Allegan State Game Area

Natural Features Summary of Compartment 7

Prepared by:
Aaron P. Kortenhoven, Jesse M. Lincoln, and Joshua G. Cohen

Michigan Natural Features Inventory

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Wildlife Division
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Cover photo by Jesse M. Lincoln

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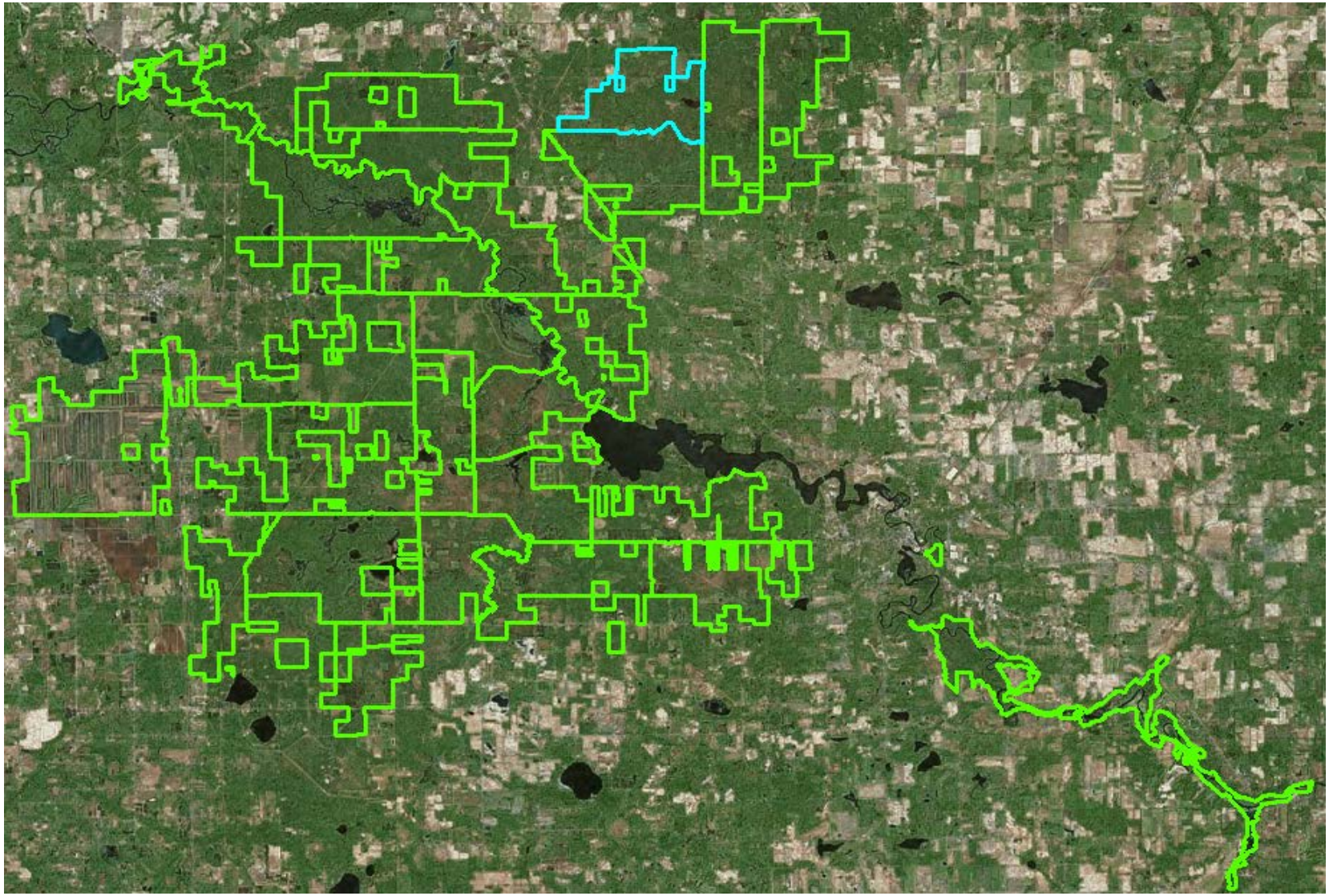

Figure 1: Compartment 7 of Allegan State Game Area is highlighted in blue.

Introduction

Project Background

During 2011 and 2012, the Department of Natural Resources (DNR) and Michigan Natural Features Inventory (MNFI) conducted the Stage 1 survey of Allegan State Game Area (ASGA, Figure 1) as part of the DNR's Integrated Forest Monitoring, Assessment, and Prescription (IFMAP, now 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 flagged areas that might meet the standards of exemplary natural community Element Occurrences (EOs). Allegan State Game Area is in the central portion of Allegan County there are 25 compartments in ASGA (Figure 1). Compartment 7 is in the northeast portion of the state game area, north and east of the Kalamazoo River and consists of 1647 acres (Figure 1). A summary of current natural communities is presented in Table 1.

This review of Compartment 7 is intended to complement current management plans by the WLD. This report will provide an overview of the historical and ecoregional context of ASGA and Compartment 7, a summary of known element occurrences and natural community restoration potential in the compartment. This report will also provide management recommendations for the areas of interest in Compartment 7. Information used in this report was obtained from MNFI's Biotics database (MNFI 2015), observations by surveyors, and on notes taken during MiFI surveys.

Ecoregional Context

Around 10,000 to 14,000 years ago, melt waters from receding glaciers caused drastic increases in water levels of Lake Michigan (Figure 2). The western portion of Allegan County was under water depositing sands and clays at the bottom of this proglacial lake. Additional sands from outwash events were deposited over lake-plain formations as receding glaciers caused periodic flooding events. Areas of lake-plain are characterized by flat to gently rolling topography with well drained and excessively-well drained soils. Based on the regional landscape classification by Albert (1995), ASGA lies almost entirely within the Southern Lake Michigan Lake Plain (Figure 3) and Compartment 7 falls completely within the Southern Lake Michigan Lake Plain region (Figure 3).

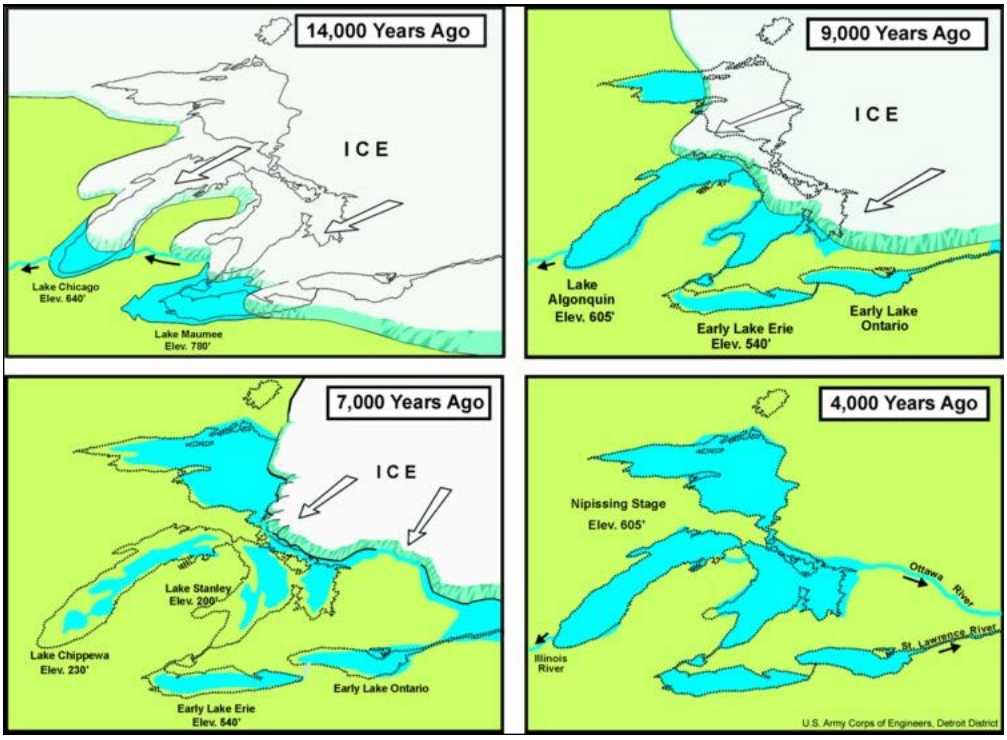

Figure 2: Stages of great Lakes development with the recession of the glaciers.

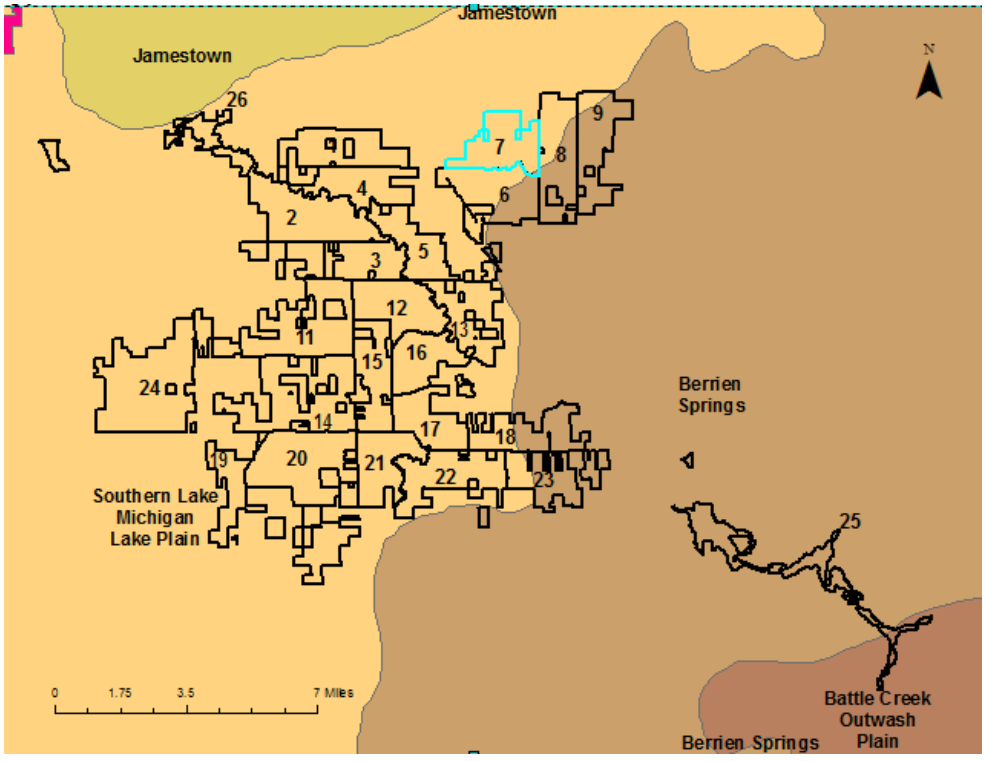

Figure 3: Ecoregions of Allegan State Game Area (Albert 1995).

Vegetation Patterns of Compartment 7

Historically, much of the game area was a mosaic of forested and non-forested uplands and lowlands, with the non-forested areas supporting savanna ecosystems characterized by large open-grown oaks and pines with an herbaceous layer consisting of both prairie and forest species. Forests were predominantly dry-mesic northern forest. Wetlands occur in outwash channels, kettle depressions, and lowlands associated with the Kalamazoo River, which is bordered by extensive tracts of floodplain forests. Lakes, marshes, bogs, inundated shrub swamps, intermittent wetlands, coastal plain marshes, and vernal pools within forested systems would have occupied the kettle depressions created by large blocks of ice left by the retreating glaciers. Outwash channels formed from glacial melt-waters would have been occupied by wet prairies, shrub swamps, and forested swamps. Due to gaps in surveyor's notes aspects of the historic vegetation maps may not precisely reflect the extent of certain small-scale systems; particularly emergent wetlands and hardwood swamps. The majority of the upland areas of Compartment 7 were dominated by oak-pine barrens and white pine-mixed hardwood forests; the lowland areas were characterized by southern hardwood swamps, coastal plain marshes and wet-mesic sand prairies (Figure 4, Figure 5).

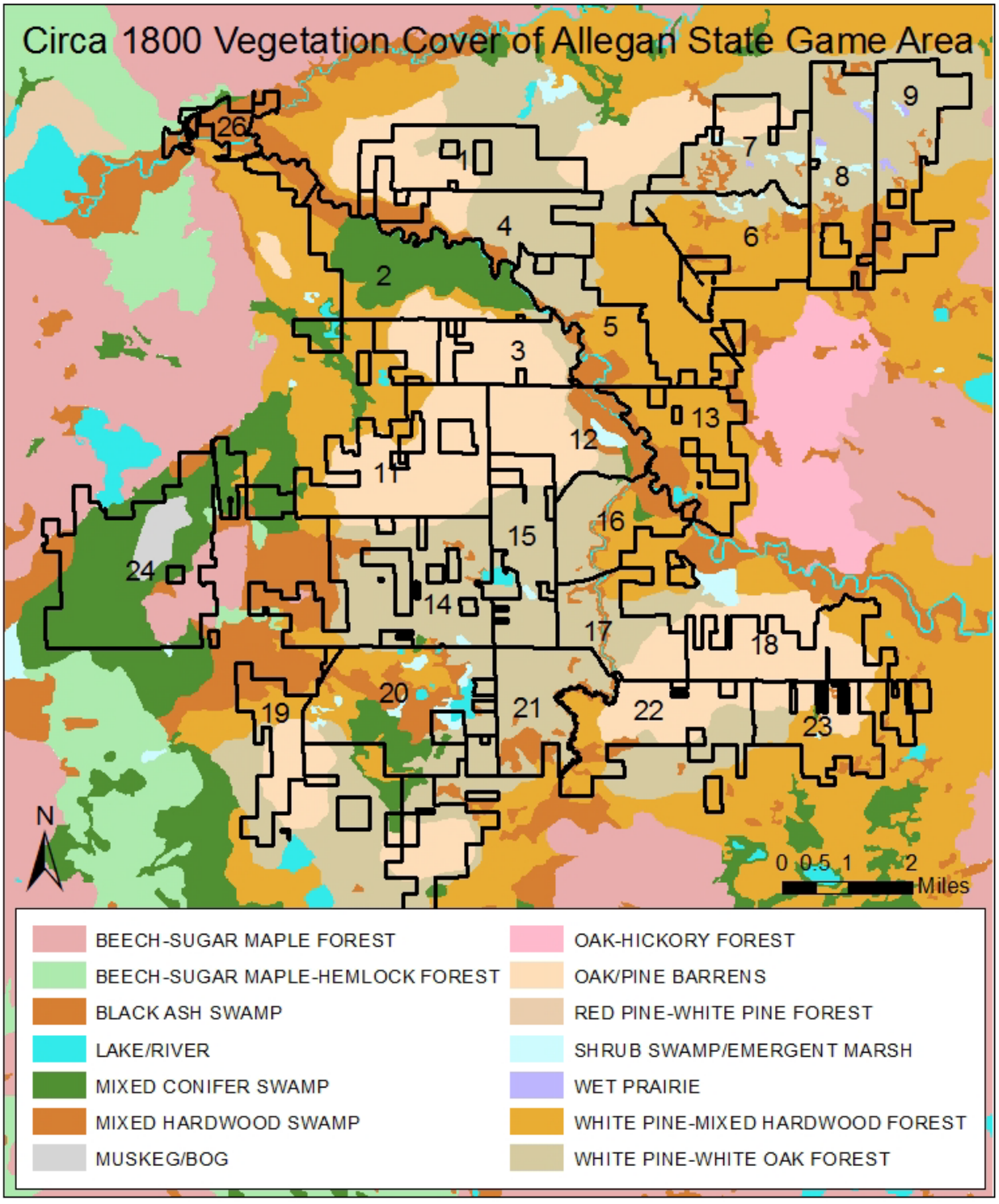

Figure 4: Approximate vegetation cover of Allegan State Game Area Circa 1800 (Comer et al. 1995).

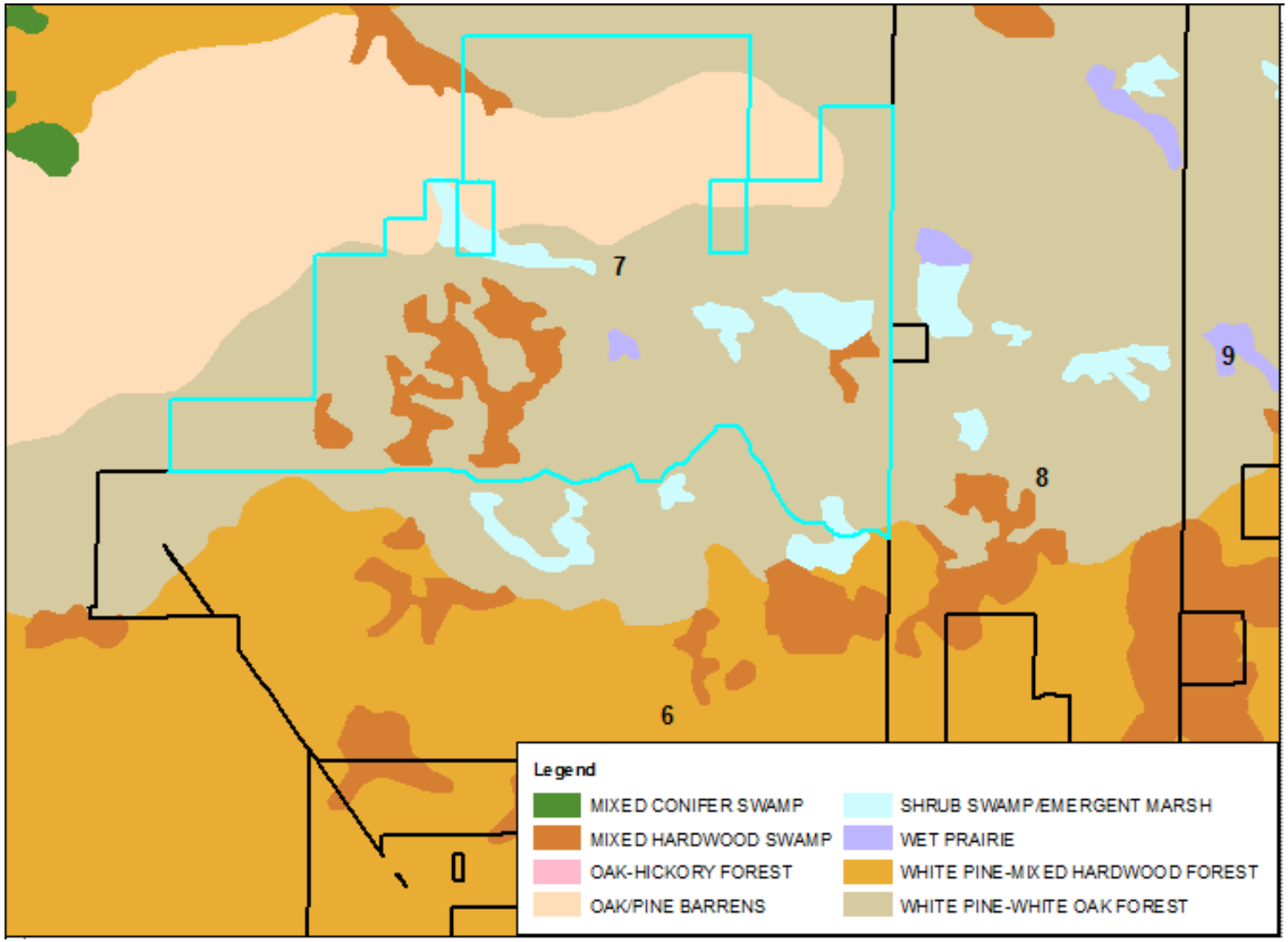

Figure 5: Approximate vegetation cover of Compartment 7 Circa 1800 (Comer et al. 1995).

The dominant forest cover type for Compartment 7 was dry-mesic northern forest. White pine (*Pinus strobus*) was often a dominant or codominant canopy species in this forest type, often forming a super-canopy. Hemlock (*Tsuga canadensis*) was historically present in wetter habitats and was occasionally codominant with white pine in the canopy or supercanopy, especially along steep slopes and mesic areas that were less fire prone.

Currently, most forests in this compartment are characterized by a significant hardwood component and often lack pine. Hardwood associates include white oak (*Quercus alba*), black oak (*Q. velutina*), red oak (*Q. rubra*), and red maple (*Acer rubrum).* Bracken fern (*Pteridium aquilinum*) often dominates the ground layer.

Characteristic species of the shrub layer include serviceberries (*Amelanchier* spp.), bush honeysuckle (*Diervilla lonicera*), huckleberry (*Gaylussacia baccata*), witch hazel (*Hamamelis virginiana*), flowering dogwood (*Cornus florida*), choke cherry (*Prunus virginiana*), and blueberries (*Vaccinium* spp.).

Lowland forested areas in Compartment 7 were largely dominated by southern hardwood swamp historically. Locally, this forest type occurred between dune ridges in seasonally inundated depressions with mineral soils. Today this community type is characterized by canopy dominance of red maple (*Acer rubrum*), pin oak (*Quercus palustris*), swamp white oak (*Q. bicolor*), and green ash (*Fraxinus pennsylvanica*). Throughout this compartment, sycamore (*Platanus occidentalis*), cottonwood (*Populus deltoides*), basswood (*Tilia americana*), tulip tree (*Liriodendron tulipifera*), and quaking aspen (*Populus tremuloides*) occur as canopy species in lowland forests.

Historically compartment 7 contained oak-pine barrens in the northern portion. Oak-pine barrens likely originated when prairie fires created openings by spreading into surrounding closed oak and pine forests. Repeated low-intensity fires, periodic drought, frost, and windthrow maintained these ecosystems. The extent to which barren remnants were present during the early part of the 20th century can be seen in 1938 aerial photos in (Figure 6).

At present only a few stands that contain patchy oak-pine barrens remain in areas where this community occurred historically (Table 1, Figure 7). Compartment 7 is a mix of white oak/black oak dominant forest. White pine is present in the sub-canopy, but rarely as a canopy tree. Some of the forested stands have small open areas which contain little bluestem (*Schizachyrium scoparium*), black oatgrass (*Piptochaetium avenaceum*), and goat's rue (*Tephrosia virginiana*). Patches with these barrens species are found in the herbaceous layer of stands 9, 25, 40, 34, 36, 54, (Figure 6).

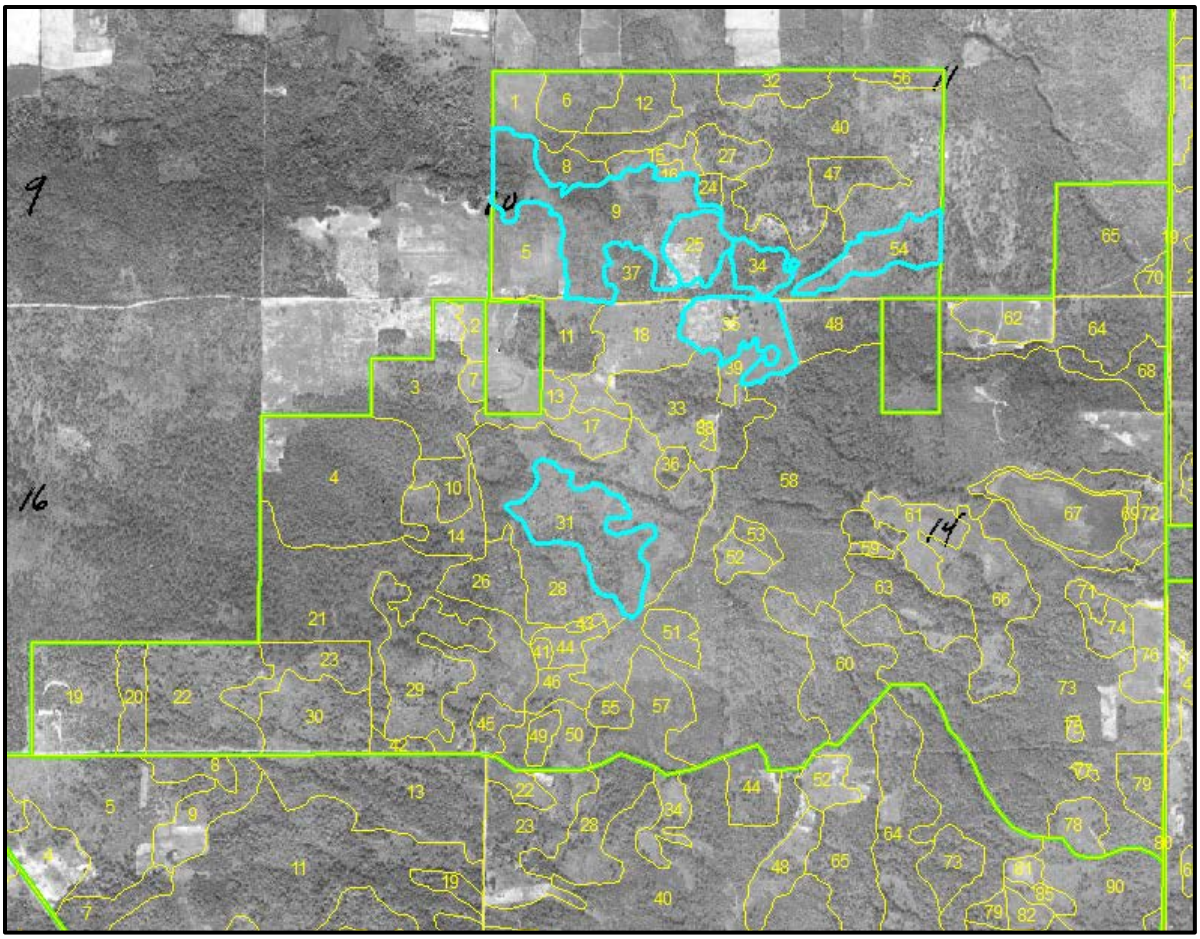

Figure 6: 1938 aerial imagery of Compartment 7.

Natural Communities

There are currently five different natural community types represented in Compartment 7: southern hardwood swamp, dry southern forest, oak-pine barren, coastal plain marsh and wet-mesic sand prairie (Table 1, Figure 7).

Table 1. Stands of interest in Compartment 7, their EO status and possible actions for improving the ecological integrity of these unique communities.

Hydrologic regime	Ecological Group	Community Type	Stand	Quality	Action
Terrestrial	Savanna	Oak-Pine Barrens	9	EO	Burn
		Oak-Pine Barrens	25	EO	Burn
		Oak-Pine Barrens	40	EO	Burn
		Oak-Pine Barrens	34	EO	Burn
		Oak-Pine Barrens	36	RP	Burn
		Oak-Pine Barrens	54	RP	Burn
	Forest	Dry Southern Forest	65	RP	Burn
		Dry Southern Forest	58	RP	Burn
Palustrine	Forested wetland	Southern Hardwood Swamp	31	RP	Maintain
		Southern Hardwood Swamp	26	RP	Maintain
	Marsh	Coastal Plain Marsh	2	RP	Burn
		Coastal Plain Marsh	7	RP	Burn
		Coastal Plain Marsh	15	RP	Burn
		Coastal Plain Marsh	17	RP	Burn
		Coastal Plain Marsh	18	RP	Burn
		Coastal Plain Marsh	61	EO	Burn
		Coastal Plain Marsh	67	EO	Burn
	Wet Prairie	Wet-mesic sand Prairie	5	EO	Burn
		Wet-mesic sand Prairie	8	RP	Burn
		Wet-mesic sand Prairie	12	RP	Burn
		Wet-mesic sand Prairie	13	EO	Burn
		Wet-mesic sand Prairie	15	RP	Burn
		Wet-mesic sand Prairie	52	EO	Burn

RP = restoration potential.

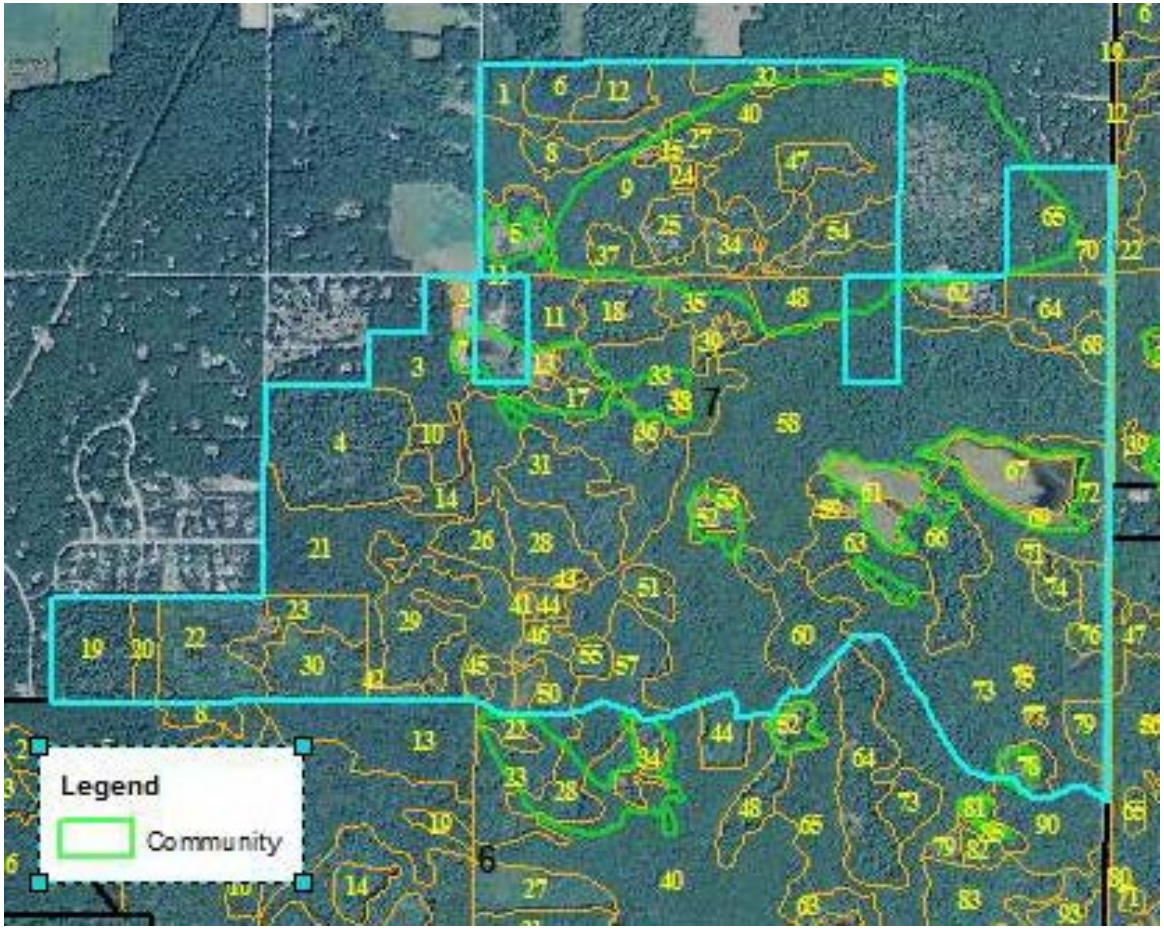

Figure 7: Mapped natural community element occurrences in Compartment 7.

Southern hardwood swamp

Southern hardwood swamp is a minerotrophic forested wetland dominated by a mixture of lowland hardwoods that occur in southern Lower Michigan on mineral or occasionally organic soils. Conifers are absent or local. The community occupies shallow depressions and high-order stream drainages on a variety of landforms. The canopy is typically dominated by silver maple (*Acer saccharinum*), red maple (*A. rubrum*), green ash (*Fraxinus pennsylvanica*), and black ash (*F. nigra*).

Southern hardwood swamp provides critical habitat for a variety of animal species. The community provides important breeding and foraging habitat for several amphibians, and reptiles, including state-listed species, such as spotted turtle (*Clemmys guttata*), Kirtland's snake (*Clonophis kirtlandii*), and Blanding's turtle (*Emydoidea blandingii*), red-shouldered hawk (*Buteo lineatus*), barred owl (*Strix varia*) and pileated woodpecker (*Dryocopus pileatus*). Indiana bat (*Myotis sodalist*, Focal Species) also nest and/or roost in southern hardwood swamp, where they utilize large, mature trees and snags.

In the southern portion of Compartment 7 there are several areas containing southern hardwood swamp (Figure 8). Stands 26 and 31 are examples of this natural community that are either decent quality or have restoration potential. For this community allowing natural processes to take place will lead to mature higher quality forest. During the time of this survey ash trees in the canopy were still alive, but this may no longer be the case given the prevalence of emerald ash borer in the area. The trajectory of succession in southern hardwood swamps after canopy gaps occur from the loss of ash should be monitored.

Stand 29 and 31 need little management to maintain them as southern hardwood swamps. For these two stands continued monitoring for invasive species is the most critical element to having them mature. Care should be given to not alter hydrology as this can lead to tree die-off and or the establishment of invasive species. Allow fire from adjacent upland areas to extinguish naturally as this will create a natural transition zone that will be utilized by wildlife species for both browse and cover as pioneer vegetation matures. Such transition zones would provide excellent feeding habitat for insectivorous birds such as the hooded warbler (*Wilsonia citrina*) and cerulean warbler (*Dendroica cerulea*).

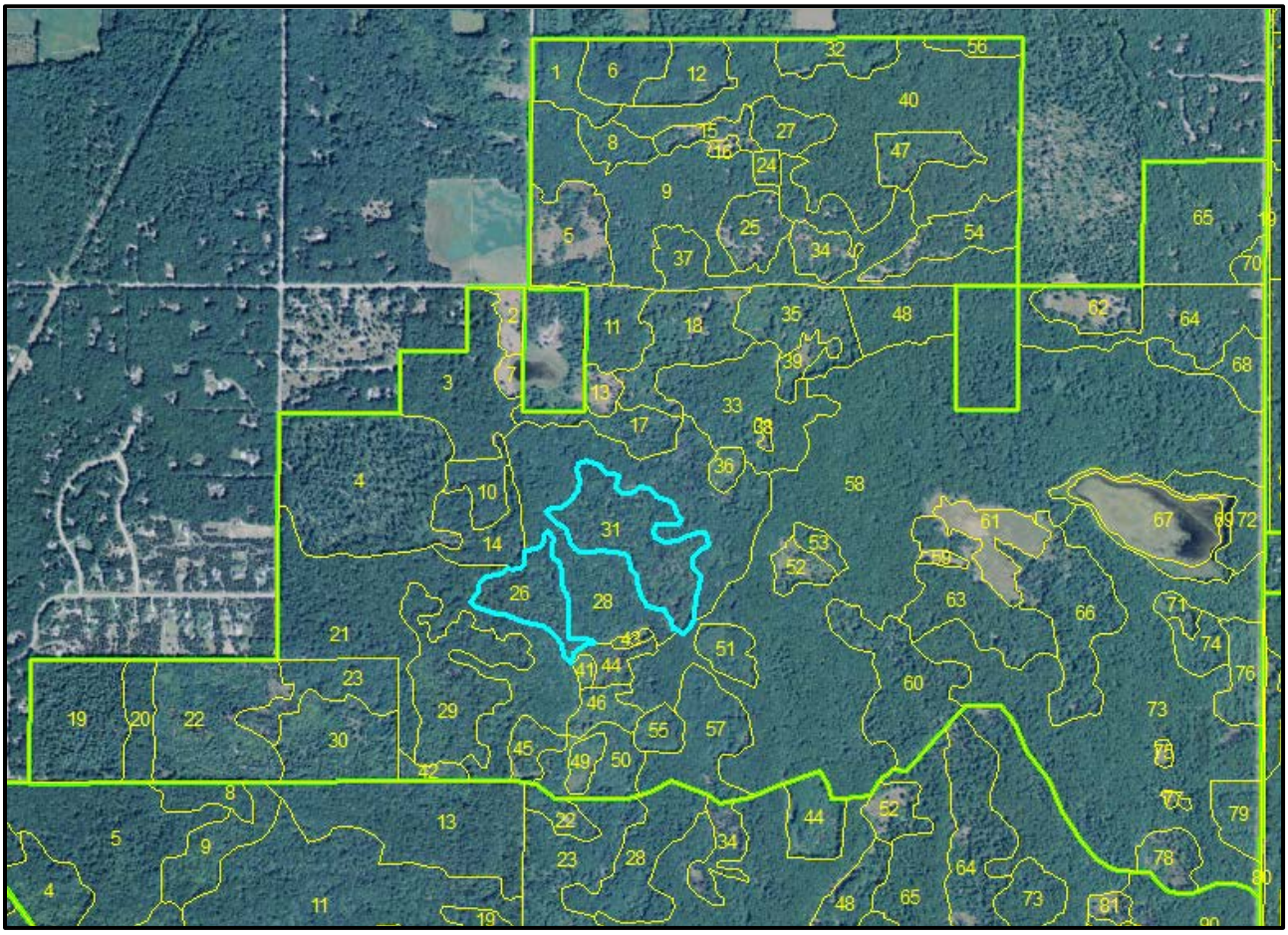

Figure 8: The highlighted stands depict areas in Compartment 7 that contain southern hardwood swamp.

Dry Southern Forest

Dry southern forest is a fire-dependent, oak-dominated forest type on dry sites lying mostly south of the climatic tension zone in southern Lower Michigan. Frequent fires maintain semi-open conditions, promoting oak regeneration and ground and shrub layer diversity.

The canopy layer generally is dominated or codominated by black oak (*Quercus velutina*) and white oak (*Q. alba*). Prevalent canopy associates include pignut hickory (*Carya glabra*), red maple (*Acer rubrum*), black cherry (*Prunus serotina*), and sassafras (*Sassafras albidum*). Northern pin oak (*Q. ellipsoidalis*) is present on the driest sites close to the tension zone. Prevalent species of the subcanopy layer include flowering dogwood (*Cornus florida*), American hazelnut (*Corylus americana*), cherries (*Prunus* spp.), and sassafras (*Sassafras albidum*). Characteristic shrubs include serviceberries (*Amelanchier* spp.), New Jersey tea (*Ceanothus americanus*), low sweet blueberry (*Vaccinium angustifolium*), velvetleaf

blueberry (*Vaccinium myrtilloides*), gray dogwood (*Cornus foemina*), American hazelnut (*Corylus americana*), hawthorns (*Crataegus* spp.), huckleberry (*Gaylussacia baccata*), witch hazel (*Hamamelis virginiana*), choke cherry (*Prunus virginiana*), and blackberries (*Rubus* spp.). Typical herbaceous species include hog peanut (*Amphicarpaea bracteata*), wild geranium (*Geranium maculatum*), beggars lice (*Hackelia virginiana*), woodland sunflower (*Helianthus divaricatus*), whorled yellow loosestrife (*Lysimachia quadrifolia*), false Solomon's seal (*Maianthemum racemosum*), wintergreen (*Gaultheria procumbens*), and summer grape (*Vitis aestivalis*).

Stands 58 and 65 in Compartment 7 are both dry southern forest (Figure 9). While this forest type is found throughout ASGA, stand 58 is one of the largest blocks and had few invasive species present.

These are dry-mesic forests tend to be fire suppressed and there are several areas where red maple and black cherry are dominating the subcanopy. Stands 58 and 65 would benefit from periodic, low-intensity ground fires that would stimulate oak and pine regeneration while reducing the dominance of mesophytic species (i.e., red maple and black cherry) in the subcanopy. Preventing fragmentation in stand 58 will provide a large area for forest interior species such as hooded warbler (*Wilsonia citrina*) and cerulean warbler (*Dendroica cerulea*).

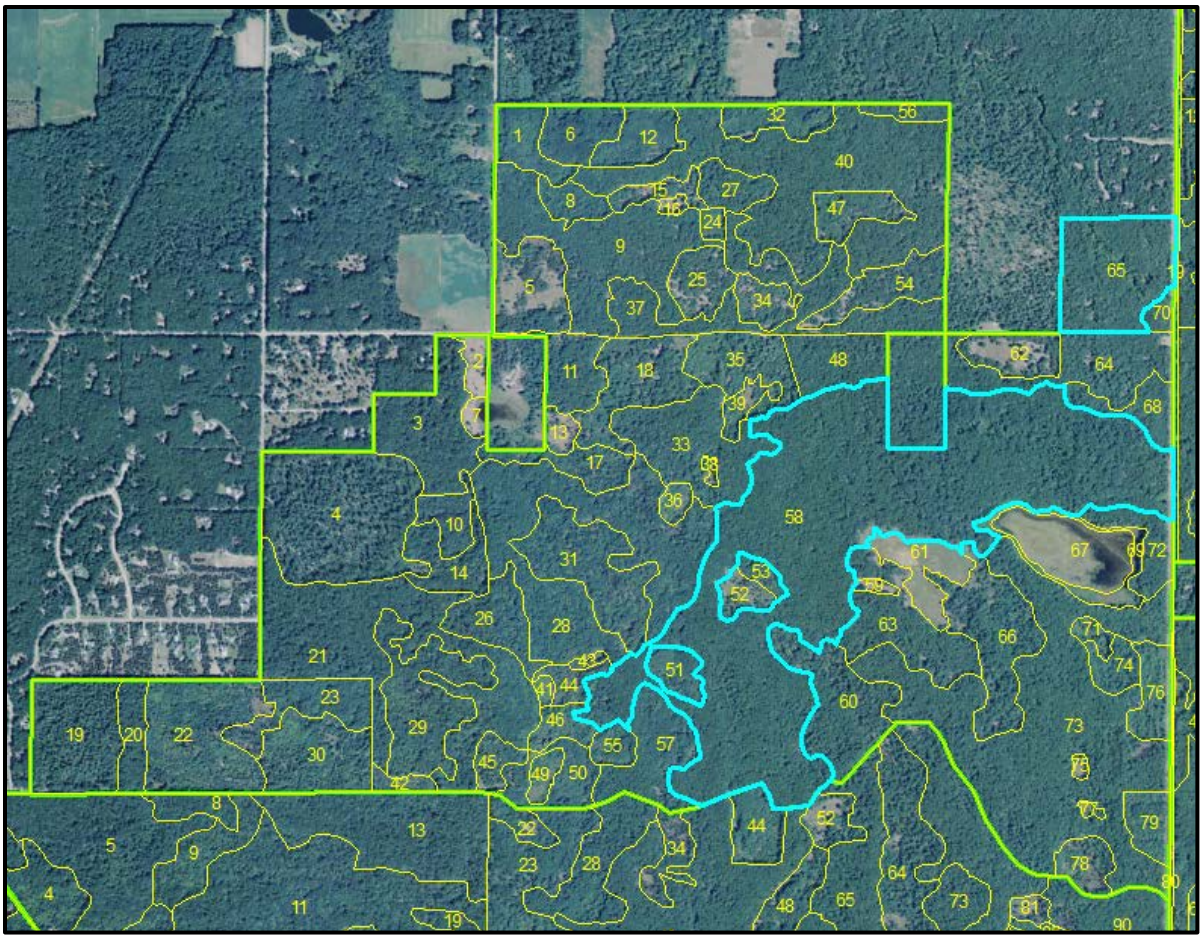

Figure 9: The highlighted stands depict areas in Compartment 7 that contain dry southern forest.

Photo 1: Dry Southern forest in stand 58. Photo by Jesse Lincoln

Oak Pine Barrens

The oak-pine barrens in Michigan have faced continuing decline over the last 150 years. This decline is largely due to agricultural and forestry practices as well as the lack of fire in the landscape over the last century. Oak-pine barrens natural community type has a state rank of S2, designating it as imperiled in the state due to restricted range and limited occurrences (less than 20 sites). Fire is the most significant factor in preserving oak-pine barrens landscapes (Cohen 2000). The absence of fire over the last century and natural succession has led to barrens in the area converting to closed canopy forests. Areas of barrens in this compartment that had less than 50 % canopy cover in the 1930s currently have over 80 % canopy (Figure10).

Compartment 7 has 6 stands that contain areas of oak-pine barrens which are located in stands: 9, 25, 40, 34, 36, and 54 (Figure 10 and Table 1). Stands 9, 25, 34 and 40 are current EOs.

Stands 25, 34 and 54 had already undergone some woody vegetation management in 2010/2011 and need little more than fire to maintain the community structure and improve vegetation composition and structure. In addition to fire, these stands can be maintained with winter mowing to reduce encroaching sassafras, black cherry, oak saplings (grubs), and other woody species that rapidly colonize open areas in the absence of fire.

Many of the areas that were historically oak-pine barrens have become forested and could be thinned to expand barrens habitat. Stands 9, 40, 34, 36, are candidates for conversion from oak forests to oak-pine barrens. Target canopy closure for restored barrens should be between 5 and 60 %. This can be achieved by leaving both individual trees and scattered clumps of mature oaks within a given area. We recommend leaving wooded buffers around current openings to avoid damaging the intact barrens vegetation and ant mounds in these openings. These buffers will emulate natural oak barrens structure over time with senescing trees and possible recruitment. We also recommend cutting trees low to facilitate mowing.

It is also important to avoid damaging ant mounds with logging equipment. The survivorship of butterflies is often increased by the presence of ants. Consequently, consideration and protection should be given to the large ant colonies that exist in the area.

Understory plants will flourish after canopy tree removal and this creates the potential for accelerated loss of barrens areas if fire is not employed in barrens maintenance to control woody encroachment. For this reason, fire must be considered a critical management tool, particularly in the first 5 to 10 years after thinning. Repeated fires will be required to prevent the formation of dense undergrowth. Burning during the growing season will also help limit sprouting of woody vegetation. Additional mowing and herbicide application may be needed if fire does not succeed in impeding woody vegetation growth.

The restriction of burning to spring time is a management concern. Fires have the greatest impact on those 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. Fires historically burned in a variety of seasons, including spring, during the growing season, and fall. Many of the natural communities found at ASGA including oak-pine barrens and dry-mesic northern forest likely historically burned primarily in late summer and early fall. Varying the seasonality of prescribed burns to match the full range of historical variability better mimics the natural disturbance regime and leads to higher biodiversity: pyrodiversity facilitates biodiversity.

Repeated early spring burns are of particular concern in oak-pine barrens and dry-mesic northern forest where a goal for prescribed burning is to control woody species. Prior to bud break and leaf flushing, the vast majority of energy in a woody plant is stored in roots as carbohydrate reserves. As plants expand 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 are able to 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 leafout, or during the growing season, energy reserves are already 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 including ease of controlling burns, greater windows of opportunity for conducting burns because suitable burning conditions are often most prevalent this time of year, and the belief that doing so reduces the probability of detrimentally impacting fire-sensitive animal species, such as herptiles (i.e., eastern box turtle). While these are all legitimate reasons, we feel that the long-term benefits of diversifying burn seasonality outweigh the costs and that ultimately, successful restoration of oak-pine barrens ecosystems will depend 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 within and around known hibernacula and establishing rotating refugia within large burn units (Cohen et al. 2009).

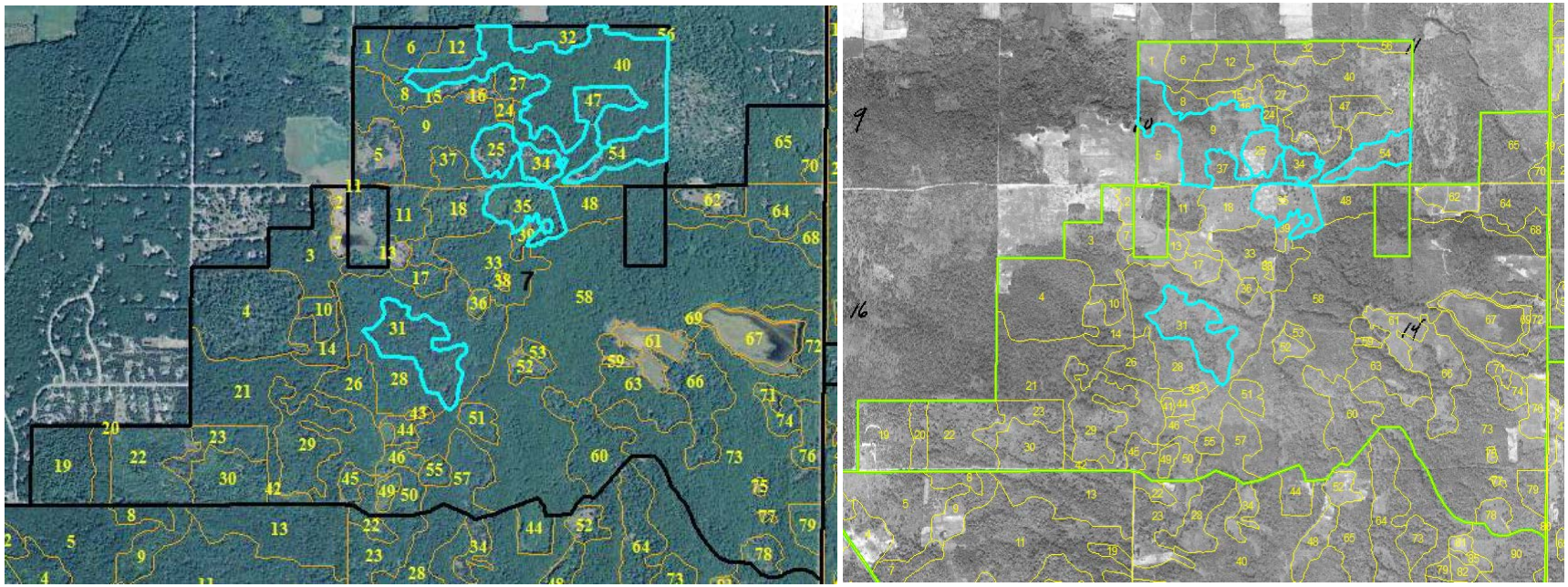

Figure 10: Current aerial imagery and 1938 aerial imagery showing the change in percent canopy cover, highlighted stands depict areas in Compartment 7 that contain oak-pine barrens.

Photo 2: Oak-pine barrens in stand 25. Photo by Jesse Lincoln

Coastal plain marsh

While the majority of Compartment 7 was forested, several lowland areas were occupied by coastal plain marsh. Coastal plain marsh is a graminoid dominated wetland that contains numerous plant disjuncts from the Atlantic and Gulf coastal plains. Coastal plain marshes typically contain four distinct vegetation zones, often occurring as concentric bands around the open water portions of depressions, lakes, and ponds. This unique natural community type has a state rank of S2, designating it as imperiled in the state due to restricted range, limited occurrences, fire suppression and hydrologic alteration.

The dominant natural processes in coastal plain marshes are 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 likely 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 species 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 that have been depleted from a site's seed bank.

As noted, coastal plain marshes are characterized by distinct vegetive zonation. 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 (*Rhyncospora 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 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 steeplebush (*Spiraea tomentosa*). Characteristic of 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 (*Lipocarpha 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)

Compartment 7 has seven stands that are classified as, or can be classified as, coastal plain marsh: stands 2, 7, 15, 17, 18, 61 and 67 (Table 1, Figure 11). Stands 61 and 67 are known coastal plain marsh EOs. 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 the course of surveying wood ducks were regularly seen in coastal plain marshes, many with young. Coastal plain marshes in proximity to oak forest provide ideal wood duck habitat. Coastal plain marshes also provide excellent amphibian and herptilehabitat.

Encroachment of woody vegetation and invasive species (particularly reed canary grass) are a major threat to the long-term viability of the coastal plain marshes in Compartment 7. At the time of the survey many stands with coastal plain marsh had medium to high levels of reed canary grass. Unchecked, this species will quickly out compete native vegetation.

In addition to invasive species, altered hydrology, establishment of invasive species and encroachment of woody vegetation pose a threat to coastal plain marshes. In stands where big-tooth aspen (*Populas grandentata*) is encroaching in these trees should be girdled to prevent further expansion into the core area of coastal plain marshes. Establishing buffer zones around coastal plain marshes when heavy equipment is used in the vicinity will eliminate heavy tire/track marks which can lead to altered

hydrology. These buffer zones would create adequate protection if they were wide enough to include a decent swath of forest (100 m+). Special attention should be given to stand 61 and 67 as these are the largest and most intact coastal plain marshes in ASGA. Coastal plain marshes will benefit most from late season prescribed burns.

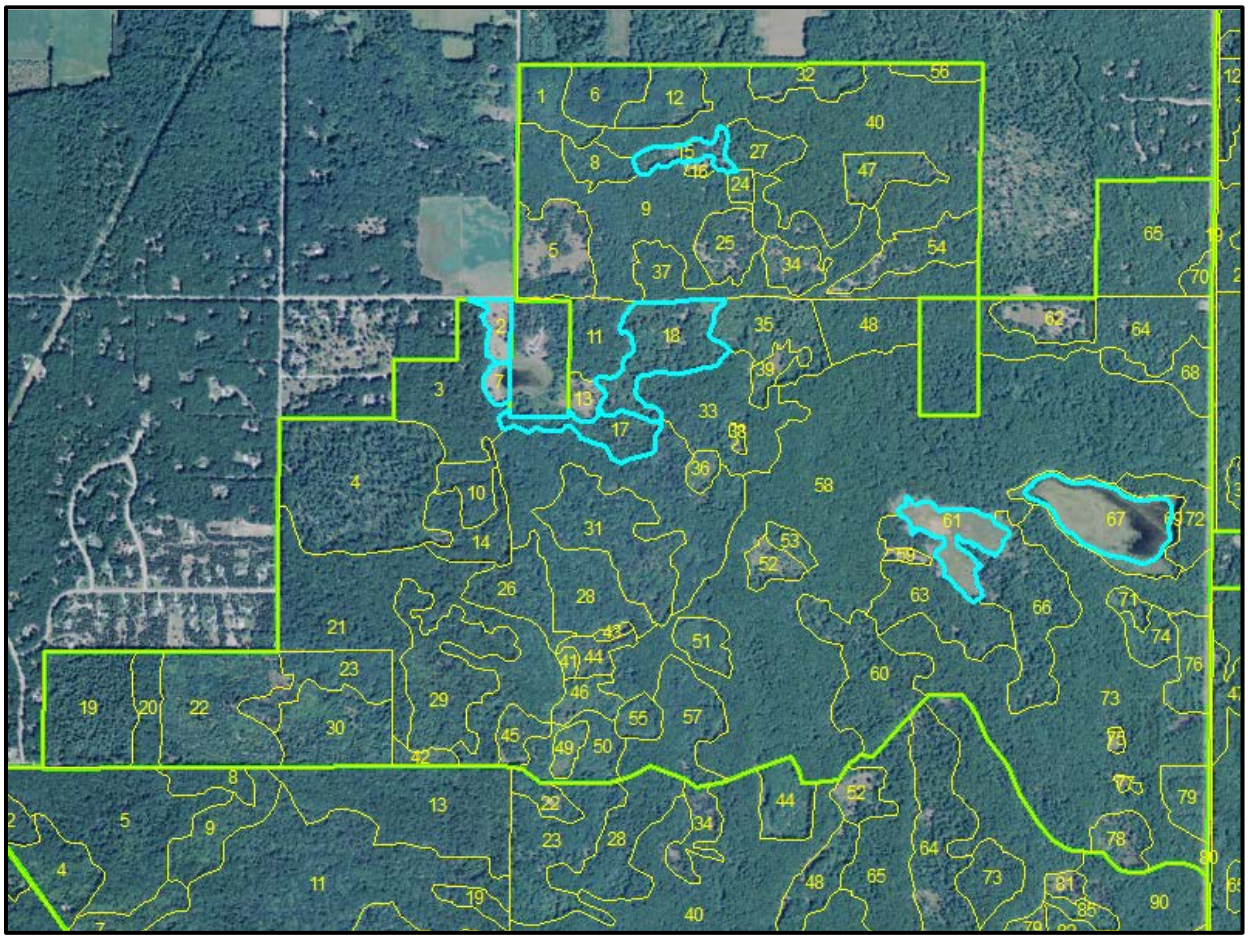

Figure 11: The highlighted stands depict areas in Compartment 7 that contain coastal plain marsh communities.

Photo 3: Coastal plain marsh mudflats in stand 61. Photo by Jesse Lincoln

Photo 4: Coastal plain marsh mud flats in stand 67. Photo by Jesse Lincoln

Wet-mesic sand prairies

Wet-mesic sand prairies are a native lowland grassland community occurring on sandy outwash plains and lakeplains within shallow depressions and as a vegetation zone separating fire-dependent upland and open wetland systems. Wet-mesic sand prairies natural community type has a state rank of S2, designating it as imperiled in the state due to restricted range, limited occurrences and fire suppression.

Species dominance varies among several prairie and wetland grasses and sedges, including bluejoint grass (*Calamagrostis canadensis*), cordgrass (*Spartina pectinata*), big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), prairie dropseed (*Sporobolus heterolepis*, state special concern), Indian grass (*Sorghastrum nutans*), and tussock sedge (*Carex stricta*). Shrubs are important in some occurrences, and are represented by tag alder (*Alnus incana*), black chokeberry (*Aronia prunifolia*), leatherleaf (*Chamaedaphne calyculata*), gray dogwood (*Cornus foemina*), red-osier dogwood (*C. sericea*), Kalm's St. John's-wort (*Hypericum kalmianum*), shrubby cinquefoil (*Dasiphora fruticosa*), pasture rose (*Rosa carolina*), northern dewberry (*Rubus flagellaris*), swamp dewberry (*R. hispidus*), willows (*Salix* spp.), and meadowsweet (*Spiraea alba*). Trees are occasional or patchy and are characterized by species typical of the surrounding landscape.

Characteristic herbs include ticklegrass (*Agrostis scabra*), harebell (*Campanula rotundifolia*), sedges such as *Carex buxbaumii, C flava, C leptalea, C. pellita, C. pensylvanica*, swamp thistle (*Cirsium muticum*), bastard toadflax (*Comandra umbellata*), golden-seeded spike-rush (*Eleocharis elliptica*), grass-leaved goldenrod (*Euthamia graminifolia*), wild strawberry (*Fragaria virginiana*), fowl manna grass (*Glyceria striata*), blue flags (*Iris virginica* and *I.versicolor*), rushes (i.e., *Juncus balticus, J. effusus, J. greenei*, and *J. vaseyi*, state threatened), cardinal flower (*Lobelia cardinalis*), pale spiked lobelia (*L. spicata*), common water horehound (*Lycopus americanus*), wild bergamot (*Monarda fistulosa*), northern panic grass (*Dichanthelium boreale*), switch grass (*Panicum virgatum*), water smartweed (*Persicaria amphibia*), Virginia mountain mint (*Pycnanthemum virginianum*), wool-grass (*Scirpus cyperinus*), balsam ragwort (*Packera paupercula*), common blue-eyed-grass (*Sisyrinchium albidum*), late goldenrod (*Solidago gigantea*), rough goldenrod (*S. rugosa*), purple meadow rue (*Thalictrum dasycarpum*), marsh fern (*Thelypteris palustris*), marsh St. John's-wort (*Triadenum fraseri*), and white camas (*Anticlea elegans*). Invasive Canada bluegrass (*Poa compressa*) and Kentucky bluegrass (*P. pratensis*) are common in some sites.

Compartment 7 has six stands that can be or are already classified as wet-mesic sand prairie: 5, 8, 12, 13, 15, and 52 (Table 1, Figure 12). Stands 5, 13 and 52 are current wet-mesic sand prairie EOs. The remaining stands have characteristic species of wet mesic sand prairies and have restoration potential.

Much like coastal plain marshes in the area, the primary threat to wet-mesic sand prairies is altered hydrology, establishment of invasive species and encroachment of wood vegetation. Establishing buffer zones around coastal plain marshes when heavy equipment is used in the vicinity will eliminate heavy tire/track marks which can lead to altered hydrology. These buffer zones would create adequate protection of they were wide enough to include a decent swath of forest (100 m+). Special attention should be given to stand 5 and 13. Continued monitoring of these stands is essential to prevent invasive species establishment and woody vegetation encroachment.

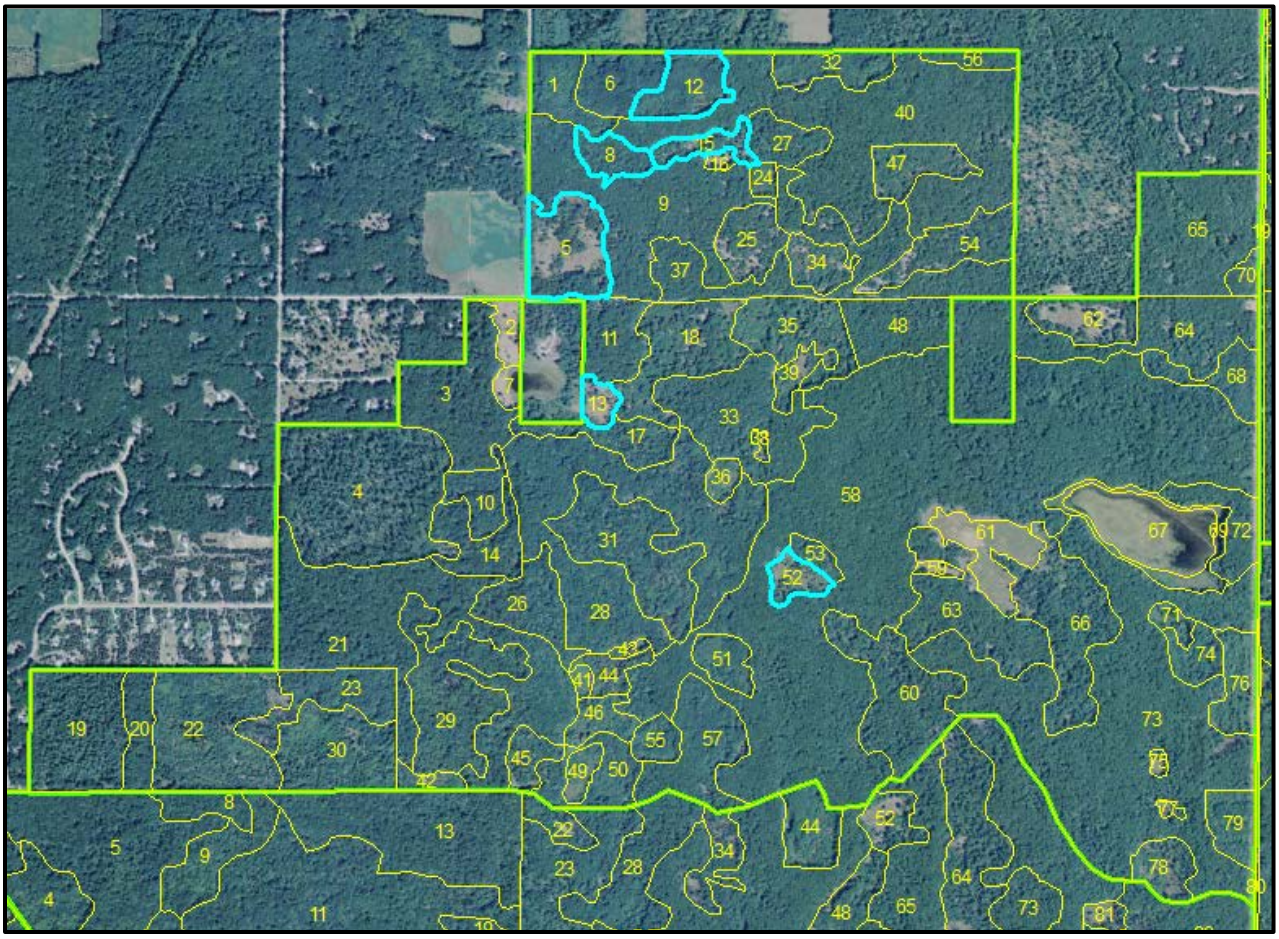

Figure 12: The highlighted stands depict areas in Compartment 7 that contain wet-mesic sand prairies.

Photo 5: Wet-mesic sand prairie in stand 5. Photo by Jesse Lincoln.

Special Plants and Animals in Compartment 7

Compartment 7 is one of the most biologically diverse compartments in ASGA and accounts for 3 vertebrate element occurrences, 9 natural community element occurrences and 11 plant element occurrences (Table 2 and Figure 12). The plant EOs were recorded in 9 different stands.

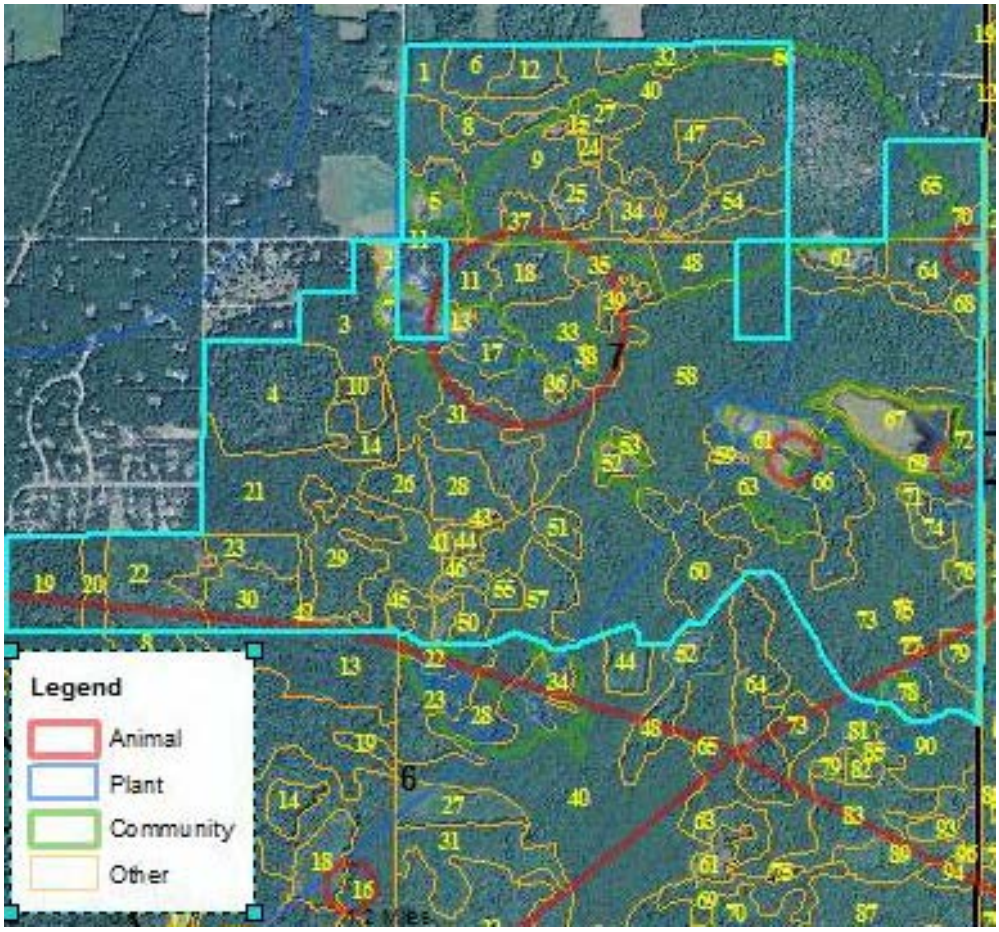

Figure12: Element Occurrence points for Compartment 7.

Special Plants

Plants

Several rare plant species have been documented in Compartment 7; the majority of these plants are associated with coastal plain marsh and wet-mesic sand prairie EOs (Table 2, Figure 12). Rare plants characteristic of coastal plain marsh tend to have the majority of their populations along the Atlantic and Gulf coast with several satellite populations occurring sporadically throughout the eastern United States. Long-leaved panic grass (*Panicum longifolium*, State Threatened) typifies this distribution pattern and within Michigan, this plant has been found only in the coastal plain marshes of ASGA and only in Compartments 6, 7, and 8 with the next nearest population several hundred miles away along the Atlantic coast.

Table 2: Rare plant element occurrences that have been recorded in Compartment 7, with their state rarity rank, stand and year recorded.

Species	State Status/rank	Stand	Year recorded
Scirpus-like rush *Juncus scirpoides*	T/S2	5, 17	1991
Short-beaked rush *Rhynchospora nitens*	E/S1	67	2003
Tall beakrush *Rhynchospora macrostachya*	SC/S3S4	73*	1991
Three-ribbed spike rush *Eleocharis tricostata*	T/S2	5, 61	1991, 2015
Black-fruited spike-rush *Eleocharis melanocarpa*	SC/S3	61	1991
Atlantic blue-eyed-grass *Sisyrinchium atlanticum*	T/S2	5	2015
Long-leaved panic grass *Panicum longifolium*	T/S2	11	2015
Meadow beauty *Rhexia virginica*	SC/S3	13	1981
Maryland meadow beauty *Rhexia mariana*	T/S1S2	5,16,61	1991, 2015
Whorled mountain mint *Pycnanthemum verticillatum*	SC/S2	5,13	1991
Waterthread pondweed *Potamogeton bicupulatus*	T/S2	73*	1991

*Located in the northeast finger of stand 73 immediately below stand 72, where a few very small lowland areas are located within an upland forested area.

Nearly all of the rare plants documented within this compartment are coastal plain marsh or wet-mesic sand prairie obligates. The dynamic nature of these communities, particularly coastal plain marsh, means that they may be present one year and then absent for several years. Further, each one of these species may be present in any and all of the coastal plain marshes throughout this compartment but were not observed at the time of survey because conditions were not ideal. There may also be additional rare species that are coastal plain marsh obligates such as Hall's bulrush (*Schoenoplectiella hallii*, State Threatened), dwarf burhead (*Echinodorus tenellus*, State Endangered), and several others.

Actions to protect these populations of rare plants should be centered on preservation and protection of the coastal plain marsh and wet-mesic sand prairie systems. It is critical to avoid altering hydrology with ditches, roads, or logging ruts as these actions will favor invasive species or accelerate succession towards forested swamp by lowering the water table. Returning fire to the landscape, particularly in the late summer or fall during drought years, is critical to maintaining these marshes as open and preventing further loss to woody encroachment. Finally, low-impact tree removal may be necessary in some areas where fire tolerant and flood tolerant trees have already taken hold.

Special Animals

Insects

Frosted elfin (*Incisalia irus,* State Threatened) was recorded in Stand 66 in 1990. Frosted elfin has been identified as a Priority Species by the WLD. The frosted elfin utilizes early-successional, open habitats such as oak savanna, oak-pine barrens, open areas, and forest edges (Nielsen 1999, Glassberg 1999). When disturbances are eliminated and the savanna areas form closed canopies, the frosted elfin can be found in the transitional areas between closed canopy oak areas and sand prairies (Nielsen 1994). Roadsides, power-line and railroad rights-of-ways can provide habitat if adequate food plants are available (i.e., wild lupine, wild indigo, and blueberry for nectaring) (Gehring 2006).

Amphibians

There are no EO records for amphibians in Compartment 7. However, several areas in the compartment offer ideal habitat for Blanchard's cricket frog (*Acris crepitans Blanchardi* / state threatened/S2S3). We recommend conducting surveys for Blanchard's cricket frog in stands 5, 61, 67.

Blanchard's cricket frog has been reported in about 40 sites in seven counties in southwest Michigan (Allegan, Barry, Berrien, Calhoun, Kalamazoo, Kent and Van Buren). Since the 1980s their population has been in steady decline. Blanchard's cricket frogs inhabit a variety of open edge habitats found along permanent ponds, lakes, floodings, bogs, seeps, and slow-moving streams and rivers and they prefer open or partially vegetated mud flats and muddy or sandy shorelines. They require a permanent water source that does not dry up seasonally (Lee et al. 2000).

Herptiles

In 2015 an eastern box turtle was recorded in stand 5. Eastern box turtle (*Terrapene carolina carolina,* State Special Concern/ S2S3) have been documented in the vicinity of the compartment. Eastern box turtle have 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. Box turtles may also be found in adjacent thickets, old fields, pastures, or savannas. Access to unshaded nesting sites in sandy, open areas, is critical for successful reproduction. This compartment falls within a large area identified by MNFI as a potential Focal Area for management for eastern box turtle (Cohen et al. 2014).

Birds

A high number of avian species that are on Michigan's featured species list for habit management were recorded in Compartment 7 during IFMAP surveys. Featured species that were seen or heard during the survey include: wood duck (*Aix sponsa*), red-shouldered hawk (*Buteo lineatus*), red-headed woodpecker (*Melanerpes erythrocephalus*), pileated woodpecker (*Dryocopus pileatus*), American woodcock (*Scolopax minor*), wood thrush (*Hylocichla mustelina*), wild turkey (*Meleagris gallopavo*), ruffed grouse (*Bonasa umbellus*), eastern bluebird (*Sialia sialis*), eastern meadowlark (*Sturnella magna*) and black-throated blue warbler (*Setophaga caerulescens*). Additionally, several species of greatest conservation need were recorded. These included: Cooper's hawk (*Accipiter cooperii*), yellow-billed cuckoo (*Coccyzus americanus*), northern flicker (*Colaptes auratus*), Acadian fly-catcher (*Empidonax virescens*), eastern kingbird (*Tyrannus tyrannus*), brown thrasher (*Toxostoma rufum*), and northern parula (*Parula americana*).

There are three avian EOs in Compartment 7. In 2003 a male prairie warbler (*Dendroica discolor*, State Endangered/S1) was documented in stand 13 singing in an area with suitable nesting habitat. This area was re-visited in June of 2011 and no birds were heard or seen, but the area still remains suitable breeding habitat and we recommend continued monitoring of the area. In 2003 a cerulean warbler (*Dendroica cerulean*, State threatened/S3) was recorded in stand 72. In 2011 a hooded warbler (*Wilsonia citrina*, State special concern/S3*)* was recorded in stand 12. There is excellent habitat for the aforementioned warbler species throughout Compartment 7 and it is likely a survey would reveal more nesting locations.

Prairie warblers prefer upland scrub areas including early successional habitat for breeding. As a result of breeding habitat rapidly changing, prairie warblers use areas for brief periods before moving to different sites (Cooper 2000). This habitat preference would fall in line with post burn succession and burns may entice prairie warblers to utilize areas for breeding.

During the breeding season, the cerulean warbler inhabits mature deciduous forest

preferring mesic to wet stands over more xeric forest. They are found in areas with variable canopy closure and areas with an open understory. They tend to show a preference for bottomlands over uplands, and are frequently found floodplains (Hyde et. al. 2000). The most likely areas in Compartment 7 to provide breeding habitat for cerulean warblers would be stands 29 and 31 and the surrounding lowland stands. Allowing these stands to mature will continue to provide breeding habitat for this species. Large tracts (>4,000 ha) of mature forest with minimal perimeter to area ratios should be preserved while smaller tracts (700 ha) will support smaller populations. Low-intensity land uses such as single-tree selective timber removal may be compatible with Cerulean Warbler management especially if the openings created approximate natural treefall gaps created by windstorms (Hyde et. al. 2000).

Hooded warblers nest in a variety of forest types that all have a mature forest canopy and a dense understory of small trees and shrubs. Management should focus on preserving these characteristics in large contiguous 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 direct impacts to nesting birds (MNFI 2007).

Photo 6: Cerulean warbler *Dendroica cerulea* (State threatened/S3). Photo by Aaron Kortenhoven

Photo 7: Male prairie warbler *Dendroica discolor* (State Endangered/S1). Photo by Jackie Elmore

Photo 8: Hooded warbler *Wilsonia citrina (*State special concern/S3*).* Photo by Aaron Kortenhoven

Photo 9: Red-shouldered hawk *Buteo lineatus* (State Threatened/S3S4). Photo by Aaron Kortenhoven

Mammals

Photo 9: White-tailed deer (*Odocoileus virginianus*). Photo by Aaron Kortenhoven

With the exception of white-tailed deer, chipmunks, and fox squirrels, few mammals were observed during the survey of Compartment 7. We recommend small mammal surveys be conducted in this compartment. It would be good to conduct thorough bat surveys 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*) occur in the area.

Indiana bats can occur in oak plains, oak openings, flood plains and southern hardwood swamps (MNFI 2007). Indiana bats roost and form maternity colonies under loose bark or in hollows and cavities of mature trees in the floodplain forest. In Michigan, savanna habitats adjacent to riparian corridors may have been historically important for roost sites, as the bats are thought to prefer sun-exposed trees for maximum warmth at the northern limit of their range (MNFI 2007). The Indiana bat requires large blocks of mature floodplain forest, including standing snags and other suitable living roost sites. A primary limiting factor in their summer range has been the deforestation of riparian habitats and removal of roost trees,

which usually occurs from the cutting of large, dead trees for firewood. Cutting of snags, canopy removal, and general land clearing activities along streams and rivers for development, agriculture, utility corridors, river or drain dredging and other purposes should be avoided. The species would likely benefit from restoration of floodplain forests and adjacent savannas through tree planting efforts (MNFI 2007).

The eastern pipistrelle is primarily known from the western UP and extreme southwest Lower Michigan (Berrien Co.). It hibernates primarily in caves, mines, and deep crevices, but it also has been found hibernating at a hydroelectric facility in Manistee Co. In summer, it forages over the open water of streams and ponds, as well as forest edges. Summer roosts are usually within 30 miles (48 km) of hibernacula and may include buildings, tree hollows, and bridges. Eastern pipistrelles can be found in open woods near the edges of water, as well as over water. They are not usually found in open fields, deep forests, or buildings (MNFI 2007).

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 found on hillsides and ridges, but have also been noted to forage along paths, ponds and streams, and at forest edges. All roost reported by Foster and Kurta (1999) were close to wetlands

All three of these bat species have been identified as Focal Species by WLD. This compartment falls within a large area identified by MNFI as a potential Focal Area for management for northern long-eared bat (Cohen et al. 2014).

The following management recommendations for compartment 7 are provided for your consideration:

- Important upland forests
    - Stands 9,25,40,34,36,54, 65,58.
    - Allow fire to carry into forests; vary seasonality and intensity of burns
    - Allow forests to continue maturing
    - Limit fragmentation and provide forested buffers between intensive forestry activities to assist obligate forest interior birds.
    - Maintain large diameter trees to function as nesting and roosting locations for species such as red shouldered hawk and Indiana bat
    - Survey for cerulean warbler, hooded warbler and listed bats
- Important lowland forests
    - Stands 31 and 26
    - Prevent further alterations to hydrology
    - Allow fire to carry into forests
    - Allow forests to continue maturing and avoid fragmentation
    - Excellent habitat for several species of greatest conservation need
    - Good for Indiana bat which feeds on aquatic insects
    - Red-shouldered hawk observed in several areas
    - Maintain large diameter trees to function as nesting and roosting locations for species such as red-shouldered hawk and Indiana bat
    - Survey for cerulean warbler, hooded warbler and listed bats
- Important coastal plain marshes
    - Stands 61 and 67
    - Additional opportunity for coastal plain marsh expansion in portions of Stands 2, 7, 15, 17, 18.
    - Avoid disturbing soil and hydrology, prevent logging equipment from entering
    - Prevent horse trails from entering
    - Burn when possible, late season burns in dry years will provide the best fuel load
    - Targeted tree removal through girdiling in core or coastal plain marshes
    - Prevent ORV use
    - Survey for rare plants associated with coastal plain marsh
- Important wet-mesic sand prairies
    - Stands 5, 13 and 52.

    - Additional opportunity for wet-mesic sand prairies expansion in portions of Stands 8, 12, and 15.
    - Monitor for invasive species
    - Allow prescribed fire to extend into this stand
    - Targeted tree and shrub removal through girdiling to reverse succession
    - Prevent ORV use
- Manage for oak-pine barrens habitat
- Thin and burn Stands 9, 40, 34, 36
- Riparian corridor around Silver Creek.
    - Stands 65
    - Create a forested buffer around these stands to prevent sedimentation flow into the stream and the spread of invasive species
    - Allow stands to continue maturing for maximum benefit to species of greatest conservation need
    - Survey for rare species (e.g., red-shouldered hawk, Cerulean warbler, Indiana bat)
    - Maintain large diameter trees to function as nesting and roosting locations for species such as red-shouldered hawk and Indiana bat
- Trap/kill raccoons and other mesopredators to reduce predation on herptiles and birds

Threats

The primary threat to both wildlife and plants in Compartment 7 is illegal off-road vehicle use. While compartment 7 did not have significant issues with ORV use, continued monitoring is necessary to stop it when it first starts. The current management practice of placing signs and stumps in areas where ORV use has been observed has proven to be an effective course of action.

Conclusion

Managing the northern portion of Compartment 7 towards the restoration of oak-pine barrens will provide greater habitat heterogeneity. By so doing, key featured species such as white-tailed deer and wild turkey will likely benefit. In addition, barrens restoration can potentially benefit numerous Focal and Priority Species including Karner blue, eastern box turtle, eastern massasauga, frosted elfin, persius dusky wing, ottoe skipper, and Sprague's pygarctia. The creation of oak-pine barrens in a matrix of forested surroundings will provide edge habitat. Edge effect often increases species diversity in an area. Restoring barrens will enhance habitat for both game and non-game wildlife species in a holistic management approach that meets the criteria laid out in Michigan's Wildlife Action Plan.

Expanding and maintaining the areas of wet-mesic prairie and coastal plain marshes in compartment 7 will benefit the plants that are unique to these areas. Additionally these areas are and will be used by game species.

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