 6, 15, 41, 52, and 92 (highlighted in Figure 5). These were identified based on age, size of stand, lack of invasive species, proximity to other stands of similar age and quality, and adjacency to important wetlands. Stands 12, 46, and 76 are forested slopes along the Kalamazoo River outwash channel and should be protected from intensive management to prevent erosion and protect water quality. Though not necessarily exemplary natural communities, when considered together, these 8 stands are regionally important dry-mesic forests.



Photo 2. Steep slopes along the Kalamazoo River are variable in composition depending on aspect. The forests on these slopes provide habitat for a myriad of species and the forested hillsides provide stabilization of the soil and protect water quality of the river.



Figure 5. Mature upland forests in the highlighted stands provide an opportunity for promoting and protecting large tracts of late-succession forest.

Lowland Forest

The forested wetland flanking Kalamazoo River is a significant natural feature of the compartment. This floodplain forest is in flux as a result of the recent emerald ash borer outbreak and the majority of the canopy ash has been lost as a consequence. These stands provide critical habitat for many species and the wetland helps maintain water quality of the Kalamazoo River as well as providing habitat to many species of conservation interest and migratory birds. There are large areas of mature floodplain forests in Compartment 13 that are included with an existing EO that extends north of M-89. There are also areas of the floodplain forest that are relatively young with a history of agriculture. Despite the degraded nature of some of these forested stands, the majority of the floodplain system is relatively high quality and these forests are part of a much larger contiguous forested wetland complex flanking the river. Prothonotary and cerulean warblers have been documented from Stands 1, 4, 7, 8, 12, 38, and 60. These species rely on extensive tracts of mature lowland forest.

Away from the floodplain, there are additional important lowland forest in Stands 66 and 89. These are a mosaic of mesic southern forest and southern hardwood swamp with zones of upland and lowland throughout. described as a dry-mesic northern forest though has elements of other forest communities throughout. These stands have a prevalence of red oak, red and sugar maple, tulip tree, beech, shagbark, and bitternut hickory and are best described as mesic forests and atypical of the rest of the compartment. Within these stands there is an unusual confluence of wet and dry habitats as well as northern and southern species resulting in a composition atypical of the region and not seen in many other locations within ASGA. While these stands are unusual, comprised of mature trees, and mostly free from invasives, they do not qualify as an EO due to their small size, areas of historic selective logging, areas of locally dominant invasive species and fragmented nature of surrounding area. These two stands also provide excellent habitat to cerulean warblers.



Photo 3. An unusual forest type persists in the southern portion of Stand 89. Tulip tree, bitternut hickory, beech, shagbark hickory, ironwood, and spicebush are common species within this stand but are much less common elsewhere in ASGA. This is a unique stand that is a mosaic of southern hardwood swamp and mesic forest.



Figure 6. Mature lowland forests in the highlighted stands provide an opportunity for promoting and protecting large tracts of late-succession forest. These forests in particular have an added importance of protecting water quality and mitigating floods along the Kalamazoo River.

Rare Animals

Mammals

A least shrew (*Cryptotis parva*, State Threatened) was found in this area in 1935. Little information is available for this record other than “near Kalamazoo River”. The least shrew inhabits dry upland meadows with dense coverage of grasses and forbs. It can also be found in marshy areas, fencerows, and woodland edges. Nests are often found tucked under rocks and logs.

Two woodland voles (*Microtus pinetorum*, State Special Concern) were found in 1939. Again, no information was provided about the vole occurrence other than “near Kalamazoo River”. The woodland vole occurs in deciduous woodlands with loose sandy soils, deep humus, and heavy leaf litter. Although it prefers deciduous forests comprised of oak, maple and/or beech, the woodland vole can potentially be found in any forest type.

Herptiles

Blanchard’s cricket frogs (*Acris blanchardi*, State Threatened) were found in 1961 in the area though no specific location was provided within Compartment 13. This species inhabits the open edges of permanent ponds and wetlands and prefers open or partially vegetated sandy shorelines. This frog may occupy small forested wetlands within Stands 66, 71, and 89 but there is likely little preferred habitat in Compartment 13.

A gray ratsnake (*Pantherophis spiloides*, State Special Concern) was observed in the area in 2002, though that specific record is from across the Kalamazoo River in Compartment 16. Locational information for this record

does not provide a specific stand. The gray ratsnake is the largest snake in the Great Lakes region and usually occurs in forested habitats but it also uses adjacent open habitats including shrubby fields, prairies, and marsh and bog edges. The gray ratsnake often climbs trees to eat nestling birds or eggs. Gray ratsnakes hibernate in mammal burrows, root networks, rock crevices or other sites that provide refuge from freezing temperatures. Gray ratsnakes deposit eggs in loose soil, rotted stumps or logs, cavities under rocks, logs, or other cover. This portion ASGA is known to have a population of ratsnakes and suitable habitat likely exists throughout the compartment.

Eastern massasauga rattlesnakes (*Sistrurus catenatus*, Federally Threatened) were found in the area in 1938. Individuals have been documented in adjacent compartments more recently, but not in Compartment 13. This species has been recently listed as federally threatened and is facing decline from habitat loss, persecution, and recently from snake fungal disease. Populations in southern Michigan are typically associated with open wetlands, particularly prairie fens and wet meadows. They also utilize open uplands and forest openings for foraging, basking, gestation and giving birth to young. Massasaugas usually hibernate below the frost line in crayfish or small mammal burrows, tree root networks or rock crevices in or along the edge of wetlands or in upland areas with presumably high water tables. Massasauga habitat is generally open, sunny areas intermixed with shaded areas for thermoregulation, presence of the water table near the surface for hibernation, and variable elevations between adjoining lowland and upland habitats. Future surveys for massasauga are recommended in Stand 30, 47, 46 and adjacent uplands.

Table 1. Element Occurrences of rare animals in Compartment 13. 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, X = Extirpated from Michigan, L denotes federal status.

Common Name	Scientific Name	EO ID	EO Rank	Status	First Observation Date	Last Observation Date	Stands
Mammals							
Least shrew	<i>Cryptotis parva</i>	8373	H	T	11/24/1938	11/24/1938	Vague Record
Woodland vole	<i>Microtus pinetorum</i>	9585	H	SC	07/14/1939	07/14/1939	Vague Record
Herptiles							
Blanchard's cricket frog	<i>Acris blanchardi</i>	2366	H	T	05/24/1961	05/24/1961	Vague Record
Gray ratsnake	<i>Pantherophis spiloides</i>	1288	E	SC	1989	04/01/2002	Vague Records
Eastern massasauga	<i>Sistrurus catenatus</i>	711	H	LT	1938	1938	Vague Record
Birds							
Prothonotary warbler	<i>Protonotaria citrea</i>	13998	E	SC	05/20/1992	2005	1, 4, 8, 12, 38, 60
Cerulean warbler	<i>Setophaga cerulea</i>	13323	AB	T	05/20/1992	06/11/2015	1, 7, 12, 20, 38, 60
Fish							
Lake sturgeon	<i>Acipenser fulvescens</i>	1883	E	T	1980	04/18/2016	Kalamazoo River
Weed shiner	<i>Notropis texanus</i>	1918	H	X	10/03/1937	05/06/1939	Kalamazoo River



Figure 7. Locational information of rare animals was mapped with stands in Compartment 13.

Birds

Cerulean warblers (*Setophaga cerulean*, State Threatened) were documented within Compartment 13 as recently as 2015. Observations were within the floodplain forest along the Kalamazoo River in Stands 1, 7, 12, 20, 38, and 60. Cerulean warblers seem to prefer mesic sites over more xeric sites. They are most commonly found in the canopy of large tracts of mature deciduous forest. Given their habitat requirement, there is additional suitable habitat for Cerulean warbler within the compartment in mature forests along the steep hillsides that flank the Kalamazoo River outwash channel as well as mature forests in Stands 66 and 89.

Prothonotary warblers (*Protonotaria citrea*, State Special Concern) were documented from Stands 1, 4, 8, 12, 38, and 60 as recently as 2011. All observations occurred within the floodplain forest along the Kalamazoo River. The prothonotary warbler is a hole-nesting warbler. In southern Michigan the preferred habitat is mature bottomland forests with abundant snags and cavities for nesting.

Fish

Lake sturgeon (*Acipenser fulvescens*, State Threatened) were documented within Compartment 13 in the Kalamazoo River as recently as 2016. Lake sturgeon are generally benthic species and occur in large rivers and shallow areas of large lakes. They are most often associated with unvegetated deep run and pool habitats (>5ft) in rivers. Spawning often occurs in gravel bottom streams.

Specimens of weed shiner (*Notropis texanus*; Extirpated) were collected from the Kalamazoo River in 1937. This species has not been found in Michigan since 1953 and is considered extirpated. The weed shiner was once found in open, sandy streams, river, and impoundments with submerged aquatic vegetation. In Michigan, they were found mostly in tributary junctions and below dams of major rivers. Populations were locally distributed and rare, leaving them vulnerable to extinction.



Photo 4. Prothonotary warblers have been documented in Compartment 13 from floodplain forests along the Kalamazoo River. Photo by Aaron Kortenhoven 2016.

MANAGEMENT RECOMMENDATIONS

Management recommendations provided here are intended to promote and protect native biodiversity, especially rare species and native communities. The extensive forested wetlands in this area are critical habitat for rare bird taxa. Maintaining ecological integrity of these forests and their current state as closed-canopy forested wetlands should be a management objective to protect rare taxa and biodiversity.

Additional management activities recommended for this compartment are intended to promote mature and unfragmented forest as well as the use of prescribed fire as a maintenance tool for upland forests. Elsewhere in the game area, fire is often used to promote and expand barrens systems that have degraded as a result of protracted fire suppression and conversion to forest. Because barrens habitat was historically only a minor component of this compartment, fire can be employed primarily as a part of forest ecosystem management. The objectives of this approach would be to minimize mesophytic invaders (such as maple and cherry), stimulate regeneration of pine and oak, create structural diversity by causing localized mortality of canopy trees, and favor barrens species that may lie dormant within the seed bank.

Ideally, the fire regimen would be varied across the compartment in order to create refugia for the species that utilize the affected habitats. Fire frequency and intensity can be varied to achieve additional objectives, such as: maintaining barrens openings, creating barrens openings where characteristic species are present, maintaining early-succession habitat, and promoting aspen regeneration. Within this compartment, fire as a management tool can replace mechanical harvest in most situations and thereby avoid the fragmentation observed with clearcutting. The varied and uneven nature of burns will ideally create a complex habitat that favors both game and non-game species. The reduction of red maple in the subcanopy will be particularly important as this mesophytic species intercepts sunlight and limits the herbaceous vegetation that white-tailed deer utilize in the summer months. A more robust fire regimen would therefore increase food sources for focal species while promoting ecosystem integrity and habitat for rare species.

Landscape-level use of prescribed fire for maintenance of forested systems should be applied to the largest areas of forest that also include stands that relatively high-quality, existing features for burn breaks, as well as areas that have potential for barrens. The easiest area to apply fire to meet these conditions is between the Kalamazoo River and 43rd St/123rd Ave (Figure 8). The river and the road can be used as a burn break and the area contains blocks of mature forest as well as openings with barrens species. A large block east of 41st St and north of 122nd Ave would also be a good area for implementing prescribed fire, particularly for maintaining early successional habitat and promoting aspen. Within these areas, smaller units can be created using existing logging trails in order to employ fire to maintain early succession habitat where pine plantations, aspen stands, and younger forests already exist. The existing patchwork of habitat and burn break options should provide the necessary refugia while allowing managers the flexibility of implementing a diversity of burn plans. Increased fire frequency, burning during the growing season, and targeting barrens areas should virtually eliminate the need for mechanical tree removal.

While some barrens species are present in this compartment, the quality of habitat is severely lacking. Considering the abundance of high-quality barrens areas elsewhere within the game area, the areas within Compartment 13 are not likely to be a realistic priority for long-term barrens restoration.

Because of the presence of so many rare taxa of herptiles in Compartment 13 and nearby Compartment 16, maintenance and enhancement of habitat should be a primary focus. The use of prescribed fire to create suitable nesting habitat adjacent to high-quality wetlands is an obvious opportunity but actions to control mesopredators such as raccoons and possums should also be considered. These are very effective predators of herptile nests and many excavated turtle nests were observed throughout the area in the field seasons of 2011 and 2012. It has also been reported that this area is often used to release trapped raccoons that locals prefer not to kill.

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 13 are provided for your consideration but should be considered in the wider context of the game area:

- Maintain large tracts of mature forest
 - Important upland Stands: 6, 12, 15, 41, 46, 52, 76, and 92
 - Allow these stands to continue maturing
 - Provide 150 ft forested buffer between top of the slopes flanking Kalamazoo River outwash channel and intensive forestry management activities
 - Avoid further fragmentation to protect and promote habitat for neotropical migrants and red-shouldered hawks
 - Important lowland Stands: 1, 7, 8, 20, 30, 38, 47, 66, and 89
 - Floodplain habitat occupied by cerulean and prothonotary warblers
- Return fire as a disturbance
 - Implement before timber harvest to promote oak regeneration and reduce maple
 - Focus fire use in high-quality forests mentioned above
 - Use existing features such as roads and streams as burn breaks
 - Vary seasonality of burns to create habitat variability
 - Monitor to identify areas where barrens vegetation is expressed as a result of fire
 - Increase fire frequency and intensity to promote early-succession habitat
- Promote habitat for rare herptiles
 - Avoid alterations to hydrology in occupied wetlands
 - Provide buffers of natural cover between intensive forestry operations and wetlands
 - Reduce mesopredator populations
 - Utilize prescribed fire in uplands adjacent to occupied wetlands in order to promote nesting sites
- Promote oak-pine barrens habitat
 - Not a top priority area for barrens restoration
 - Focus efforts around Stand 17
 - Include surrounding forests in prescribed burns
 - Thin surrounding forests to achieve barrens structure



Figure 8. Potential project areas to focus the use of prescribed fire.

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