Natural Features Inventory and Management Recommendations for Gratiot-Saginaw State Game Area



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We collectively acknowledge that Michigan State University occupies the ancestral, traditional, and contemporary Lands of the Anishinaabeg – Three Fires Confederacy of Ojibwe, Odawa, and Potawatomi peoples. In particular, the University resides on Land ceded in the 1819 Treaty of Saginaw. We recognize, support, and advocate for the sovereignty of Michigan's twelve federally recognized Indian nations, for historic Indigenous communities in Michigan, for Indigenous individuals and communities who live here now, and for those who were forcibly removed from their Homelands. By offering this Land Acknowledgement, we affirm Indigenous sovereignty and will work to hold Michigan State University more accountable to the needs of American Indian and Indigenous Peoples.

We further acknowledge that Indigenous peoples and their cultural practices were and are integral to the healthy, functioning natural ecosystems. The definition of natural communities presented in this report recognizes this fact.

Cover Photo: Meridian Swamp within Gratiot-Saginaw State Game Area. Photo by J.M. Lincoln.

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Author contributions: Jesse M. Lincoln led report preparation, conducted natural community surveys, and wrote the natural community sections and synthesis of discussion. Aaron P. Kortenhoven, Logan M. Rowe, Dan J. Earl, and Peter J. Badra conducted surveys and authored sections on birds, insects, herpetofauna, and land snails, respectively. Helen D. Enander provided GIS analyses, model development, and cartography. Joshua G. Cohen served as principal investigator and contributed model development, writing, and editorial review. The report's ecological methods and interpretive framework also draw on language and approaches developed collaboratively by MNFI's ecology team over successive reports.



A large swamp white oak in Meridian Swamp, one of three natural communities documented during the integrated inventory of Gratiot-Saginaw State Game Area. Prior to MNFI's surveys, no natural community occurrences had been documented within the game area. Photo by J.M. Lincoln.

EXECUTIVE SUMMARY

The Gratiot-Saginaw State Game Area (SGA) encompasses 17,053 acres of semi-contiguous public land in Gratiot and Saginaw Counties in Michigan's central Lower Peninsula. As the second largest state game area in Michigan, it protects extensive forested wetlands, upland forests, and open wetlands that provide habitat for game and non-game wildlife. These habitats support natural communities and populations of rare species that have been substantially reduced or degraded across the surrounding landscape. The extent and connectivity of its forests and wetlands make the game area especially important for maintaining native biodiversity, sustaining ecological integrity, and advancing long-term conservation.

Michigan Natural Features Inventory (MNFI) completed the Michigan Forest Inventory (MiFI) habitat cover type mapping process within the Gratiot-Saginaw SGA. MNFI later conducted natural community and rare species surveys from 2021 through 2025 as part of the Integrated Inventory Project, a collaborative effort with the DNR's Wildlife Division. This project is part of a long-term effort to document areas of high conservation significance on state lands and provide information to support sustainable management. Surveys focused on natural communities, birds, insects, reptiles, and land snails, building on previous ecological inventories and historical records.

MNFI scientists have documented a total of 17 Element Occurrences (EOs) within Gratiot-Saginaw SGA. Of these, 13 were newly documented or updated during the 2021-2025 surveys. These include three natural community EOs and ten rare species EOs. Prior to the 2021-2025 surveys, no high-quality natural communities had been documented within the game area. Ecologists identified three natural communities encompassing 498.9 acres, or approximately 2.9% of the game area: Mason Meadow, a 20.2-acre southern wet meadow; Marion Springs Swamp, a 177.5-acre wet-mesic flatwoods; and Meridian Swamp, a 301.2-acre wet-mesic flatwoods. Meridian Swamp is the largest documented wet-mesic flatwoods occurrence in Michigan. Together, these sites support diverse native vegetation and relatively intact hydrologic processes, with the flatwoods also supporting mature forests and vernal pools. Their conservation is especially important given the extensive historical loss and alteration of forested wetlands across southern Michigan.

Three rare plant EOs have been documented within the game area, including a newly documented population of sedge (*Carex seorsa*; State Threatened) and an updated occurrence of whorled pogonia (*Isotria verticillata*; State Threatened). The whorled pogonia population, associated with oak-dominated uplands [redacted] is among the most significant remaining populations in Michigan. The third occurrence, three-awned grass (*Aristida longespica*; State Special Concern), was last documented in 1988.

Rare bird surveys documented two active red-shouldered hawk (Buteo lineatus; State Special Concern) nests and three new wood thrush (Hylocichla mustelina; State Special Concern) EOs. Forest songbird surveys recorded 49 bird species, including 12 singing male wood thrush at seven survey points. These findings emphasize the importance of the game area's mature forests and relatively contiguous forested wetlands for breeding birds. Insect surveys documented two rare bumble bee species, black and gold bumble bee (Bombus auricomus; State Special Concern) and yellow bumble bee (Bombus fervidus; State Special Concern), and recorded 115 bumble bee observations representing eight species during a targeted survey. Surveys for royal fern borer (Papaipema speciosissima; State Special Concern) did not detect the species. Land snail surveys documented six species, none of which are state-listed.

Herpetofauna surveys identified a previously undocumented population of Blanding's turtle (*Emydoidea blandingii*; State Special Concern), with five adults observed across multiple wetlands. Spotted turtle (*Clemmys guttata*; State Threatened) had been previously found within the game area but was not detected, although potentially suitable habitat remains and additional spring surveys may be warranted. Likewise, surveys to relocate Eastern massasaugas (*Sistrurus catenatus*; Federal and State Threatened) were unsuccessful and the occurrence is classified as historic. These findings reinforce the importance of protecting wetland hydrology, maintaining habitat connectivity, and monitoring rare reptile populations.

Despite its conservation significance, Gratiot-Saginaw SGA faces several threats to ecological integrity. Historical logging, wetland drainage, road construction, invasive species, fire suppression, and white-tailed deer (*Odocoileus virginianus*) herbivory have altered the composition and structure of forests and wetlands. Hydrologic alterations and fragmentation threaten the persistence of high-quality wetlands, while fire suppression and excessive deer browsing are limiting oak and pine regeneration in many forests. These pressures are reducing native biodiversity and the capacity of forest ecosystems to regenerate and negatively impacting overall floristic diversity and composition.

We provide management recommendations that include prioritizing the protection of high-quality natural communities and maintaining large, contiguous blocks of forest and wetland habitat. We also propose priority conservation areas where we recommend minimizing additional fragmentation, protecting and restoring wetland hydrology, allowing forests surrounding high-quality natural communities to mature, and maintaining connectivity between important habitats. Stewardship goals will ideally include targeted invasive species control, prescribed fire in fire-dependent uplands, and measures to reduce deer browsing pressure and improve native tree regeneration. Restoration of natural ecological processes, including fire and beaver activity, offers opportunities to improve habitat diversity while reducing reliance on intensive mechanical management. Continued monitoring of rare species, forest regeneration, wetland hydrology, and management outcomes will be essential for evaluating conservation success.

Gratiot-Saginaw SGA makes a substantial contribution to the conservation of native biodiversity in a landscape extensively modified by agricultural conversion, forest clearing, wetland drainage, and habitat fragmentation. Although state game areas have traditionally emphasized habitat management for game species and hunting opportunities, protecting rare species and functioning natural ecosystems is also a fundamental responsibility of public land stewardship. Maintaining these resources and restoring the ecological processes that sustain them will benefit game and nongame wildlife while protecting the ecological integrity of Gratiot-Saginaw SGA for future generations.



A population of the state threatened Whorled pogonia has been documented in an oak-dominated forest [redacted]. Gratiot-Saginaw State Game Area supports one of Michigan's best remaining populations of this rare orchid, highlighting the importance of protecting its habitat. Photo by J.M. Lincoln.

Table of Contents

ACKNOWLEDGMENTS iii

EXECUTIVE SUMMARY iv

INTRODUCTION 1
Landscape and Historical Context 3
Ecoregions 3
Circa-1800 Vegetation 7
Indigenous Occupancy 10
Changes in Land Cover 11
Project Goals and Report Scope 16

METHODS 17
Natural Community Surveys 18
Rare Bird Surveys 19
Rare Insect Surveys 21
Rare Reptile and Amphibian Surveys 23
Land Snail Surveys 25

RESULTS 27
Natural Communities 29
Mason Meadow Southern Wet Meadow 31
Marion Springs Swamp Wet-Mesic Flatwoods 33
Meridian Swamp Wet-Mesic Flatwoods 37
Rare Plants 42
Rare Birds 43
Rare Insects 45
Rare Reptiles and Amphibian Surveys 47
Land Snails 48

DISCUSSION 49
Establishing Priority Conservation Areas 50
Protecting Wetlands 53
Controlling Invasive Species 55
Applying Prescribed Fire 57
Monitoring 59

CONCLUSIONS 61

LITERATURE CITED 63

APPENDICES 66

List of Figures

Figure **Page**

1. Imagery of Gratiot-Saginaw SGA. 1
2. Ecoregions of southern Michigan. 3
3. Surficial geology of Gratiot-Saginaw SGA 4
4. Elevation and shaded relief of Gratiot-Saginaw SGA and surrounding lands 6
5. Circa-1800 vegetation of the Gratiot-Saginaw SGA. 8
6. Trees recorded during the General Land Office surveys of the game area. 10
7. Aerial imagery from 2020 shows extensive ditching and excavated potholes. 11
8. Mosaic of 1938 aerial photographs of Gratiot-Saginaw SGA 12
9. Detail of 1938 aerial imagery showing the Marion Springs wet-mesic flatwoods. 14
10. A land use index of Gratiot-Saginaw SGA. 15
11. Location of bird surveys within Gratiot-Saginaw SGA 20
12. Location of rare insect surveys within Gratiot-Saginaw SGA. 22
13. Location of rare reptile and amphibian surveys within Gratiot-Saginaw SGA. 23
14. Location of land snail surveys within Gratiot-Saginaw SGA 25
15. Natural community element occurrences documented within Gratiot-Saginaw SGA 30
16. Location of Mason Meadow southern wet meadow 31
17. Location of Marion Springs Swamp wet-mesic flatwoods 33
18. Location of Meridian Swamp wet-mesic flatwoods 37
19. Location of rare plants documented within Gratiot-Saginaw SGA. 42
20. Location of rare birds documented within Gratiot-Saginaw SGA. 44
21. Location of rare insects documented within Gratiot-Saginaw SGA. 45
22. Location of rare reptiles documented within Gratiot-Saginaw SGA. 47
23. Proposed Priority Conservation Areas for Gratiot-Saginaw SGA 51
24. Prescribed fire needs assessment of Gratiot-Saginaw SGA. 57

List of Tables

Table **Page**

1. Circa-1800 vegetation cover types within the Gratiot-Saginaw SGA 9
2. Contemporary land-cover classes of Gratiot-Saginaw SGA 12
3. Rare plants at Gratiot-Saginaw SGA. 27
4. Rare birds, insects, and reptiles at Gratiot-Saginaw SGA. 27
5. Natural community element occurrences documented within Gratiot-Saginaw SGA 30
6. Bumble bee visits to flowering plants 46
7. Land snail species found in leaf litter samples collected from Gratiot-Saginaw SGA 48

List of Appendices

Appendix **Page**

1. General Land Office Survey Records from Gratiot-Saginaw SGA. 66
    A1-1. Historical survey notes and tree diameters for Gratiot-Saginaw SGA 66
    A1-2. Field notes recorded by General Land Office surveyor 67
2. Land Snails Documented at Gratiot-Saginaw SGA 68
    A2-1. Comb snaggletooth 68
    A2-2. Black striate 68
    A2-3. Minute gem. 68
    A2-4. Fine-ribbed striate and minute gem comparison 68
    A2-5. White-lip globe 69
    A2-6. Fine-ribbed striate. 69
    A2-7. Quick gloss 69
3. Plant species observed within the natural communities of Gratiot-Saginaw SGA. 70
    A3-1. Plant species observed within Mason Meadow 70
    A3-2. Plant species observed within Marion Springs Swamp 70
    A3-3. Plant species observed within Meridian Swamp 72
4. Bird species documented during point-count surveys at Gratiot-Saginaw SGA 74
5. Priority Conservation Areas identified within Gratiot-Saginaw SGA 75
6. Potential Locations for Hydrological Restoration at Gratiot-Saginaw SGA 75

INTRODUCTION

The Gratiot-Saginaw State Game Area (SGA) is a large block of semi-contiguous public land in the central Lower Peninsula of Michigan, consisting of 17,053 acres in Gratiot and Saginaw Counties (Figure 1). The land is owned and managed by the Wildlife Division (WLD) of Michigan's Department of Natural Resources (DNR). Acquisition of the game area began in 1939 with funds secured by the Pittman-Robertson Federal Aid in Wildlife Restoration Act, Game Protection fund, the Natural Resource Trust Funds, and through the acquisition of tax-reverted lands (Michigan DNR 1990). It is important ecologically because it provides critical habitat for a myriad of game and non-game species and extensive natural cover in an area with widespread agricultural operations and isolated fragments of natural cover.

Michigan Natural Features Inventory (MNFI) is Michigan's natural heritage program and maintains a geospatial database of populations of rare and declining species and benchmark natural communities. MNFI and the DNR WLD have been collaborating since 2009 to provide comprehensive ecological evaluation of state lands through an "Integrated Inventory" project that is also funded through the Pittman-Robertson Act. As part of the DNR's Integrated Inventory Project, in 2011 MNFI conducted the Michigan Forest Inventory (MiFI) habitat cover type mapping process. Surveys for high-quality natural communities and rare animals were conducted between 2021 and 2025. This project is part of a long-term effort by MNFI to document areas of high conservation significance on state lands and provide the DNR WLD with information to inform the sustainable management of those areas.

This project addresses MNFI's mission and vision to guide the conservation of Michigan's biodiversity for current and future generations by providing the highest quality scientific expertise and information and the DNR WLD's complementary mission to enhance, restore and conserve the State's wildlife resources, natural communities, and ecosystems for the benefit of Michigan's citizens, visitors, and future generations.

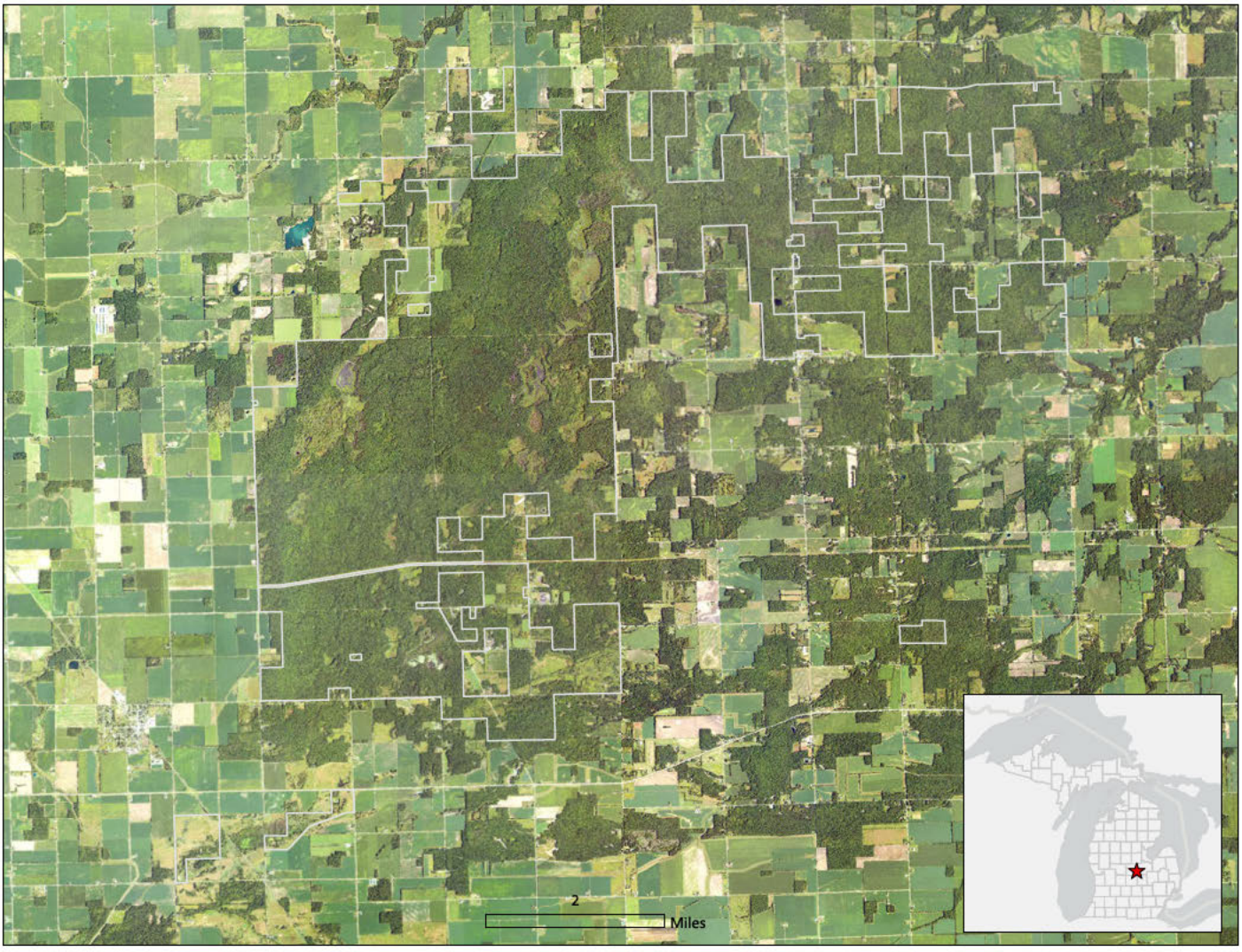


Figure 1. Imagery of Gratiot-Saginaw State Game Area. Imagery source: Esri 2025.



Marion Springs Swamp, a wet-mesic flatwoods within Gratiot-Saginaw State Game Area, supports large trees exceeding 180 years in age, high native plant diversity, and few invasive species. The forest is developing old-growth characteristics, including massive lateral branches, canopy deadwood, pit-and-mound topography, and coarse woody debris in multiple stages of decay. Such features, once widespread across the regional landscape, persist in scattered remnants protected within the game area. Photo by J.M. Lincoln.



Extensive agricultural fields and drainage ditches characterize the landscape surrounding Gratiot-Saginaw State Game Area. Within this predominantly agricultural setting, the game area retains a substantial block of forests and wetlands that provides important habitat for native biodiversity. Photo by J.M. Lincoln

Landscape and Historical Context

Ecoregions

Michigan's ecoregions are defined by regional differences in climate, glacial landforms, physiography, soils, and characteristic ecosystems (Albert 1995). Organized into sections, subsections, and sub-subsections, this classification provides a framework for understanding the distribution of natural communities and large-scale processes that influence them. The Gratiot-Saginaw SGA is within the Saginaw Bay Lake Plain Subsection (Figure 2), a relatively flat and broad glacial lakeplain that features deposits of lacustrine clay and sand (Figure 3). The landscape historically supported some of the region's largest pine forests. Elevations range from approximately 572 to 800 feet. The subsection has a relatively long growing season of 150 to 160 days, low annual precipitation and snowfall compared with much of Michigan, and a climate moderated by Lake Huron and Saginaw Bay (Albert 1995).

Glacial Lake Warren covered the Saginaw basin approximately 12,700 years ago, when the retreating Laurentide Ice Sheet continued to obstruct drainage through the emerging Great Lakes. The lake inundated much of eastern Gratiot and western Saginaw Counties and drained southwestward through the Grand River channel near present-day Maple Rapids (Larson and Schaetzl 2001). Fine lacustrine sediments deposited across the lake bottom formed the broad, poorly drained Saginaw lakeplain. Wave action produced narrow sand and gravel beach ridges and wind-blown sand ridges that rise slightly above the surrounding wetlands (Leverett and Taylor 1915) (Figure 4). These subtle landforms strongly influenced subsequent vegetation and human use by providing localized areas of dry ground within an otherwise wet landscape.

Poorly drained clay soils supported extensive wet-mesic forests dominated by species such as white pine (*Pinus strobus*), elm (*Ulmus* spp.), ash (*Fraxinus* spp.), basswood (*Tilia americana*), beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), and hemlock (*Tsuga canadensis*).

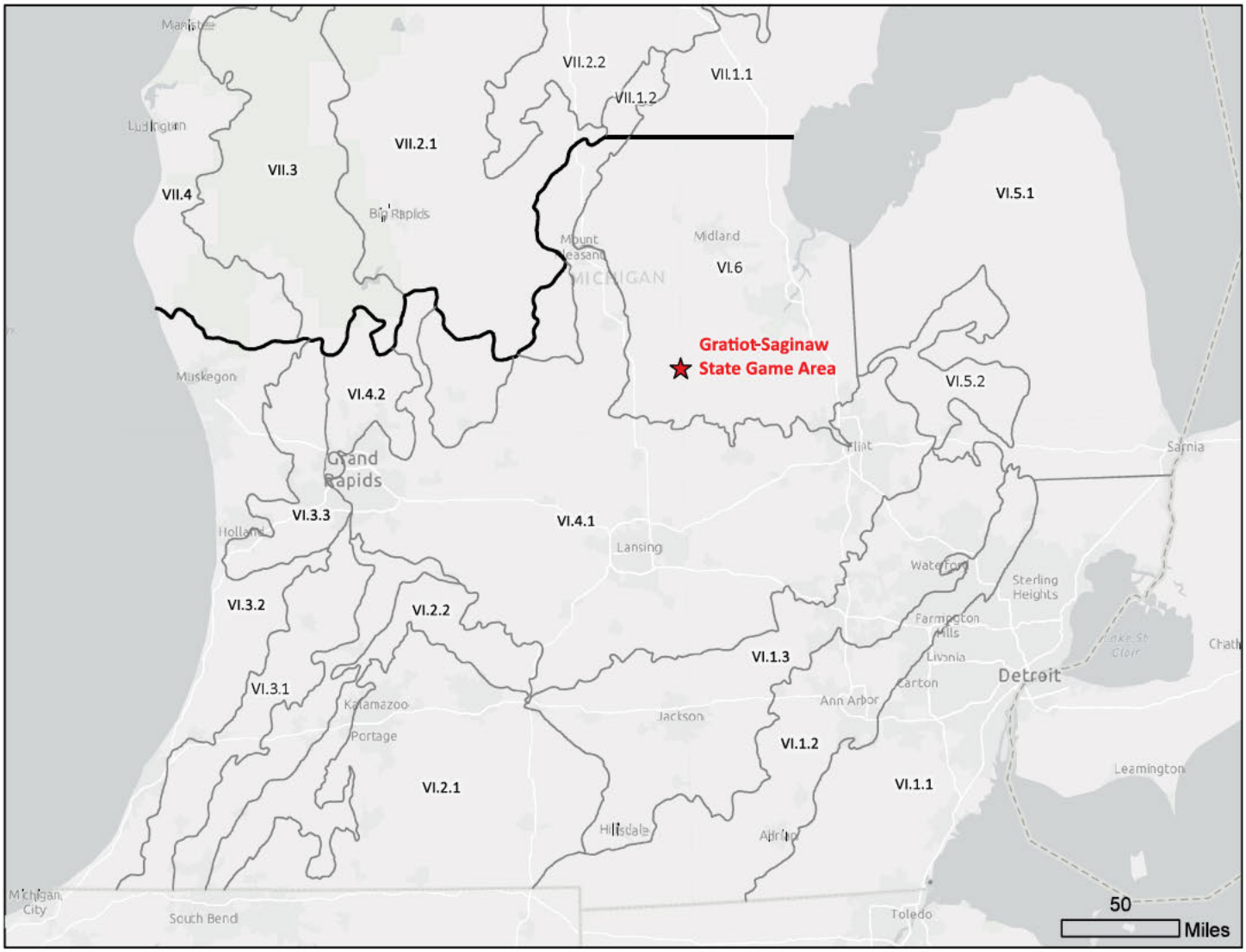


Figure 2. Ecoregions of southern Michigan. Gratiot-Saginaw SGA occurs within the Subsection (VI.6) of southern Michigan (Albert 1995).



A high-quality southern wet meadow adjacent to forested uplands within Gratiot-Saginaw State Game Area. This close proximity of fire-adapted uplands and wetlands likely allowed periodic fires to cross community boundaries when conditions permitted, helping maintain open wetland vegetation. Photo by J.M. Lincoln.

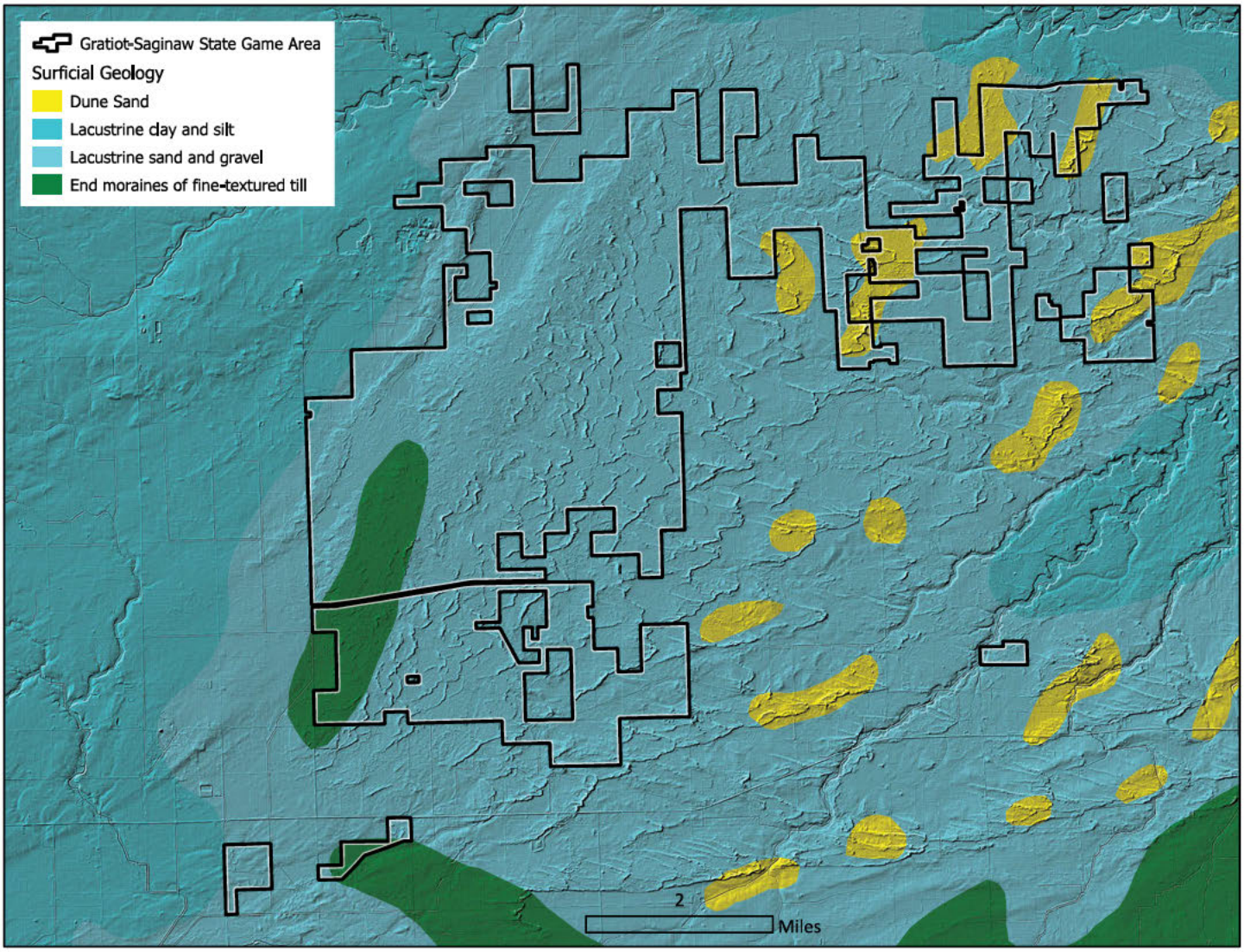
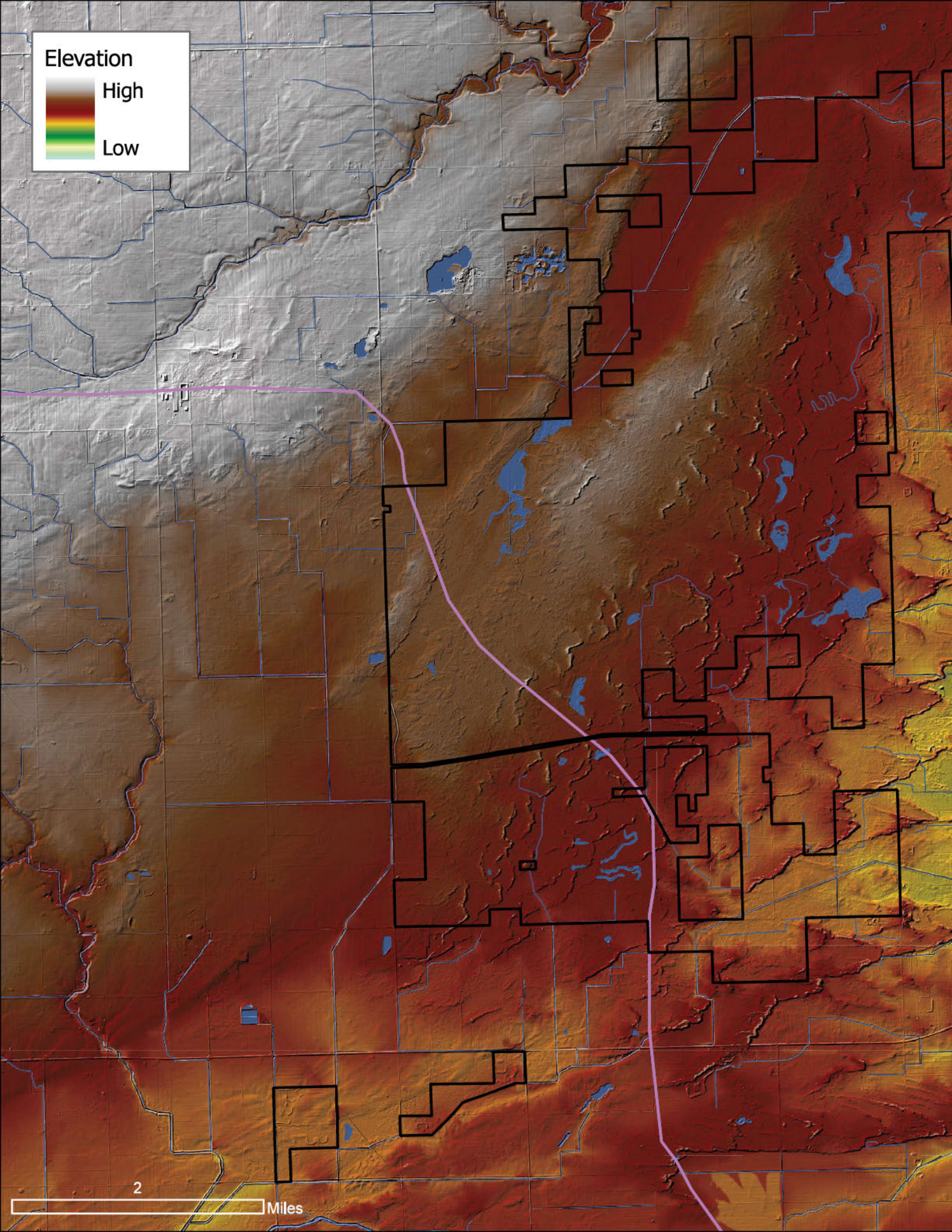


Figure 3. Surficial geology of Gratiot-Saginaw State Game Area and surrounding lands. Lacustrine deposits dominate the landscape, interspersed with dune sands and end moraines. The map depicts broad geological patterns and the boundaries are approximate. Smaller dunes and subtle landforms visible in the shaded relief are not consistently captured by this coarse-level map.


Elevation
High
Low
2
Miles

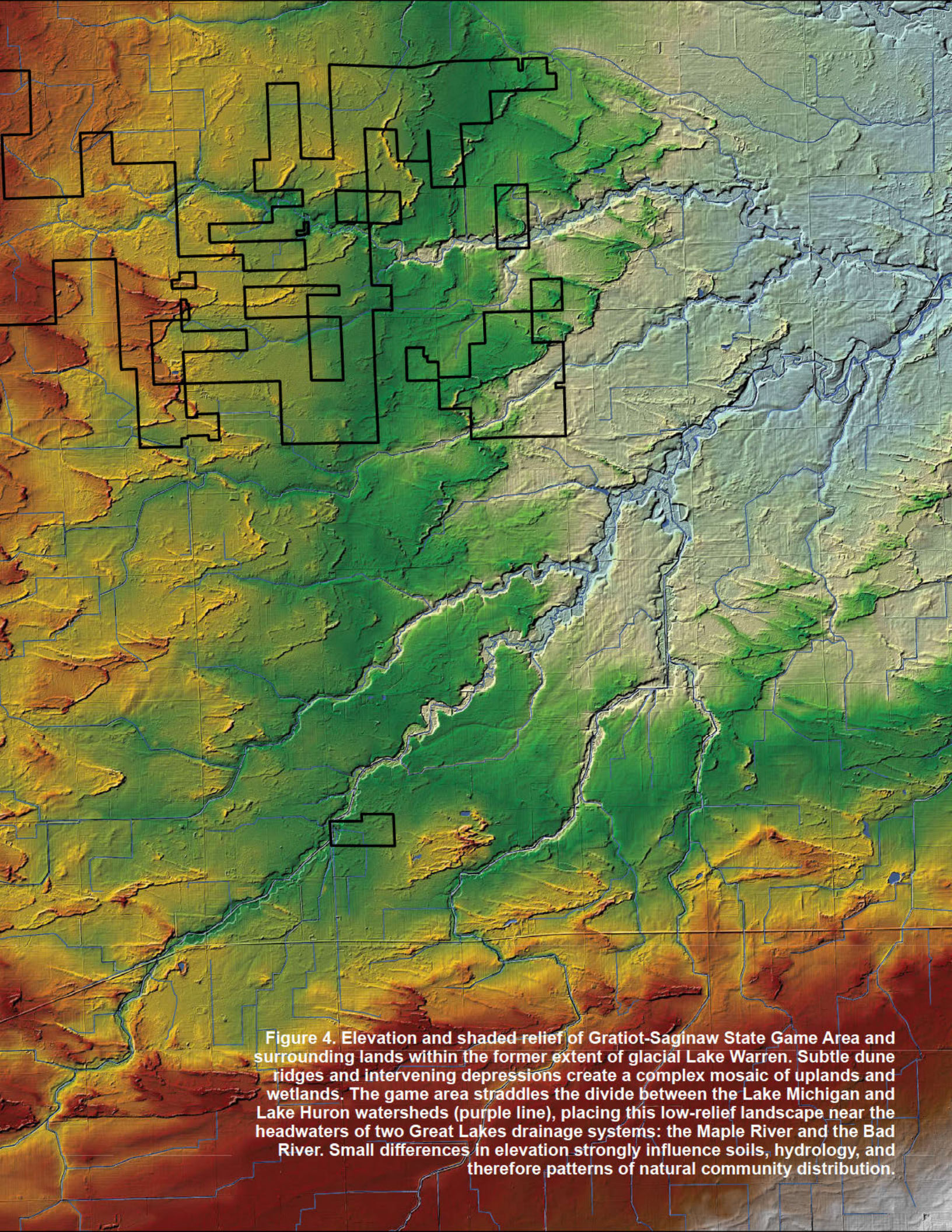


Figure 4. Elevation and shaded relief of Gratiot-Saginaw State Game Area and surrounding lands within the former extent of glacial Lake Warren. Subtle dune ridges and intervening depressions create a complex mosaic of uplands and wetlands. The game area straddles the divide between the Lake Michigan and Lake Huron watersheds (purple line), placing this low-relief landscape near the headwaters of two Great Lakes drainage systems: the Maple River and the Bad River. Small differences in elevation strongly influence soils, hydrology, and therefore patterns of natural community distribution.

Swamp forests and marshes occupied the wettest portions of the lake plain. Well-drained sandy landscape features supported white pine-mixed hardwood forests while wet depressions supported both lowland hardwood and conifer swamps. Within the Saginaw Bay Lake Plain Subsection, wet prairies occurred locally on lakeplain ridges, near streams, and along the margins of wetlands. Fire helped maintain these prairie and pine-dominated systems, while water-level fluctuations and flooding shaped wetlands near rivers and the Saginaw Bay shoreline (Albert 1995).

Circa-1800 Vegetation

Vegetation patterns of the area reflect subtle differences in soils, drainage, and topography. Soils of the Gratiot-Saginaw SGA are highly variable, reflecting the interspersion of sandy and poorly drained portions of the landscape (Figure 4). Loamy, poorly drained soils formed from silt and clay loams are intermingled with well drained dry sandy soils and organic soils (Michigan DNR 1990). This fine-scale variation in soil texture and drainage contributes to substantial local variation in vegetation across the game area.

A useful resource for understanding vegetation patterns across the Gratiot-Saginaw SGA is the General Land Office (GLO) survey record. The GLO surveys were conducted in this area in 1831 by Thomas Robinson, who recorded information on tree species composition, tree size, and general land conditions within and surrounding Gratiot-Saginaw SGA (Robinson 1831; Appendix 1). MNFI ecologists later interpreted these records to reconstruct circa-1800 vegetation patterns across the state (Comer et al. 1995). These reconstructed circa-1800 vegetation maps provide a coarse-scale understanding of the historic distribution of various natural communities.

The Gratiot-Saginaw SGA and surrounding area contained several distinct vegetation assemblages in the 1800s (Comer et al. 1995) (Figure 5). Circa-1800 vegetation mapping depicts a landscape dominated by fire-adapted forests, including white pine-mixed hardwood forest (49.1%) and white pine-white oak forest (8.8%). Forested wetlands were also prevalent, including mixed conifer swamp (19.7%), mixed hardwood swamp (13.7%), and black ash swamp (1.5%) (Table 1).



White pine logging in Gratiot County during the nineteenth century. The large logs and standing pines convey the size of trees that once characterized the region's forests. White pine was the most frequently recorded tree in GLO surveys within and immediately surrounding Gratiot-Saginaw SGA, where pine-dominated forests covered nearly 58% of the circa-1800 landscape. Photograph reproduced from Tucker (1913, p. 54).

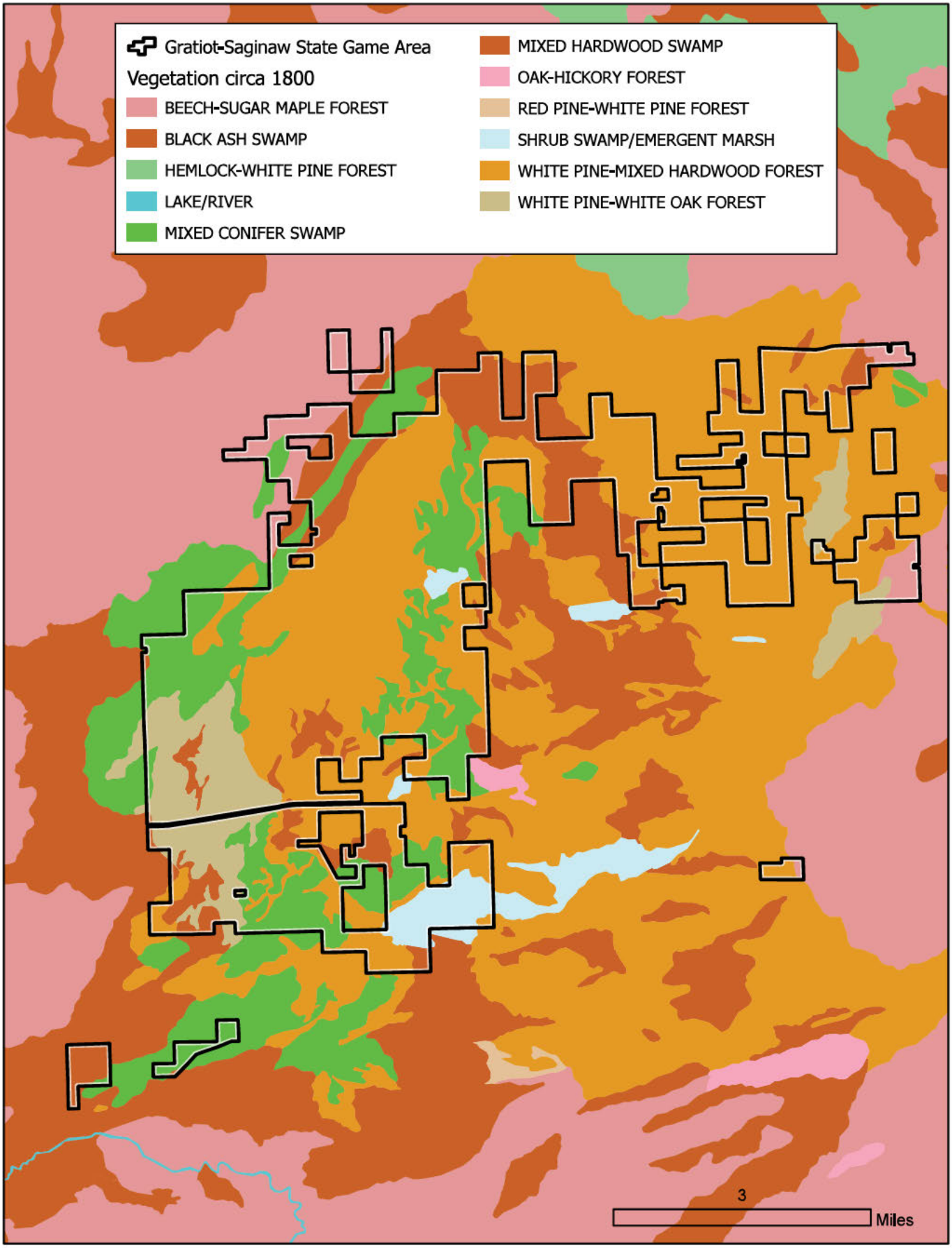


Figure 5. Circa-1800 vegetation of the Gratiot-Saginaw State Game Area (Comer et al. 1995). MNFI ecologists interpreted nineteenth-century General Land Office survey notes to reconstruct historical vegetation patterns. This provides a coarse-scale view of the distribution of major vegetation types and helps identify landscapes that historically supported fire-dependent forests and wetlands.

Robinson's field notes provide additional details of this landscape. Along a half mile of one survey line, he recorded "Enter swamp, left [swamp], Enter [swamp], left [swamp]" in succession. These alternating entries capture the rapid changes between swamp and forested sandy ridges across a short distance (Appendix 1).

To further characterize historical forest composition and structure, we compiled the species and diameters of trees recorded by GLO surveyor Thomas Robinson in 1831 within and immediately surrounding Gratiot-Saginaw SGA (Appendix 1). White pine (*Pinus strobus*) was the most frequently recorded tree, accounting for 48 of 132 transcribed records. White pine was recorded in both uplands and wetlands, with recorded diameters ranging from 6 to 48 inches. It was the only species larger than 36 inches in diameter. Other prevalent species included maple (*Acer* spp.; n = 18), black ash

Table 1. Circa-1800 vegetation cover types within the Gratiot-Saginaw SGA, based on MNFI interpretations of General Land Office surveyor notes (Comer et al. 1995). Acreage and percentage reflect the mapped extent of each cover type within the game area.

Circa-1800 Covertype	Acres	Percent
White Pine-Mixed Hardwood Forest	8,369	49.1%
Mixed Conifer Swamp	3,366	19.7%
Mixed Hardwood Swamp	2,340	13.7%
White Pine-White Oak Forest	1,508	8.8%
Beech-Sugar Maple Forest	719	4.2%
Shrub Swamp/Emergent Marsh	497	2.9%
Black Ash Swamp	258	1.5%
Oak-Hickory Forest	0.2	0.0%
Total	17,053	



White pine stumps persist within Gratiot-Saginaw SGA, where white pine was the largest and most frequently recorded canopy species in the 1831 GLO surveys. The decrease in white pine abundance reflects the lasting effects of intensive logging and likely changes in disturbance regimes, including fire suppression. Photo by J.M. Lincoln.

(*Fraxinus nigra*; n = 14), American beech (*Fagus grandifolia*; n = 13), elm (*Ulmus* spp.; n = 11), and tamarack (*Larix laricina*; n = 10). White oak (*Quercus alba*; n = 8) and black oak (*Quercus velutina*; n = 4) occurred primarily on drier sites, reflecting the fire-dependent character of these landscape positions (Figure 6).

Indigenous Occupancy

Indigenous peoples inhabited and traveled through central Michigan for thousands of years before Euro-American colonization. Archaeological evidence from an excavation known as the Schultz site, approximately 36 km east of Gratiot-Saginaw SGA, documents roughly two millennia of occupation and resource use within the Saginaw Valley. Seasonal movement occurred between riverine villages and interior hunting areas. Indigenous peoples utilized the complex of uplands and wetlands for hunting, fishing, gathering, and agriculture. Deer, elk, black bear, and beaver were important components of the faunal assemblage. Shifts toward species associated with more open forests suggest that agricultural clearing and possibly fire influenced regional vegetation during the Middle and Late Woodland periods (Cleland 1966).

Archaeological investigations in Gratiot County also provide direct evidence of Indigenous use of the interior wetland and ridge landscape. These include a seasonal base camp dated to approximately 750–650 BC and a potential hunting camp near Ashley (Site 20GR176), dated to approximately 400 BC. The hunting camp was near present-day boundaries of the game area and occurred on a low ridge. These sites document seasonal use of smaller interior locations beyond the major riverine settlements (Beld 1991).

Waterways and overland trails connected this interior landscape to the broader region (Hinsdale 1931). An Indigenous trail between Maple Rapids and the Pine River linked the Grand River and Saginaw River drainage systems (Tucker 1913). First-hand accounts of the Bethany Mission near Ithaca, describe Chief Bemassikeh and an Anishinaabe community along the Pine River during the late 1840s and early 1850s, as well as severe losses to the Indigenous community from the 1837 smallpox epidemic (Baierlein 1996 [1888]). Disease, land cessions, expanding Euro-American colonization, and forced displacement disrupted Indigenous communities and their long-standing relationships with the landscape, including seasonal movement, hunting, gathering, and potentially the application of fire.

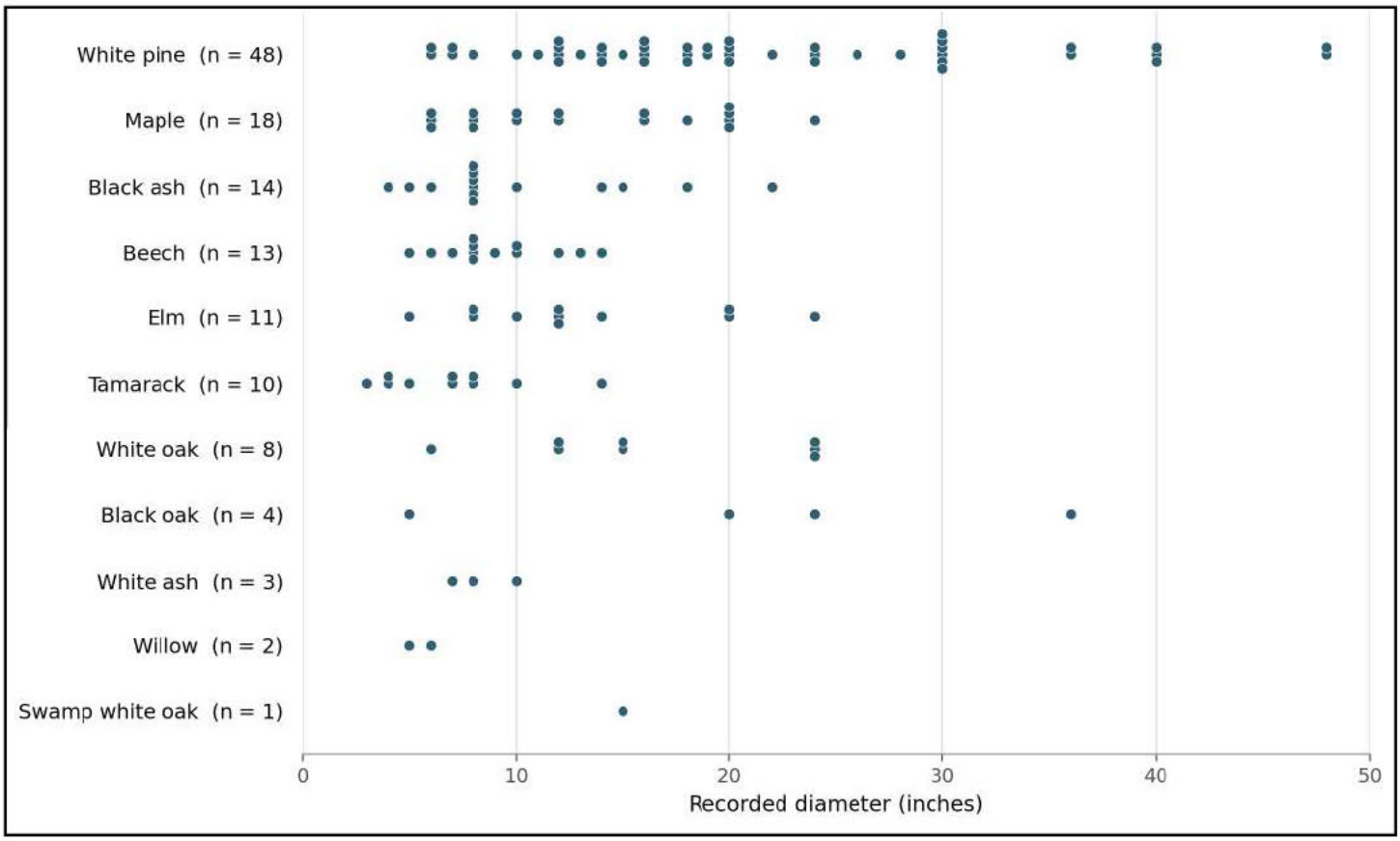


Figure 6. Trees recorded during the General Land Office surveys of the game area. Each dot represents one tree transcribed from GLO survey maps and notes; horizontal position indicates recorded diameter. Species are arranged by the number of records. The figure summarizes recorded trees rather than a comprehensive inventory of historical forest composition and structure.

Changes in Land Cover

Land cover within and around Gratiot-Saginaw SGA has changed substantially since the early nineteenth century through Indigenous displacement, logging, agricultural conversion, fire suppression, hydrologic alteration, and the spread of non-native insects, diseases, and invasive plants. Much of the Saginaw Bay Lake Plain Subsection was converted to agriculture during the late nineteenth and early twentieth centuries. Its level terrain and productive soils facilitated cultivation, while extensive drainage facilitated the conversion of forests and wetlands to farmland.

In addition, wetlands within Gratiot-Saginaw SGA have been extensively modified by drainage and waterfowl habitat development. The 1990 Master Plan for the game area documented 40 artificial impoundments totaling 717 acres, approximately 2.38 miles of dikes, 10.25 miles of ditching, and 306 excavated potholes. Level ditching occurred at 37 impoundment sites, and periodic drawdowns were proposed where water-control structures permitted (Michigan DNR 1990). Together with drainage ditches crossing and bordering forested wetlands, these modifications have substantially altered wetland hydrology throughout the game area (Figure 7). The extensive wetland cover remaining today therefore encompasses both natural communities and wetlands significantly reshaped for wildlife management.

Circa-1800 vegetation mapping classifies approximately 35.0% of Gratiot-Saginaw SGA as forested wetland (Table 1), compared to 48.4% in the contemporary MiFI inventory (Table 2). This apparent increase requires cautious interpretation because the datasets differ in mapping scale and classification within a landscape of closely interspersed uplands and wetlands. Historical vegetation classes may encompass wetland inclusions, while contemporary forested wetland classes may include sandy rises supporting upland vegetation. Robinson's repeated descriptions of entering and leaving swamp over short distances illustrate this heterogeneity (Robinson 1831). These datasets therefore do not establish a substantial conversion of upland forest to wetland. Extensive ditching further complicates that interpretation because drainage would generally cause wetland loss.

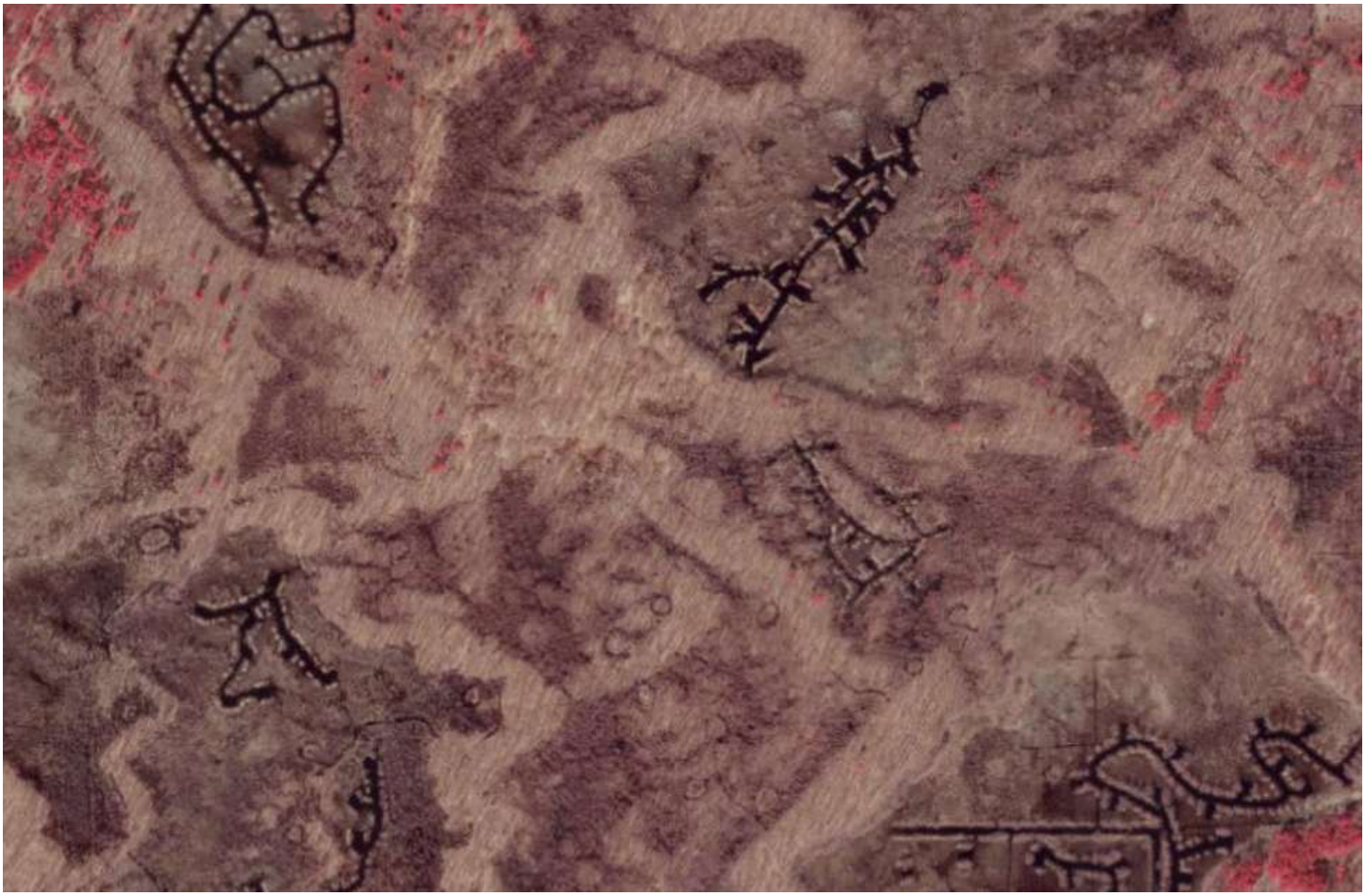


Figure 7. Aerial imagery from 2020 shows extensive ditching and excavated potholes within wetlands in Compartment 4 of Gratiot-Saginaw State Game Area. These modifications were intended to improve habitat for waterfowl and aquatic furbearers by increasing open water within wetland vegetation. The resulting excavations and spoil deposits remain prominent landscape features, and modified wetlands commonly support invasive plants, including nonnative reed canary grass and narrow-leaved cat-tail.

Logging transformed the regional landscape before agricultural development. Approximately 612 million board feet of lumber were harvested in Gratiot County between 1857 and 1880, while droughts and wildfires destroyed thousands of acres of uncut forest between 1857 and 1867 (Tucker 1913). Settlement of the land now encompassing Gratiot-Saginaw SGA occurred relatively late because of its distance from established communities and the limited agricultural suitability of its sandy and poorly drained soils. When state acquisition for the purpose of establishing a game area began in 1939, more of the property consisted of open farm fields, and much of the remaining wooded acreage had recently been logged. Many former fields subsequently developed into shrublands and young forests (Michigan DNR 1990). Aerial photographs from 1938 illustrate the extent of agricultural clearing and forest fragmentation before state acquisition (Figure 8).

Table 2. Contemporary land-cover classes, acreage, and percent cover within Gratiot-Saginaw State Game Area based on Michigan Forest Inventory (MiFI) classification.

Landcover Class	Acres	Percent
Forested Wetland	8,256	48.4%
Upland Forest	4,085	24.0%
Non-forested Wetland	2,706	15.9%
Agriculture	1,084	6.4%
Upland Grass/Shrub	611	3.6%
Developed	286	1.7%
Open Water	23	0.1%
Bare Land	1	0.0%
Total	17,053	

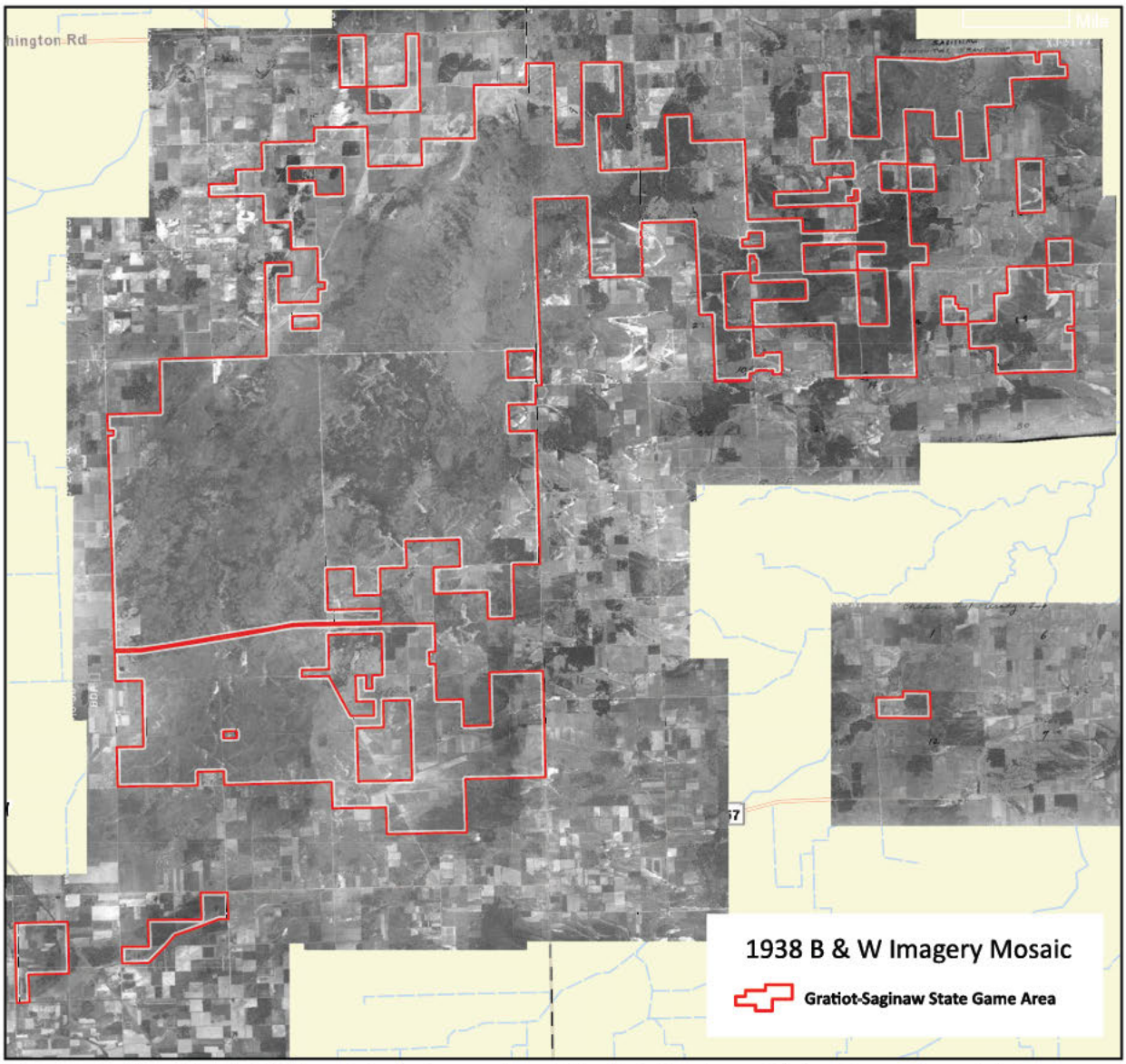


Figure 8. Mosaic of 1938 aerial photographs of Gratiot-Saginaw State Game Area. This resource can inform managers about important conservation targets because areas that were forested in the picture (typically the darker hues) tend to be dominated by native vegetation, have the oldest trees, and also exhibit the lowest levels of invasive species. Therefore, these areas generally have the highest conservation value for native biodiversity.

Many uplands within the game area were cleared and subsequently reverted to forest. These former agricultural areas now tend to support greater concentrations of invasive plants. The imagery also helps identify forest remnants that escaped agricultural conversion (Figure 9). Forested areas appear much darker in the images from 1938 and these sites generally retain older trees and feature fewer invasive plants. Their continuity of forest cover increases the likelihood that native plant populations and soil communities persist, making them important priorities for protection and ecological recovery.

Forests and wetlands that escaped clearing have nevertheless experienced substantial changes in composition and structure. Dutch elm disease (caused by the fungi *Ophiostoma ulm*i and *Ophiostoma novo-ulmi*) and emerald ash borer (*Agrilus planipennis*) have reduced mature elm and ash, altering canopy cover and regeneration in forested wetlands. Emerald ash borer, first identified in southeastern Michigan in 2002, has caused widespread ash mortality in upland and lowland forests (USDA Forest Service 2002, Roberts 2003). Surviving elm and ash frequently persist as understory trees. Additionally, outbreaks of spongy moth (*Lymantria dispar*), fire suppression, and invasive plants have further altered vegetation within both uplands and wetlands.

Despite these changes, approximately 92% of Gratiot-Saginaw SGA retains natural cover, including 499 acres of documented high-quality natural communities. Forests occupy approximately 72% of the game area, compared with 30% of the Saginaw Bay Lake Plain Subsection, where agriculture and development occupy approximately 50% and 11%, respectively.



Historical aerial imagery helped identify forests with long continuity of cover and prioritize sites for natural community surveys. Meridian Swamp illustrates the value of this approach: forest cover visible in 1938 persists today, and field surveys documented mature trees, high native plant diversity, and few invasive species. Photo by J.M. Lincoln.

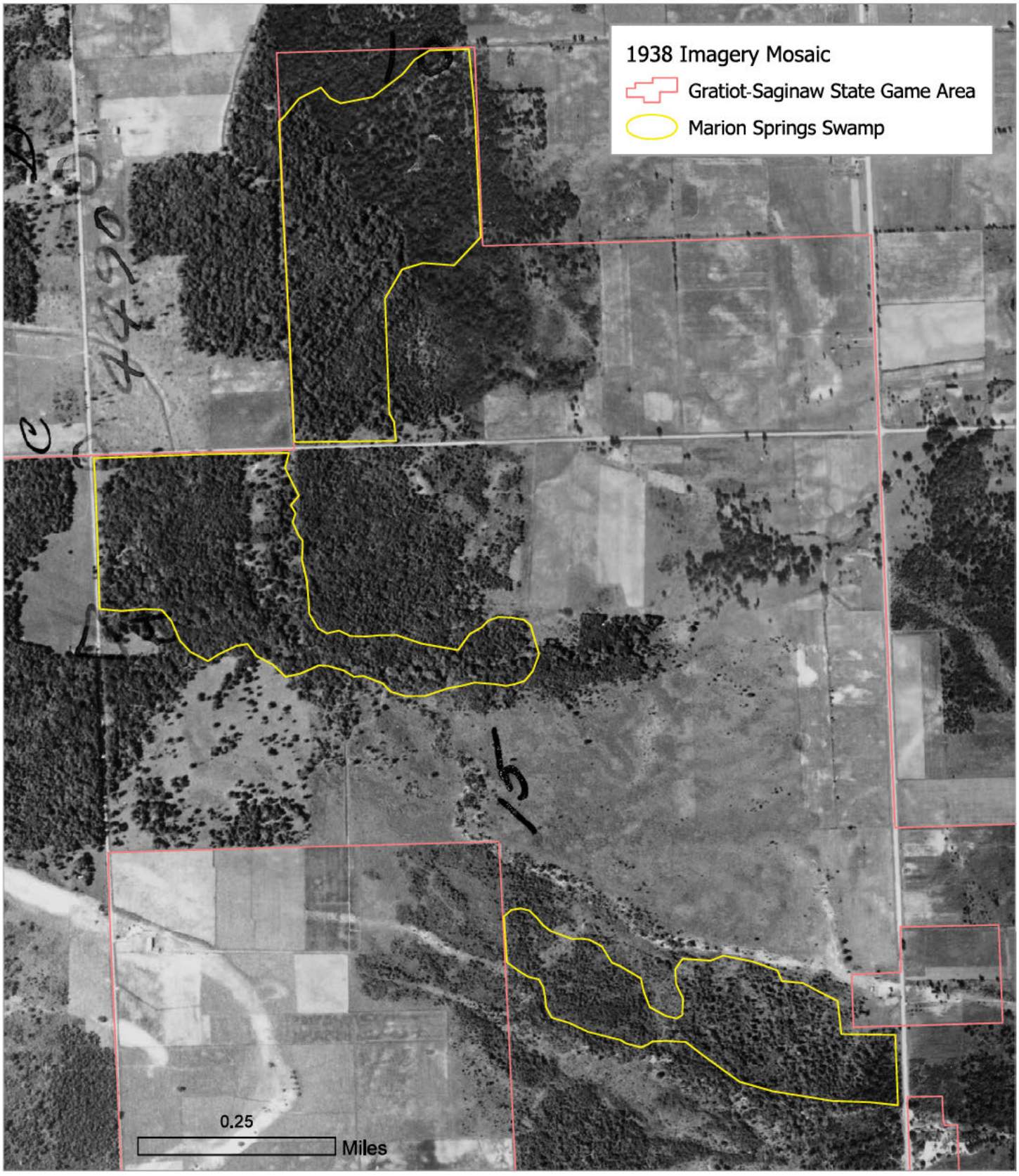


Figure 9. Detail of 1938 aerial imagery showing the Marion Springs wet-mesic flatwoods element occurrence boundaries. The correlation between the EO polygons and areas that were forested in 1938 illustrates the importance of long-term forest continuity at the site. These continuously forested areas support the oldest trees, high native plant diversity, and relatively low levels of invasive species, making them among the highest-priority areas for conservation within the game area. Adjacent areas that were forested in 1938 but not included in the EO had been harvested between 1938 and 2021.

The game area consequently retains a substantial, relatively unfragmented block of natural cover within an extensively modified landscape. MNFI's land use integrity index further illustrates this contrast (Figure 10). The index evaluates land use within and adjacent to the game area by calculating the proportion of land use and natural cover surrounding an area of interest, assigning lower scores to areas bordered by intensive uses such as row crops and residences and higher scores to areas surrounded by natural cover. High scores across much of Gratiot-Saginaw SGA reflect the continuity of its forests and wetlands and underscore its importance within the surrounding agricultural landscape.

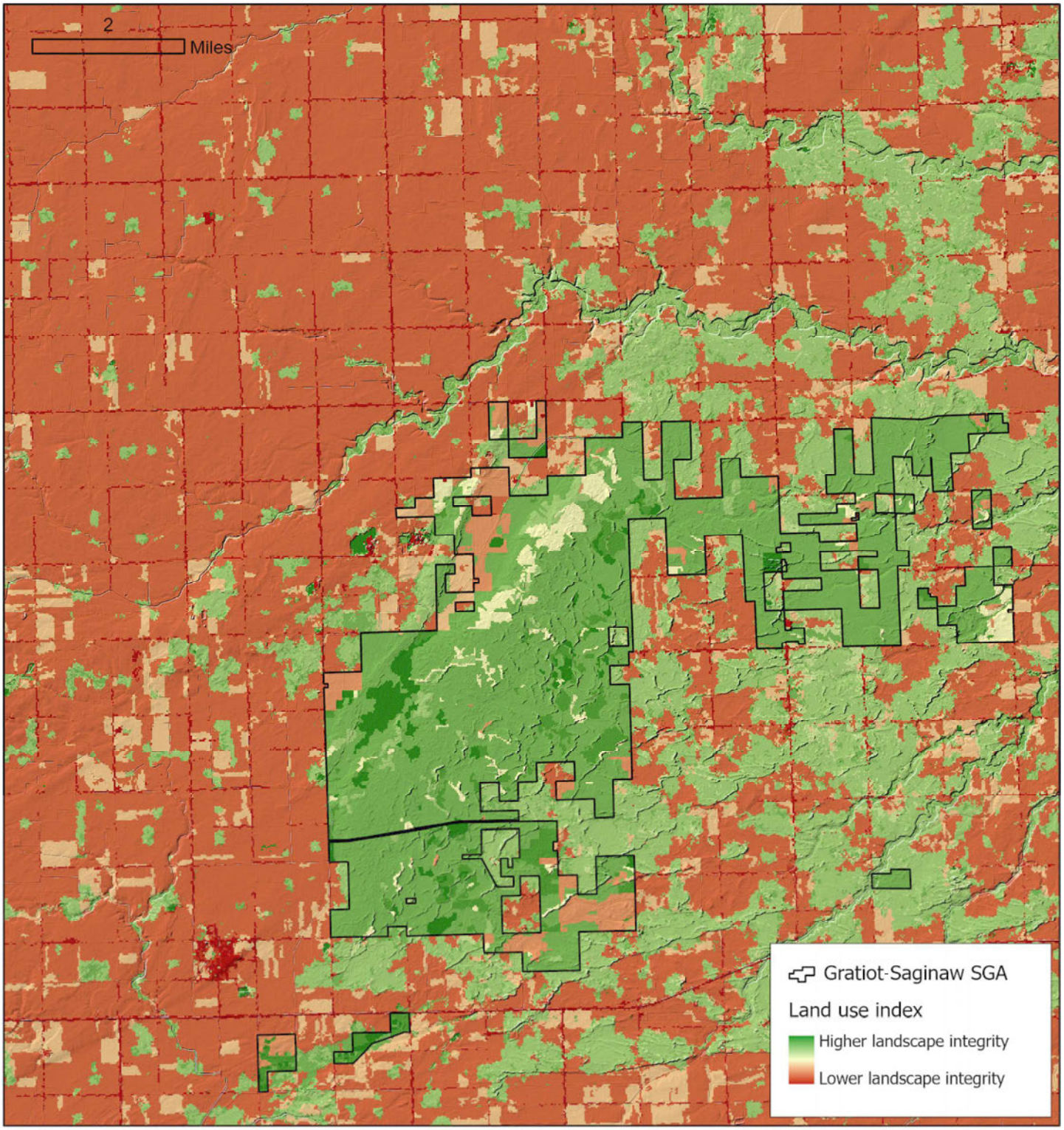


Figure 10. A land use index of Gratiot-Saginaw State Game Area. The land use index is based on the proportion of land use and natural cover surrounding an area of interest. Gratiot-Saginaw SGA is characterized by high land use index scores across the game area and especially in contrast to the surrounding agricultural lands and rural residences.

Project Goals and Report Scope

This report summarizes the landscape and historical context of Gratiot-Saginaw SGA, presents findings from MNFI's natural features inventory, and identifies stewardship priorities within the game area. The extensive natural cover within Gratiot-Saginaw SGA provides an important reservoir of biodiversity within a predominantly agricultural landscape. Before the surveys of 2021-2025, records from the game area included 2 rare bird species, 2 rare reptiles, and 2 rare plants, but no documented high-quality natural communities.

The primary goal of this survey effort is to provide resource managers and planners with updated and standardized baseline information on natural communities and rare species occurrences and identify opportunities for biodiversity stewardship. This information supports landscape-level conservation planning; native biodiversity stewardship; prioritization of protection, management, and restoration objectives; site-level stewardship decisions; and monitoring of management and restoration outcomes.

Surveys targeted potentially high-quality natural communities and suitable habitat for rare birds, insects, reptiles, amphibians, and land snails. Rare plants were documented opportunistically during natural community surveys. These efforts sought to assess previously documented occurrences and identify previously undocumented natural communities and rare species populations.

The Methods section describes survey approaches and evaluation criteria. The Results section presents rare species findings and descriptions of documented high-quality natural communities, including their composition, structure, ecological condition, and management needs. The Discussion integrates these findings to identify broader stewardship priorities and opportunities for protecting and restoring biodiversity across the game area.



Whorled pogonia is a state-threatened orchid. Gratiot-Saginaw SGA supports Michigan's largest known population, underscoring the game area's statewide significance for biodiversity conservation. Photo by J.M. Lincoln.

METHODS

Throughout this report, *element* refers to a natural community type or rare species, and *element occurrence* (EO) refers to its documented occurrence at a specific location. We used MiFI cover types, aerial photography, and field observations to identify potential habitat and survey areas. The 2011 MiFI surveys helped identify areas for targeted natural community surveys, which in turn informed subsequent rare-species surveys and management recommendations.

Rare animal survey targets were selected based on their distribution in Michigan, known occurrences within or near Gratiot-Saginaw SGA, and the presence of potentially suitable habitat indicated by MiFI cover types and natural community surveys. Surveys focused on woodland raptors, forest-interior songbirds, and grassland birds; amphibians and reptiles; selected insect groups; and land snails. We surveyed appropriate habitats when target species were most active and detectable, including during the breeding season. Surveys aimed to document new occurrences, update or expand existing occurrences, and revisit selected historical occurrences. We also recorded Species of Greatest Conservation Need (SGCN) when encountered (Derosier et al. 2015; Henehan et al. 2026).



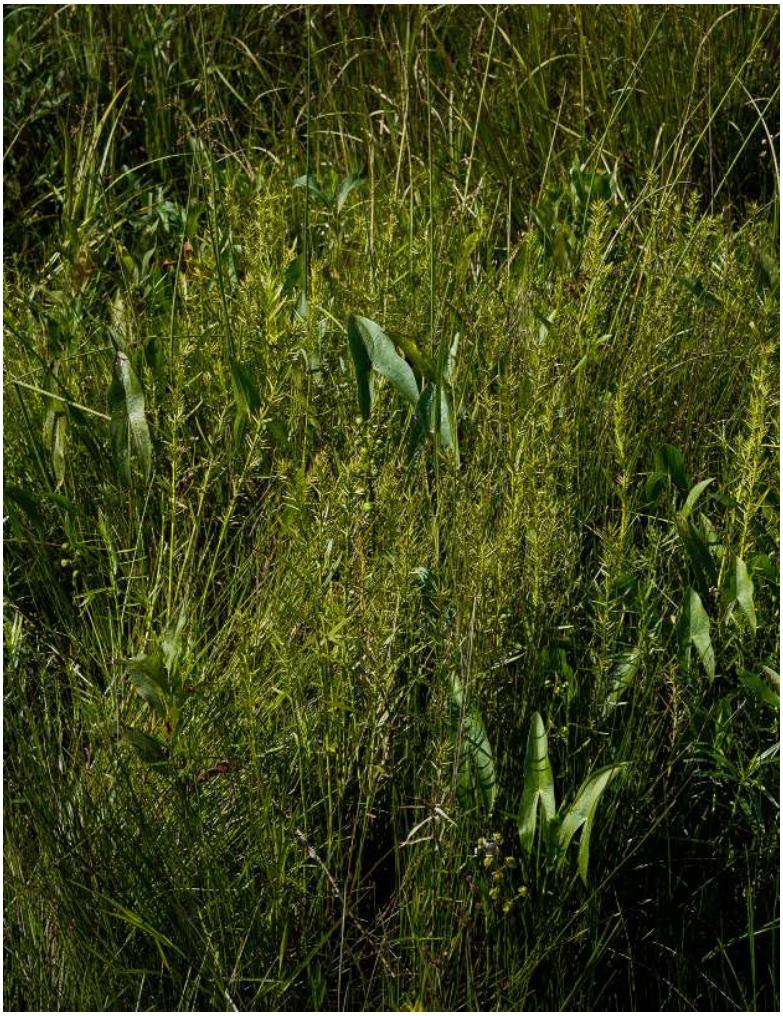




Several rare species were the focus of survey efforts based on existing EOs or abundant suitable habitat. These include grasshopper sparrow (top; Photo by A.P. Kortenhoven), Blanding's turtle (bottom right; Photo by R. Sovey), and royal fern borer (bottom left, Photo by L. M. Rowe)

Natural Community Surveys

MNFI's natural community classification recognizes 80 natural community types in Michigan. Protecting and managing representative natural communities is critical to biodiversity conservation, since native organisms are best adapted to environmental and biotic forces with which they have evolved over the millennia (Cohen et al. 2015). A natural community is defined as an assemblage of interacting plants, animals, and other organisms that repeatedly occurs under similar environmental conditions across the landscape and is predominantly structured by natural processes rather than modern anthropogenic disturbances, such as timber harvest, hydrological alteration, and fire suppression. Indigenous peoples have been integral to Michigan's landscapes, with many natural community types shaped by native land tending practices such as cultural burning, seeding, planting, and harvesting of plants, wildlife, and fish (Cohen et al. 2015, Cohen et al. 2025). This cultural stewardship has been implemented with sophistication and care at seasonally appropriate times (Kimmerer and Lake 2001, Stewart 2009).



Natural community surveys document vegetation composition and structure of the highest-quality habitats across the game area. Portions of Mason Meadow southern wet meadow are especially diverse and support a rich assemblage of native plants, captured in this close view. Photo by J.M. Lincoln.

MNFI evaluates natural community quality using Natural Heritage methodology, which considers size, landscape context, and condition (Faber-Langendoen et al. 2008, 2015). Sites that meet established criteria are documented as natural community element occurrences (EOs), entered into the MNFI Natural Heritage Database, and assigned an overall rank from A to D based on these factors (MNFI 1988). Field surveys, aerial photographic interpretation, and GIS analysis were used to assess these criteria.

We conducted targeted natural community surveys in selected areas of the game area during the 2021 and 2025 growing seasons. Qualitative meander surveys were used to evaluate natural community classification, boundaries, and ecological attributes. We documented landform, hydrologic setting, and natural ecological processes; measured and aged dominant trees; recorded vegetation composition and structure; evaluated soil pH and texture; assessed current and historical disturbances; documented invasive species; and identified threats and stewardship needs. During natural community surveys, we opportunistically searched for rare plants and rare animals. Field observations were supplemented by reviews of current and historical aerial imagery and GIS data. Survey methods followed those developed by MNFI to evaluate Ecological Reference Areas on state forest land (Cohen et al. 2008, 2009).

For each documented natural community EO, plant species data were compiled using the Universal Floristic Quality Assessment Calculator (Reznicek et al. 2014; Freyman et al. 2016). The assessment uses coefficients of conservatism (C values), which range from 0 to 10 and reflect each species' fidelity to natural habitats and tolerance of disturbance. Regional experts assign these values; species associated with specialized or minimally disturbed habitats receive higher values, while widespread, disturbance-tolerant species receive lower values. Mean C is the average C value of the recorded species, and FQI is calculated by multiplying Mean C by the square root of species richness.

Michigan sites with an FQI of 35 or greater are considered floristically important statewide, and sites with scores greater than 50 have exceptional conservation value (Herman et al. 2001). Because FQI increases with species richness, Mean C may provide a less size-dependent indicator of floristic condition (Matthews et al. 2015; Slaughter et al. 2015). Complete species lists are provided in Appendix 3.

Rare Bird Surveys

Given the presence of mature forests in Gratiot-Saginaw state game area we focused bird surveys on rare raptors, forest songbirds, and grassland birds. Rare raptor surveys targeted red-shouldered hawk (*Buteo lineatus*, State Special Concern), a DNR featured species. Rare songbird surveys targeted cerulean warbler (*Setophaga cerulea*, state threatened), hooded warbler (*Setophaga citrina*, state special concern), and wood thrush (*Hylocichla mustelina*, state special concern). Forest stands covering at least 10 acres were considered potential habitat for target species. We generated a 250 m X 250 m grid of points overlaid on the survey area. Points were assigned unique identification numbers and uploaded to a tablet computer for field location. Points falling within the survey stands were visited during raptor and songbird surveys. During field surveys some points were deemed “non-suitable” habitat and surveys did not occur at these points. We did not survey points falling within pine plantations, young aspen stands or farmstead forests. In addition to surveying for rare raptors and songbirds, point-count sampling was used to gather baseline information about the forest bird community, including relative abundance and species richness.

We conducted two-minute raptor surveys at systematically located point count stations (Figure 11; Mosher et al. 1990, Andersen 2007, Bruggeman et al. 2011). Each two-minute point count consisted of one-minute broadcasts of red-shouldered hawk calls and one minute of silent listening. Surveys were conducted between March 27 and May 1, 2021. At each station the following data were recorded: whether a red-shouldered hawk was detected; all other raptor sightings or vocalizations; other bird observations; and other rare animal species detections or potential habitats. If a rare raptor was observed, the vicinity surrounding the point was searched for potential nests. While walking and driving between station locations, we also visually inspected trees for stick nests.



Several wood thrush were documented during rare bird surveys. This species of state special concern breeds in mature forests, highlighting the value of maintaining large, contiguous forest blocks within the game area. Photo by Anneke Anglin.

Forest bird point counts were conducted at the same systematically located points used for raptor surveys (Figure 11). Ralph et al. (1995) noted that it is usually more desirable to increase the number of independent point-count stations than to conduct repeated surveys at a smaller number of locations, so we visited each point only once. Surveys were conducted from May 24 to June 1, 2021, from sunrise to 6 hours after sunrise, or until weather conditions made it unlikely to detect birds. In addition to documenting observations of the targeted rare species, we collected data on all birds seen or heard during each 10-minute point count. We recorded the species and number of individuals observed during three independent periods (2 minutes, 3 minutes, and 5 minutes) for a total of 10 minutes at each station (Ralph et al. 1995). Use of the three survey periods provides flexibility in making comparisons with other surveys (e.g., North American Breeding Bird Surveys) which adhere to these survey protocols. Each bird observation was assigned to one of four distance categories (0-25 m, 25-50 m, 50-100 m, and >100 m) based on the estimated distance of the bird from the observer to facilitate future distance analyses and refinement of density and population estimates. At each point-count station, we noted if there was suitable habitat for cerulean warbler, hooded warbler, and wood thrush.

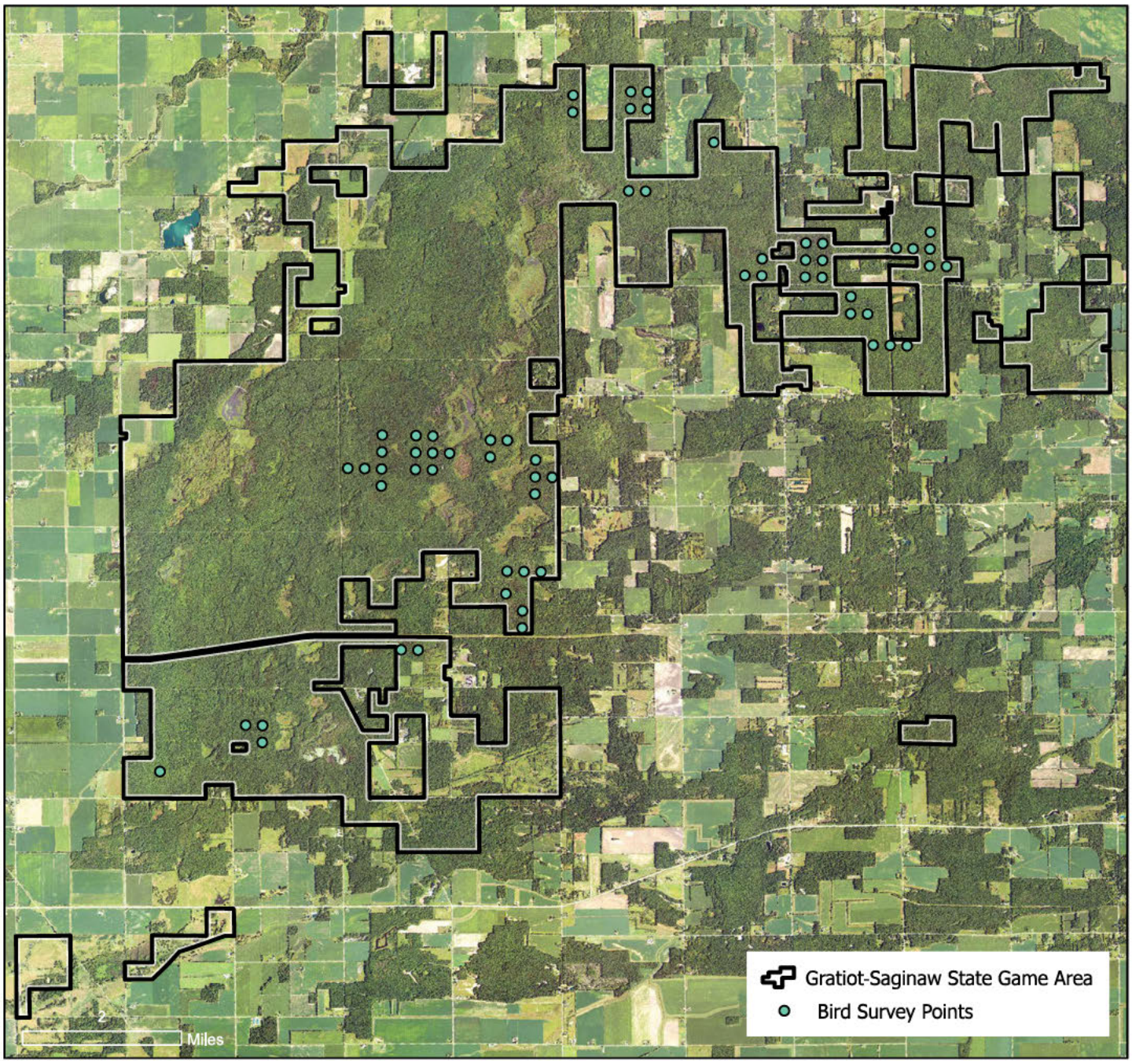


Figure 11. Location of bird surveys within Gratiot-Saginaw State Game Area.

Rare Insect Surveys

Papaipema borer moth surveys

We conducted blacklight surveys for royal fern borer moth (*Papaipema speciosissima*; State Special Concern) at one location in Gratiot-Saginaw State Game Area in October 2021 and again in September 2024 (Figure 12). Potential survey locations were identified by reviewing aerial imagery and stand-level data collected by MNFI ecologists during vegetation inventory work in 2011. We identified a stand that included natural community types associated with *P. speciosissima*: floodplain forest, inundated shrub swamp, southern hardwood swamp, and southern wet meadow. We selected the final survey location by visiting candidate sites and conducting ground surveys for host plants, including royal fern (*Osmunda spectabilis*), cinnamon fern (*Osmundastrum cinnamomeum*), and interrupted fern (*Claytosmunda claytoniana*).

The blacklight setup consisted of standard mercury-vapor and ultraviolet lights powered by a portable generator, with a large white sheet as the collecting surface. We placed the sheet centrally, with larval host plants on all sides, to increase the likelihood of attracting adults. During each survey, we recorded *Papaipema* abundance and richness and logged weather and lunar data hourly on field forms.

Bumble bee community surveys

Four state-listed bumble bee species have current statewide ranges that overlap with Gratiot-Saginaw State Game Area: *Bombus auricomus* (black and gold bumble bee; State Special Concern), *B. fervidus* (golden northern bumble bee; State Special Concern), *B. pensylvanicus* (American bumble bee; State Special Concern), and *B. sandersoni* (Sanderson's bumble bee; State Special Concern). A fifth species, *B. affinis* (rusty patched bumble bee; Federally Endangered and State Special Concern), has not been observed in Michigan since 1999 but likely occurred in the game area historically. These species depend on abundant floral resources for foraging and suitable ground cover for nesting and overwintering.

To determine whether any of these rare species occurred in the game area, we conducted a standardized meander survey of the bumble bee community at one site on July 20, 2021 (Figure 12).



Blacklight setup used to survey for nocturnal moths, including the royal fern borer, at Gratiot-Saginaw State Game Area. Photo by L.M. Rowe.

The two-hour survey used aerial netting and took place in an open field dominated by wildflowers and grasses within a matrix of dense forest. We selected the site for its abundant floral resources, proximity to forest, and ground cover that included tufts of dead vegetation (43.27633, -84.411378). Twelve flowering plant species were in bloom during the survey, including spotted knapweed (*Centaurea stoebe*), wild carrot (*Daucus carota*), purple coneflower (*Echinacea purpurea*), annual fleabane (*Erigeron annuus*), false sunflower (*Heliopsis* sp.), common St. John's-wort (*Hypericum perforatum*), wild bergamot (*Monarda fistulosa*), stiff goldenrod (*Oligoneuron rigidum*), yellow coneflower (*Ratibida pinnata*), black-eyed Susan (*Rudbeckia hirta*), Virginia mountain-mint (*Pycnanthemum virginianum*), and common mullein (*Verbascum thapsus*). Bumble bees primarily foraged on wild bergamot. We collected each bumble bee observed and placed it in a vial labeled with the associated flowering plant species. After the survey, we identified each bee to species; specimens that could not be reliably identified in the field were stored in a cooler and processed in the lab.

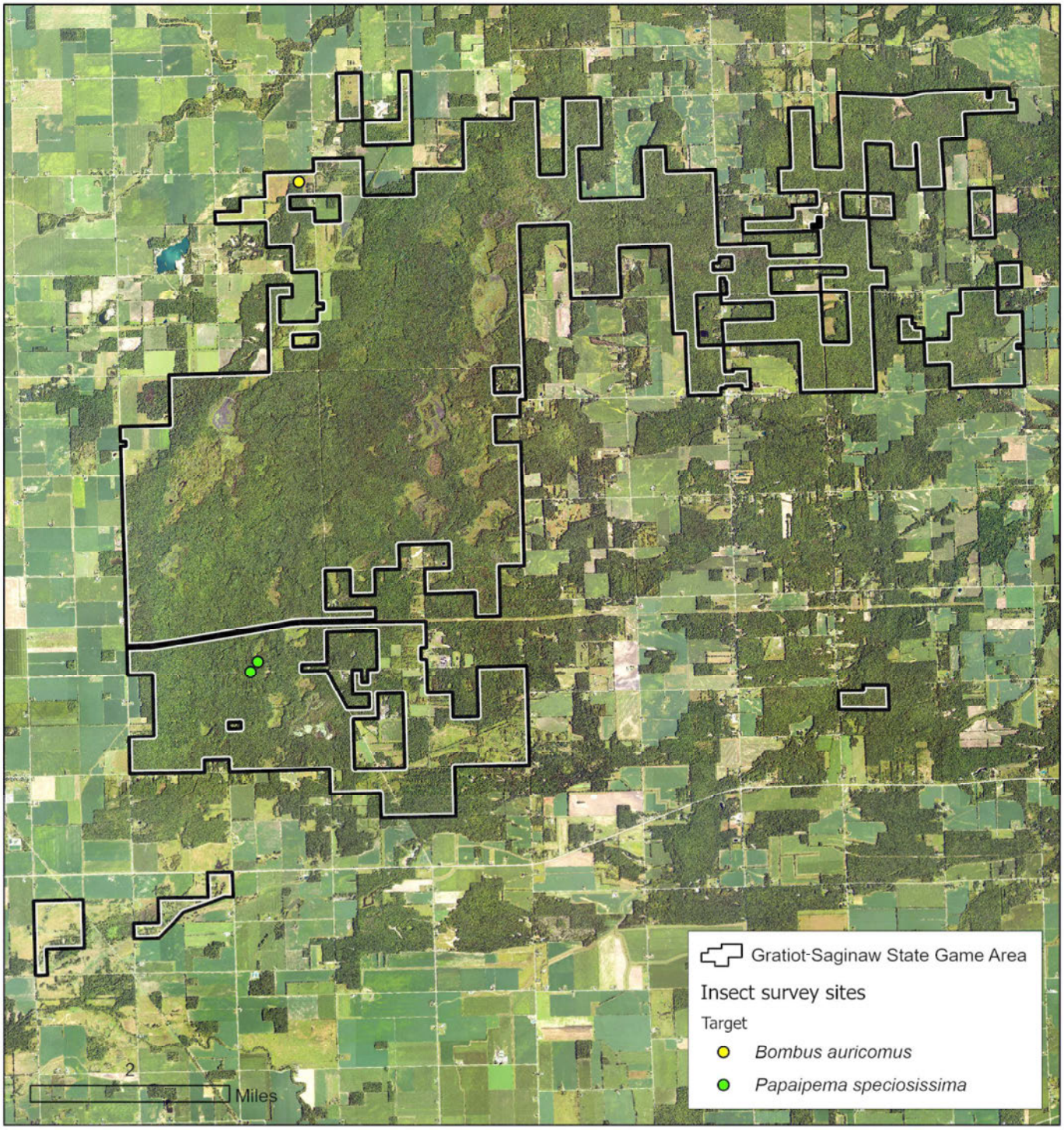


Figure 12. Location of rare insect surveys within Gratiot-Saginaw State Game Area.

Rare Reptile and Amphibian Surveys

MNFI scientists surveyed areas of the game area that could support rare amphibians and reptiles (herptiles). Prior records included a spotted turtle (*Clemmys guttata*; State Threatened) occurrence and a historic eastern massasauga (*Sistrurus catenatus*; State and Federally Threatened) record, with no observation for more than 25 years. Site visits indicated that habitat may no longer be suitable for eastern massasauga. Based on known species ranges and available habitat, survey targets included spotted turtle, Blanding's turtle (*Emydoidea blandingii*; State Special Concern), Blanchard's cricket frog (*Acris blanchardi*; State Threatened), pickerel frog (*Lithobates palustris*; State Special Concern), and Butler's garter snake (*Thamnophis butleri*; State Special Concern). These species are identified as Michigan Species of Greatest Conservation Need (SGCN). We also recorded other potential SGCN encountered during surveys, including eastern musk turtle (*Sternotherus odoratus*), northern ribbon snake (*Thamnophis saurita septentrionalis*), and gray rat snake (*Pantherophis spiloides*; State Special Concern) (Derosier et al. 2015, Henehan et al. 2026).

Surveys were conducted in 2021 to document new populations and, where possible, confirm existing records. Visual meander surveys were conducted throughout the game area from June 30 through July 2. We walked slowly through suitable habitat, overturned cover objects such as logs, woody debris, and rocks, inspected retreats, and searched for animals basking, resting, or active on or beneath the surface (Campbell and Christman 1982; Corn and Bury 1990; Crump and Scott 1994). Surveys focused on shallow wetlands and the edges of deeper wetlands that could support turtles and target frogs, as well as adjacent uplands where snakes might be observed or turtles might travel between water bodies (Figure 13). We also listened for calls of target frogs and toads. Surveys were conducted when weather



Figure 13. Location of rare herptile surveys within Gratiot-Saginaw State Game Area.

conditions were suitable for detecting active animals: temperatures of 60 to 80°F, winds below 15 mph, and no or light precipitation.

We used aquatic trapping to assess the presence, abundance, and demographics of spotted and Blanding's turtles in suitable wetlands. Trapping followed monitoring protocols developed for these species in the northeastern United States and used in ongoing MNFI research (Willey and Jones 2014; Willey et al. 2022; Cross et al. 2023). We placed 800-m-diameter reference plots over potential trapping habitat and set up to ten traps within each plot, favoring areas with suitable habitat. Depending on water depth, traps were either 1.5-m-diameter hoop nets or collapsible 12-inch-diameter minnow traps (Figure 13). Traps remained in place for four nights and were checked daily. We examined captured turtles for injuries or other health conditions, recorded demographic information such as age class and sex, photographed them, and released them. We marked hard-shelled turtles by notching the carapace with a unique code to identify individuals if recaptured (Nagle et al. 2017). As part of ongoing research with MNFI and partners, we also measured and weighed target turtles and collected blood samples. Trapping took place July 7 through 11, with 38 traps deployed for 152 trap nights, and September 12 through 16, with 15 traps deployed for 60 trap nights.

We recorded survey locations, meander routes, species observations, habitat notes, and areas of potential habitat for rare herptiles using ArcGIS Survey123. For each observed animal, we recorded behavior, age class, location, and time. We entered observations of state-listed species into the Michigan Natural Heritage Database.



A northern leopard frog among the leaf litter at Gratiot-Saginaw State Game Area. This species uses wetlands for breeding and adjoining uplands for foraging, highlighting the importance of maintaining connections between these habitats. Photo by J.M. Lincoln.

Land Snail Surveys

Michigan Natural Features Inventory conducted field surveys for rare land snail species within the Gratiot-Saginaw SGA. The Natural Heritage Database was used to review rare land snail occurrences and help determine which rare land snail species might have the greatest potential to occur in the game area. The range and habitat use of land snail species in Michigan is not well known. Given broad historical ranges and habitat associations, rare land snail species with some potential to occur in the game area include several species of State Special Concern (banded globe, *Anguispira kochi*; spike-lip crater, *Appalachina sayanus*; domed disc, *Discus patulus*; yellow globelet, *Mesodon clausus*; sealed globelet, *Mesodon mitchellianus*; copper button, *Mesomphix cupreus*; Carolina mantleslug, *Philomycus carolinianus*; pyramid dome, *Ventridens intertextus*; and flat dome, *Ventridens suppressus*), two State Threatened species (proud globe, *Mesodon elevatus*; Foster mantleslug, *Pallifera fosteri*), and one State

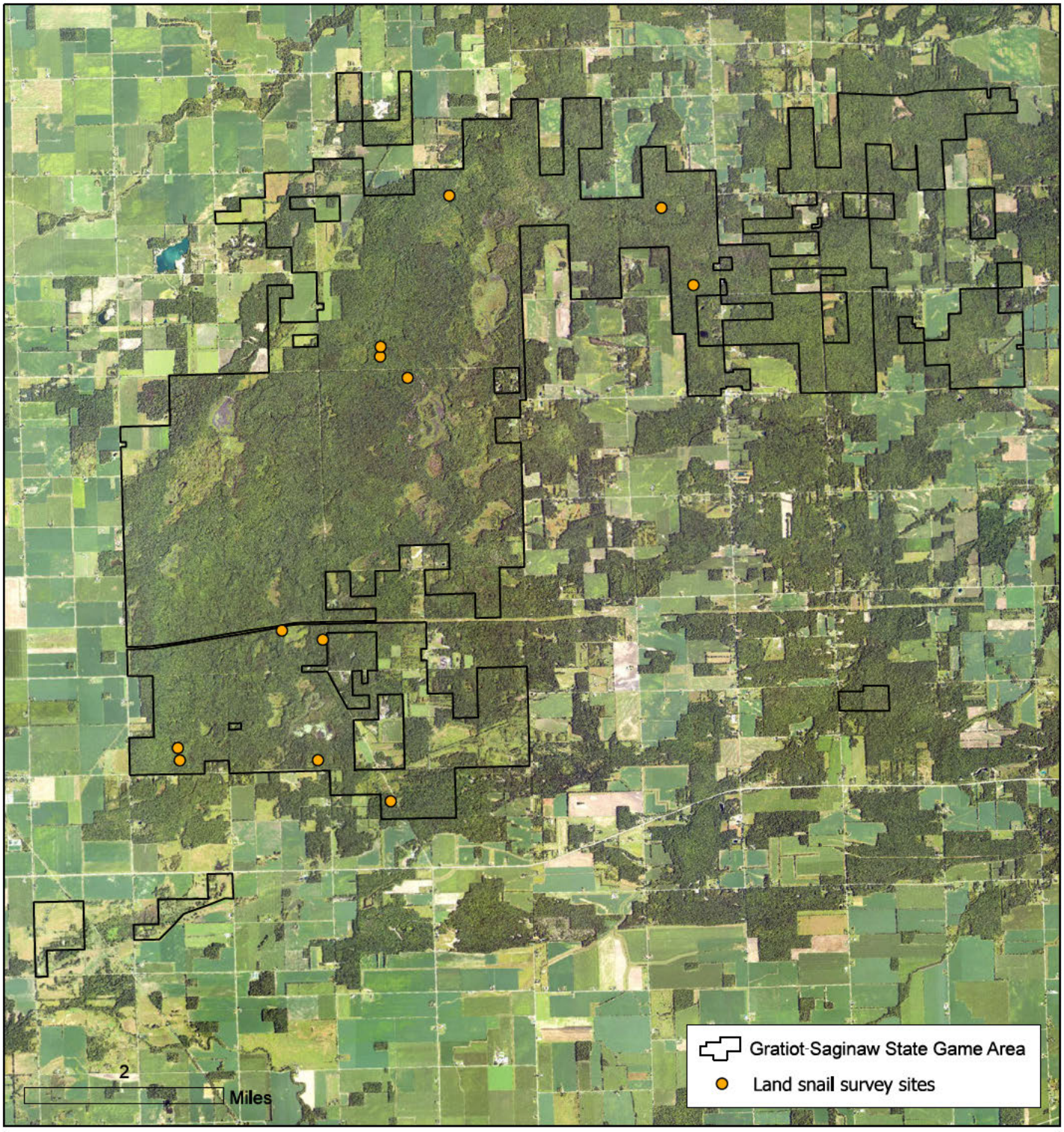


Figure 14. Location of land snail surveys within Gratiot-Saginaw State Game Area.

Endangered Species (*Mediappendix protracta*), a land snail in the ambersnail group without a common name.

Land snail samples were collected at twelve sites within the game area (Figure 14) in the summer of 2021. Microhabitats thought to be most suitable for land snails were targeted at each site including downed logs, moss, and moist leaves and soil. Surveys consisted of a short (10-15min.) visual search of the microhabitat at each site, followed by collection of a ground litter sample. Approximately 0.75 L of material including leaves, twigs, moss, soil, and bark were placed in a paper bag and labeled at each site. Any snails found during the visual search were photographed and/or placed in the paper sample bag for later identification. Coordinates of each sample site were recorded with a handheld GPS. A state threatened and endangered species permit held by MNFI covered potential handling of listed snail species. Bags containing sample material were later dried at 170° F for 1 to 3 hours, depending on moisture content. Snail shells were then sorted from organic and inorganic particles with the aid of a stereo microscope at 10x magnification (see Appendix 2 for more detail). Shells were identified to species under 8-35x magnification, and the number of individuals of each species was recorded.



Comb snaggletooth (left) and fine-ribbed striate (right). Snail shells were separated from collected material using a stereo microscope at 10× magnification, then identified to species and counted under 8–35× magnification (see Appendix 2). Photos by P.J. Badra.

RESULTS

MNFI conservation scientists have documented 17 element occurrences (EOs) from Gratiot-Saginaw SGA. Of those EOs, 13 were newly documented or updated during the course of the 2021–25 surveys. These new or updated element occurrences are composed of three natural community and ten rare species EOs. During surveys completed for the Integrated Inventory project at Gratiot-Saginaw SGA, MNFI scientists documented or updated three natural community EOs (Table 5, Figure 15), two rare plant EOs (Table 3, Figure 19), five rare bird EOs (Table 4, Figure 20), two rare insect EOs (Table 4, Figure 21), and one rare reptile EO (Table 4, Figure 22). No rare amphibians were documented during the surveys. Likewise, land snail surveys detected no rare species. Surveys for the massasauga rattlesnake were unsuccessful and the EO previously documented from Gratiot-Saginaw SGA is now presumed to be historic. Results are presented in this order: natural communities, plants, birds, insects, reptiles and land snails. Data compiled on these EOs were entered into MNFI's Natural Heritage Database (MNFI 2026).



Cerulean warbler is a State Threatened species and was documented from the game area in 2003. It has not been documented in the area since. Photo by A.P. Kortenhoven.

Table 3. Rare plants at Gratiot-Saginaw State Game Area. Status abbreviations are as follows: T, State Threatened; and SC, State Special Concern. Element occurrence rank abbreviations are as follows: AB, excellent to good estimated viability; and C, fair estimated viability.

Common Name	Scientific Name	EO ID	Rank	Status	First Observed	Last Observed	Compartment	Stands
Three-awned grass (G5/S2)	*Aristida longespica*	4424	C	SC	1988	1988	4	116
Sedge (G5?/S2)*	*Carex seorsa*	28289	C	T	2021	2022	7	74
Whorled pogonia (G5/S1)*	*Isotria verticillata*	8881	AB	T	1977	2022	[redacted]	

*documented or updated during this project

Table 4. Rare birds, insects, and reptiles at Gratiot-Saginaw State Game Area. Status abbreviations are as follows: LT, Federally Threatened; T, State Threatened; and SC, State Special Concern. Element occurrence (EO) rank abbreviations are as follows: AC, excellent to fair estimated viability; C, fair estimated viability; E, extant with viability not assessed; and H, historical.

Common Name	Scientific Name	EO ID	Rank	Status	First Observed	Last Observed	Compartment	Stands
Birds								
Red-shouldered hawk (G5/S4)*	*Buteo lineatus*	28453	E	SC	2021	2021	8	31
Bald eagle (G5/S4)*	*Haliaeetus leucocephalus*	21583	E	SC	2012	2021	6	24, 27
Wood thrush (G5/S4)*	*Hylocichla mustelina*	28471	E	SC	2021	2021	8	103, 109
Wood thrush (G5/S4)*	*Hylocichla mustelina*	28472	E	SC	2021	2021	8	107
Wood thrush (G5/S4)*	*Hylocichla mustelina*	28480	E	SC	2021	2021	5	125
Cerulean warbler (G4/S3)	*Setophaga cerulea*	13373	C	T	2003	2003	4	8
Insects								
Black and gold bumble bee (G5/S2)*	*Bombus auricomus*	24528	AC	SC	2021	2021	1	18
Yellow bumble bee (G4/S3)*	*Bombus fervidus*	27181	E	SC	2024	2024	1	69
Reptiles								
Spotted turtle (G5/S2)	*Clemmys guttata*	4916	E	T	1990	2006	3	3
Blanding's turtle (G4/S2S3)*	*Emydoidea blandingii*	24465	AC	SC	2021	2021	3	5
Eastern massasauga (G3/S3)	*Sistrurus catenatus*	3695	H	LT/T	1976	1985	7	4, 59

*documented or updated during this project



Blanding's turtle, a State Special Concern species documented during surveys of Gratiot-Saginaw State Game Area. Surveys identified a previously undocumented population of this rare turtle within the game area. Photo by Nate DeVries, DNR Wildlife Division.



Three-awned grass has not been officially documented within the game area since 1988, although a recent observation on iNaturalist suggests the population remains extant. Photo by Joseph Kurtz, iNaturalist.

Natural Communities

MNFI ecologists documented three new high-quality natural communities in Gratiot-Saginaw SGA, including a southern wet meadow and two wet-mesic flatwoods (Table 5, Figure 15). These high-quality natural communities cover 499 acres, or approximately 2.9% of the game area. For each site, we provide the site name, natural community type, global and state ranks, element occurrence rank, size, floristic quality metrics (Floristic Quality Index, Mean C, and species richness), locational information, digital photographs, site description, threat assessment, and management recommendations. The following site summaries are organized alphabetically by natural community type. Comprehensive species lists are provided in Appendix 3.





Marion Springs Swamp supports high native plant diversity, contributing to the game area's conservation value. Natural community surveys document this diversity across canopy, subcanopy, shrub, and ground layers through comprehensive plant species lists, descriptions of vegetation structure, and measurements of the size and age of dominant canopy trees. Photos by J.M. Lincoln.

Table 5. Natural community element occurrences documented within Gratiot-Saginaw State Game Area. EO rank abbreviations are as follows: BC, good to fair ecological integrity; and C, fair ecological integrity. Sizes are reported in acres.

Site Name	EO ID	Rank	Size (Ac)	First Recognized as EO	Last Visited	Compartment	Stands
Southern Wet Meadow							
Mason Meadow	28611	C	20.2	2025	2025	4	59, 64, 66
Wet-Mesic Flatwoods							
Marion Springs Swamp	27362	BC	177.5	2021	2025	7	30, 34, 43, 74
Meridian Swamp	27360	C	301.2	2021	2025	4	29, 40, 47, 53, 57, 67, 80, 89

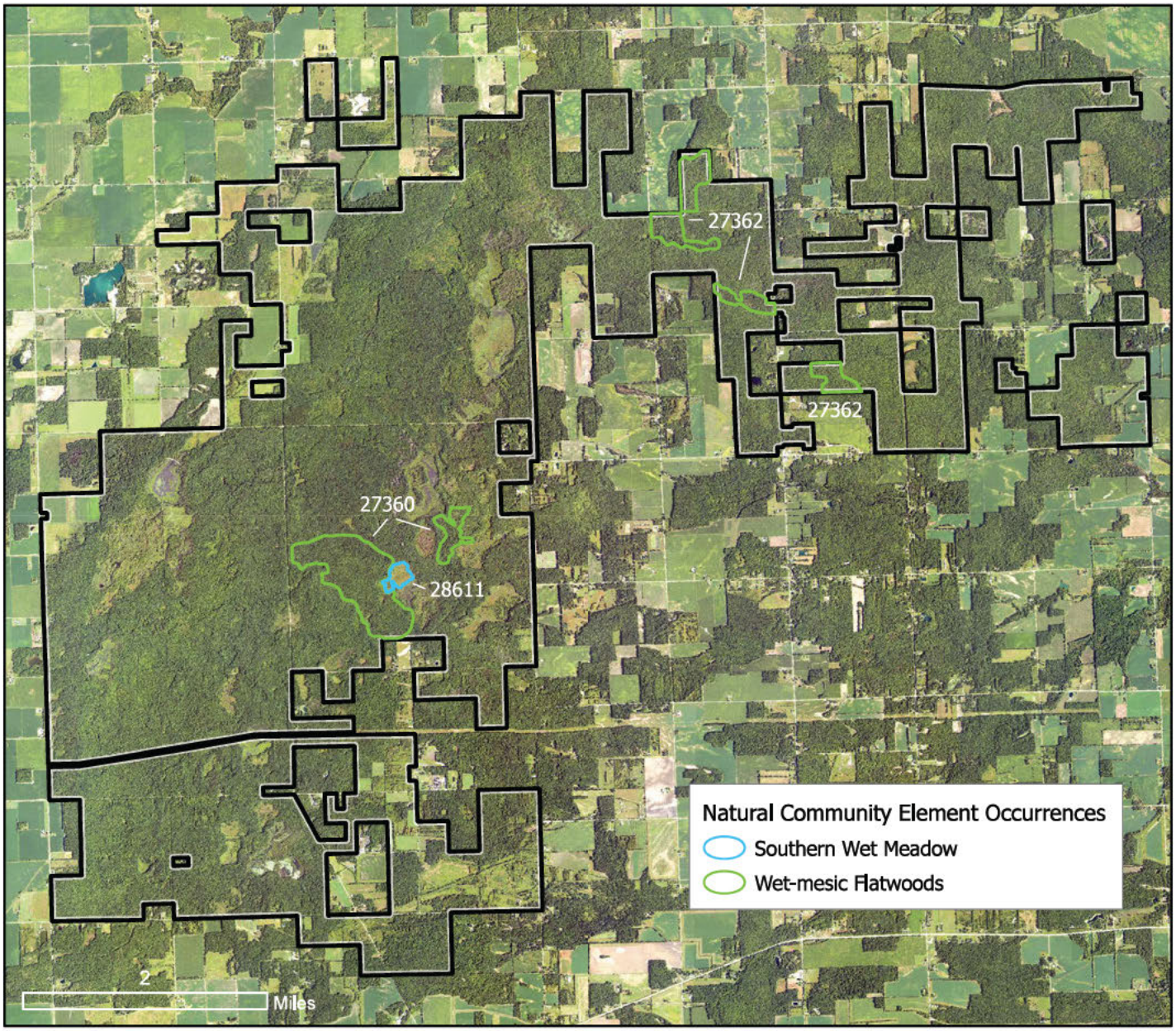


Figure 15. Natural community element occurrences documented within Gratiot-Saginaw State Game Area.

Natural Community Site Summaries
1. Mason Meadow
Natural Community Type: Southern Wet Meadow
Rank: G4? S3, Apparently secure globally and vulnerable within the state
Element Occurrence Rank: C
Size: 20.2 acres
Location: Compartment 4; Stands 59, 64, and 66
Element Occurrence Identification Number: 28611

Mason Meadow occupies a shallow depression between low sandy ridges within the former proglacial lakeplain of the Saginaw basin. It is one of the few wetlands within Gratiot-Saginaw State Game Area that has not been impacted by ditching or impoundments and its hydrology, dominance of native plant species, and vegetation zonation reflect an intact wetland. The meadow is adjacent to Meridian Swamp and grades into oak-dominated uplands on the surrounding ridges. Small differences in elevation, soil texture, and water depth produce distinct vegetation zones across the meadow. Soils near the margin have approximately 3 inches of saturated muck with a pH ranging from 5.5 to 6.0, over 5 inches of saturated organics with sand (pH of 6.0), over saturated sandy clay loam (pH of 6.5).

Most of the meadow is dominated by sedges (*Carex lacustris* and *Cx. stricta*) and zones of broad-leaved cat-tail (*Typha latifolia*). Other common species include false nettle (*Boehmeria cylindrica*), marsh fern (*Thelypteris palustris*), wool-grass (*Scirpus cyperinus*), sensitive fern (*Onoclea sensibilis*), and blue-joint (*Calamagrostis canadensis*). A particularly diverse zone of saturated, exposed muck supports three-way sedge (*Dulichium arundinaceum*), spike-rush (*Eleocharis palustris*), hardstem bulrush (*Schoenoplectus acutus*), common arrowhead (*Sagittaria latifolia*), and soft-stemmed rush (*Juncus effusus*). A single clump of purple loosestrife (*Lythrum salicaria*) was documented, and bittersweet nightshade (*Solanum dulcamara*) was uncommon throughout the meadow.

Shrubs occur in scattered clumps throughout the meadow and along its margins. Meadowsweet (*Spiraea alba*) is common, with speckled alder (*Alnus incana*), buttonbush (*Cephalanthus occidentalis*),

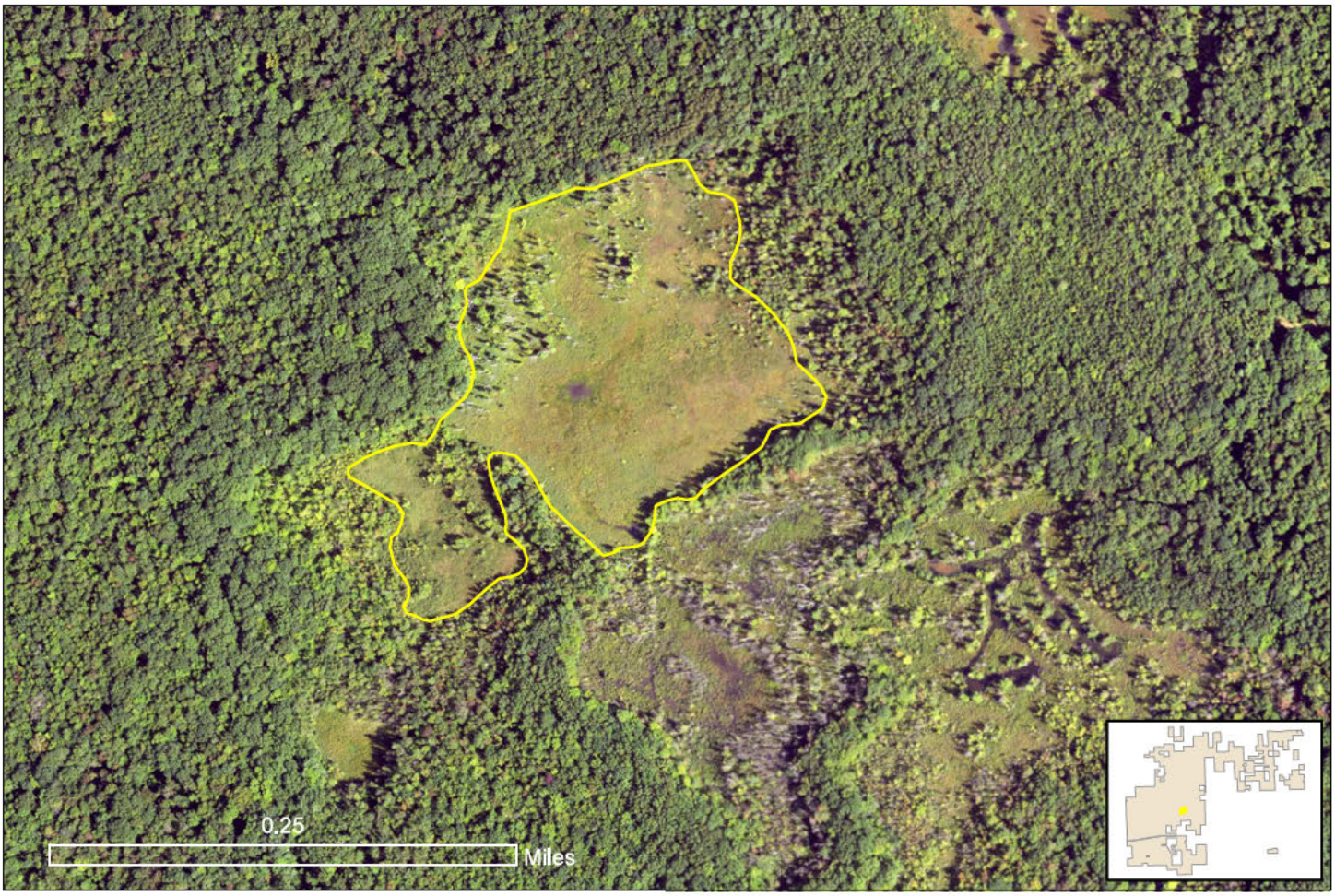


Figure 16. Location of Mason Meadow southern wet meadow within Compartment 4 of Gratiot-Saginaw State Game Area (EOID 28611).

Michigan holly (*Ilex verticillata*), and sandbar willow (*Salix exigua*) also present. Tree cover is sparse and occurs primarily along the meadow margins, although scattered stunted saplings extend into the interior. Emerald ash borer (*Agrilus planipennis*) has caused substantial mortality of green ash (*Fraxinus pennsylvanica*) along portions of the meadow edge.

Thirty-eight plant species were documented at Mason Meadow, including 36 native species and 2 non-native species (Appendix 3). The total FQI was 27.7, the native FQI was 28.8, and the native Mean C was 4.8.

Threats and Management Recommendations

We recommend maintaining the meadow, adjacent portions of Meridian Swamp, and surrounding sandy ridges as a connected wetland-upland complex. Although Mason Meadow remains unditched and comparatively intact, extensive ditching, roads, wetland excavation, timber harvest, and agricultural conversion have reduced hydrologic and ecological connectivity across the game area. We also recommend avoiding additional hydrologic alterations, preventing logging in adjacent stands, and avoiding heavy equipment in the meadow. Where feasible, evaluate filling or disabling unnecessary surrounding ditches after assessing potential effects across the wetland complex. We also recommend allowing beaver activity and natural fluctuations in water levels. We also recommend treating purple loosestrife (*Lythrum salicaria*) before it expands. Periodically monitoring the meadow and nearby roads, ditches, and disturbed wetland margins for nonnative common reed (*Phragmites australis* subs. *australis*), glossy buckthorn (*Frangula alnus*), reed canary grass (*Phalaris arundinacea*), and other invasive plants will limit the chance for them to spread into the meadow.

Fire may have periodically entered Mason Meadow from surrounding fire-dependent uplands during droughts or periods of seasonally low water. The oak-dominated ridge northwest of the meadow features white oak (*Quercus alba*) and huckleberry (*Gaylussacia baccata*) and charred stumps indicate past influence by fire. Within the meadow, fires were probably infrequent and patchy, with saturated muck and deeper depressions remaining unburned while drier margins and accumulated sedge litter carried surface fire. This context of open wetland, saturated soils, and adjacent uplands may historically have provided ideal habitat for eastern massasauga (*Sistrurus catenatus*), which is now presumed extirpated from the game area. Periodic fire may have been especially important for maintaining open basking sites along the ecotone between the meadow and adjacent upland.

If the adjacent ridge is included in prescribed burns, we recommend avoiding the construction of fire lines along the meadow's margins. We recommend allowing fire to enter the meadow and extinguish naturally in saturated areas.



A zone of deep muck near the center of Mason Meadow supports especially diverse vegetation within the southern wet meadow. Photo by J.M. Lincoln.

2. Marion Springs Swamp
Natural Community Type: Wet-Mesic Flatwoods
Rank: G2G3 S2, Imperiled to vulnerable globally and imperiled within the state
Element Occurrence Rank: BC
Size: 177.5 acres
Location: Compartment 7; Stands 30, 34, 43, and 74
Element Occurrence Identification Number: 27362

Marion Springs Swamp comprises four separate polygons of maturing second-growth wet-mesic flatwoods on the broad, nearly level lakeplain. The forest retains intact microtopography and hydrology and is continuing to develop structural complexity, but historical logging removed much of the original canopy and the occurrence lacks old-growth trees. Fine-textured soils restrict drainage and contribute to a high water table. Shallow depressions support vernal pools and standing water, while slight rises, tip-up mounds, and tree root mats create small differences in inundation, soils, and vegetation. Soils consist of approximately 1 inch of leaf litter and detritus over about 4 inches of decomposing, densely rooted organic material. Beneath the organic surface are saturated, medium- to fine-textured loamy sands or sandy loams with a pH of approximately 7.0. Sandy clays occur at approximately 28 inches and are characterized by pH ranging from 7.0 to 7.5.

The canopy is dominated by swamp white oak (*Quercus bicolor*), with black gum (*Nyssa sylvatica*) and red maple (*Acer rubrum*), and pin oak (*Q. palustris*) as codominants. White oak (*Q. alba*), silver maple (*A. saccharinum*), red oak (*Q. rubra*), basswood (*Tilia americana*) occur less frequently. Most canopy trees are approximately 90 to 130 years old and 20 to 36 inches in diameter, although some older trees persist; one black gum was aged at 173 years. Large white pine (*Pinus strobus*) stumps throughout indicate that the species was formerly an important canopy component. Emerald ash borer (*Agrilus planipennis*) and Dutch elm disease (caused by *Ophiostoma ulmi* and *O. novo-ulmi*) have substantially altered canopy composition and structure and spongy moth (*Lymantria dispar*) appears to be dramatically impacting mature white oaks.

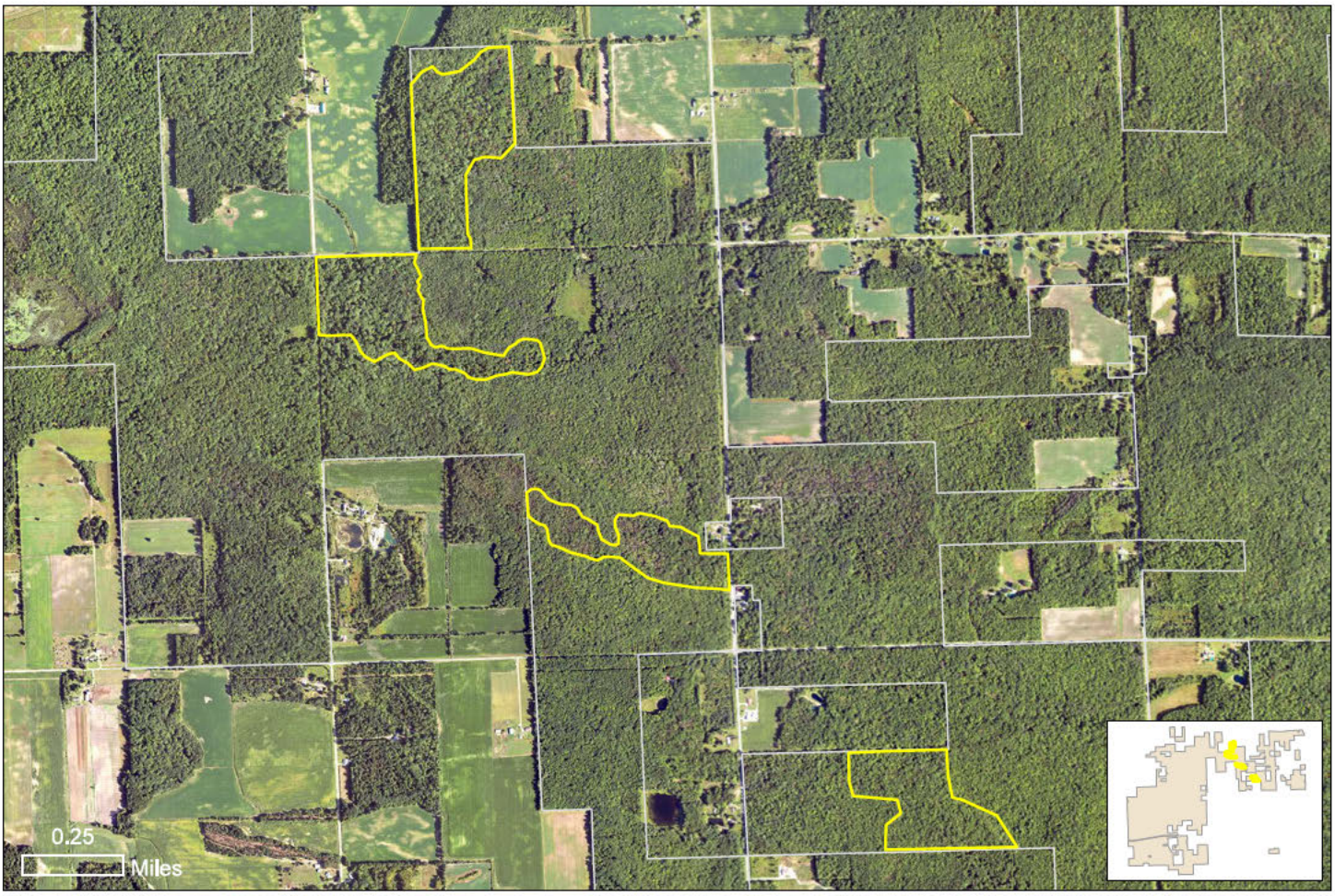


Figure 17. Location of Marion Springs Swamp wet-mesic flatwoods within Compartment 7 of Gratiot-Saginaw State Game Area (Element Occurrence 27362).





Marion Springs wet-mesic flatwoods occurs as 4 separate polygons that exhibit considerable variation in forest structure and hydrology. Areas with relatively young canopy trees support exceptionally diverse native vegetation (top), while more mature portions feature enormous swamp white oaks, a rich understory, and subtle variations in topography and soils that create a mosaic of saturated depressions and upland microsites (bottom). Photos by J.M. Lincoln.

The understory varies with moisture and topography. Red maple, black gum, and musclewood (*Carpinus caroliniana*) are common in the subcanopy. Prevalent shrubs include Michigan holly (*Ilex verticillata*) and buttonbush (*Cephalanthus occidentalis*), which occur in the wettest areas with huckleberry (*Gaylussacia baccata*) locally abundant on drier sites.

The ground layer is patchy and diverse, with approximately 40 to 60% coverage and areas of bare soil associated with vernal pools. Species composition is strongly influenced by seasonal inundation and subtle changes in topography throughout. Sedges and ferns generally dominate. Prevalent sedges include *Carex intumescens*, *Cx. bromoides*, *Cx. crinita*, *Cx. grayi*, *Cx. stricta*, *Cx. projecta*, and *Cx. normalis*. A population of the State Threatened sedge (*Cx. seorsa*) was also documented in Stand 74. Prominent ferns include royal fern (*Osmunda regalis*), cinnamon fern (*Osmundastrum cinnamomeum*), and New York fern (*Amauropelta noveboracensis*). Prevalent grasses include fowl manna grass (*Glyceria striata*), bluegrass (*Poa alsodes*), northern shorthusk (*Brachyelytrum aristosum*), Virginia wild-rye (*Elymus virginicus*), and wood reedgrass (*Cinna latifolia*). Prevalent forbs in saturated areas include water-parsnip (*Sium suave*), wild blue flag (*Iris versicolor*), northern bugleweed (*Lycopus uniflorus*), swamp-candles (*Lysimachia terrestris*), clearweed (*Pilea pumila*), swamp buttercup (*Ranunculus hispidus*), wood nettle (*Laportea canadensis*), swamp goldenrod (*Solidago patula*), water hemlock (*Cicuta bulbifera*), calico aster (*Symphyotrichum lateriflorum*), and marsh violet (*Viola cucullata*). More mesic areas support goldthread (*Coptis trifolia*), Canada mayflower (*Maianthemum canadense*), Indian cucumber-root (*Medeola virginiana*), starflower (*Trientalis borealis*), wild sarsaparilla (*Aralia nudicaulis*), downy Solomon's-seal (*Polygonatum pubescens*), dwarf ginseng (*Panax trifolius*), tall white lettuce (*Prenanthes altissima*), wood anemone (*Anemone quinquefolia*), and swamp dewberry (*Rubus hispidus*).

Non-native species are rare and were primarily observed along stream margins near recently harvested forests. Species include ground-ivy (*Glechoma hederacea*) and yellow rocket (*Barbarea vulgaris*). Autumn-olive (*Elaeagnus umbellata*) is uncommon but occurs sporadically throughout the site.

One hundred twenty-four plant species were documented at Marion Springs Swamp, including 121 native species and 3 non-native species (Appendix 3). The total FQI was 51.2, the native FQI was 52.8, and the native Mean C was 4.8.



A seasonally flooded depression within Marion Springs wet-mesic flatwoods functions as a vernal pool. Variation in microtopography and soil moisture creates a diversity of microsites that support a rich native flora, with 124 plant species documented across the site. Photo by J.M. Lincoln.

Threats and Management Recommendations

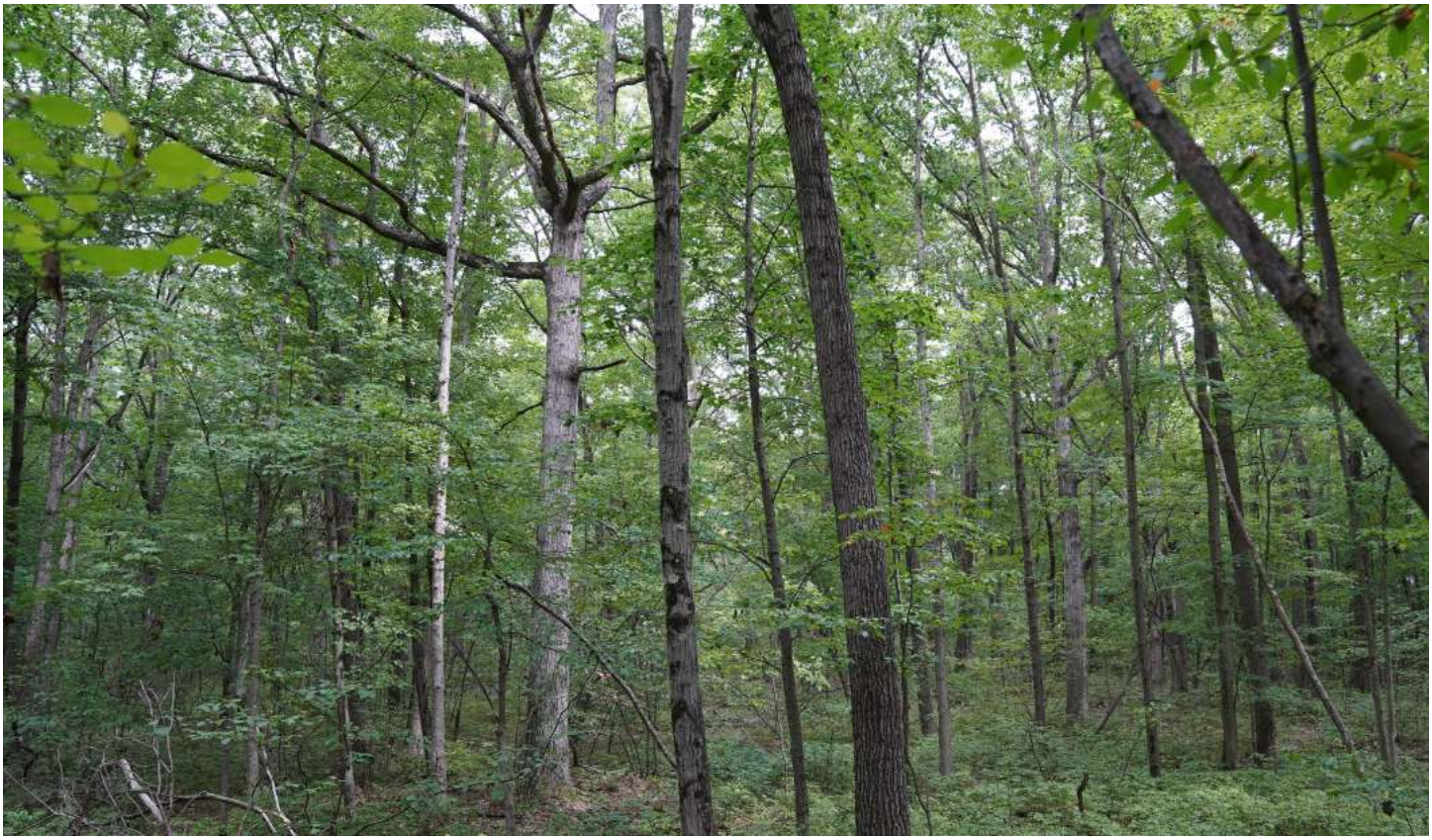
Our primary recommendation is to limit further fragmentation and maintain landscape connectivity by allowing the stands that comprise Marion Springs Swamp and adjacent stands to mature. Protecting wetland hydrology and the adjacent upland forest cover is important for maintaining the population of the State Threatened sedge (*Cx. seorsa*). Additionally, we suggest promoting connectivity between the separate polygons and minimizing fragmentation by retaining forested buffers between the polygons and timber harvest operations. Although no ditches occur within the occurrence, nearby drainage features may have locally lowered the water table or altered seasonal inundation. Where feasible, we recommend evaluating opportunities to remove unnecessary roads and disable or fill ditches.



Invasive plants are currently infrequent within the polygons but prevalent along roads and ditches elsewhere in the game area, creating pathways for spread into higher-quality wetlands. We recommend treating invasive plants within the swamp and along nearby roads and ditches. Deer herbivory was observed on numerous plants and is limiting regeneration of several species.

Burn boundaries should follow existing landscape features, avoiding new fire lines along the upland-wetland ecotone. Under appropriate conditions, fire should be allowed to enter the flatwoods and extinguish naturally in saturated areas. Equipment use within the flatwoods should be avoided. Red maple should be retained in the swamp, with mesophication treatments limited to adjacent fire-dependent areas where it is reducing characteristic structure and composition.

Stand 73 occurs on a sandy ridge with mature oak forest adjacent to Marion Springs Swamp



Mature white oak forest in Stand 73 on a sandy ridge adjacent to Marion Springs Swamp. Abundant huckleberry and large, charred white pine stumps reflect the site's history as a fire-dependent woodland. This stand [redacted] is a priority site for carefully implemented prescribed fire and long-term monitoring. Photo by J.M. Lincoln.

3. Meridian Swamp
Natural Community Type: Wet-Mesic Flatwoods
Rank: G2G3 S2, Imperiled to vulnerable globally and imperiled within the state
Element Occurrence Rank: C
Size: 301.2 acres
Location: Compartment 4; Stands 29, 40, 47, 53, 57, 67, 80, and 89
Element Occurrence Identification Number: 27360

Meridian Swamp is the largest documented wet-mesic flatwoods occurrence in Michigan, encompassing 301.2 acres across two polygons. The forest occurs on a poorly drained basin interspersed with low sandy ridges. Subtle differences in elevation, soil texture, and seasonal inundation create frequent transitions among swamp and upland forest. The highest-quality portions retain mature forest structure, scattered large and old trees, abundant coarse woody debris, and tip-up mounds. Past logging and thinning have altered portions of the occurrence, while fire suppression has contributed to increasing red maple (*Acer rubrum*) and reduced oak and pine regeneration on elevated ground. A few ditches cross the western polygon, and nearby drainage ditches may have locally lowered water levels, but numerous vernal pools persist and internal hydrology remains relatively intact.

A soil sample collected from a sparsely vegetated depression with evidence of prolonged spring inundation contained approximately 1 inch of leaf litter over 3 inches of decomposing organic material and rotten wood with dense roots. This surface layer graded into sands mixed with organic material to a depth of approximately 4 inches (pH 5.5–6.0). Fine sand and sandy loam occurred from approximately 4 to 6 inches (pH 6.0), with tan sand and sandy loam below 6 inches (pH 6.0–6.5).

The canopy varies in age and structure, with much of the forest approximately 100 to 130 years old and scattered remnant trees likely exceeding 200 years. Swamp white oak (*Quercus bicolor*) dominates wetter areas, with pin oak (*Q. palustris*), red maple (*Acer rubrum*), and black gum (*Nyssa sylvatica*) common

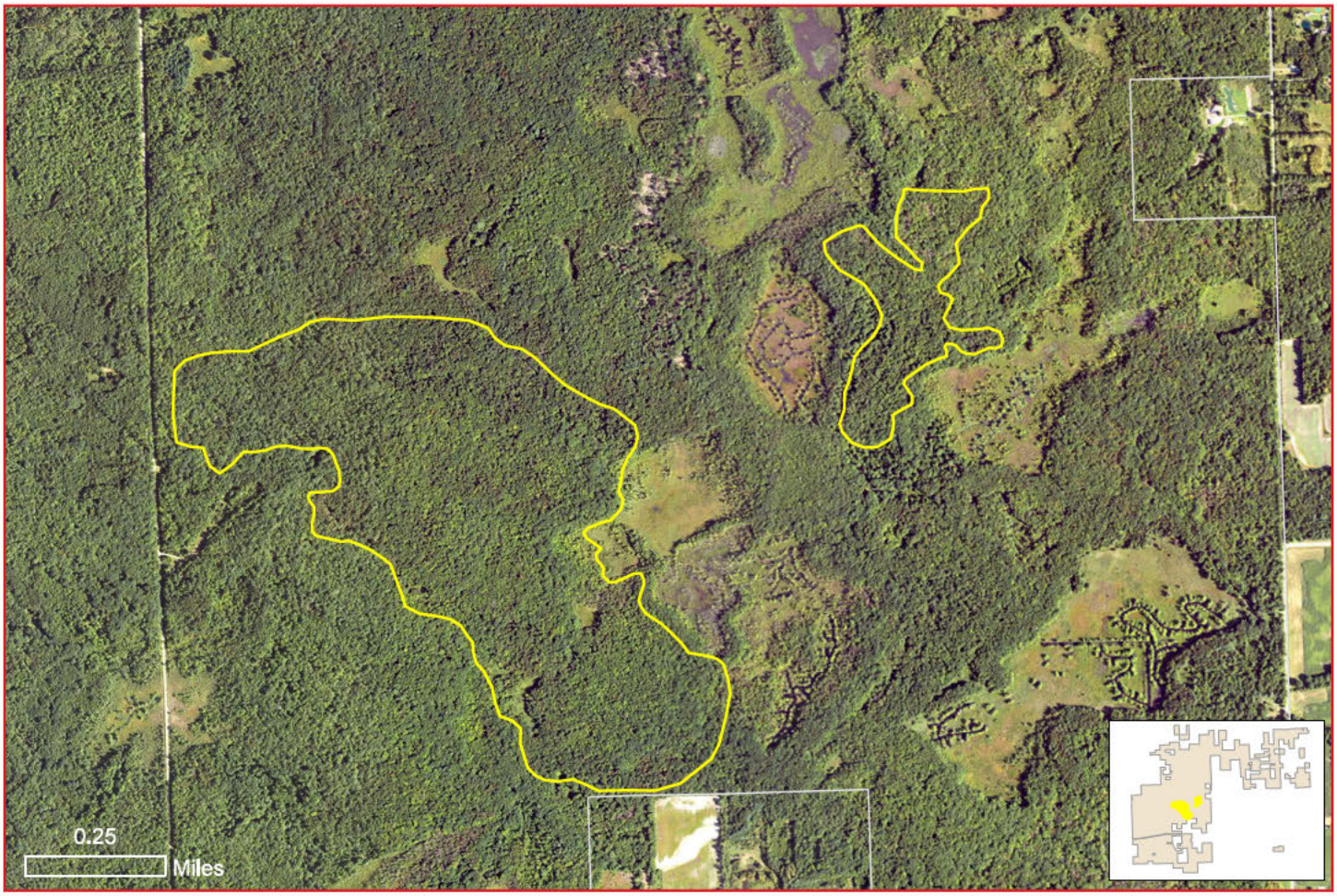
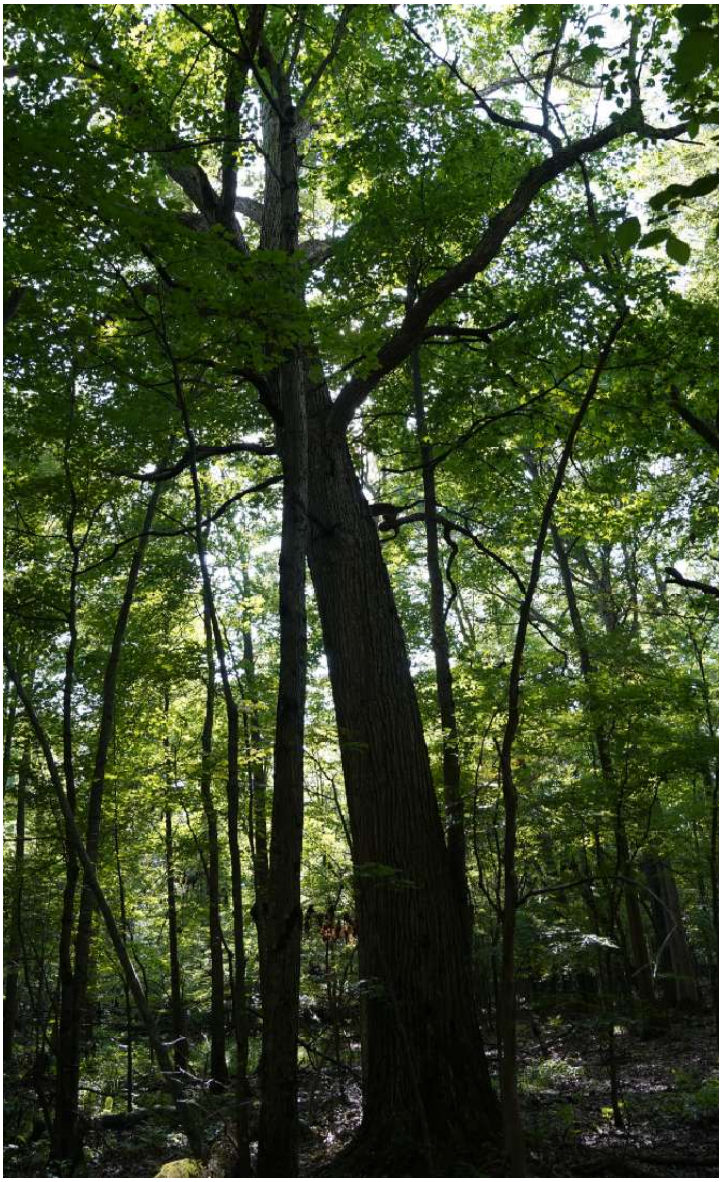


Figure 18. Location of Meridian Swamp wet-mesic flatwoods within Compartment 4 of Gratiot-Saginaw State Game Area (Element Occurrence 27360).

to codominant. Narrow sandy dune ridges and other elevated inclusions support large, mature white oak (*Q. alba*) and red oak (*Q. rubra*), generally 120 to 140 years old and 24 to 36 inches dbh. Portions of the swamp and upland inclusions were thinned approximately 40 years ago but retain characteristic canopy species and some mature trees. Large white pine (*Pinus strobus*) stumps occur throughout, indicating the removal of a formerly important canopy component. Emerald ash borer (*Agrilus planipennis*) has eliminated much of the former ash component, and spongy moth (*Lymantria dispar*) caused severe damage and localized oak mortality that was observed in 2021.

Pin oak, red maple, and musclewood (*Carpinus caroliniana*) are common in the subcanopy and locally form a dense understory. American elm (*Ulmus americana*), black gum, black ash (*Fraxinus nigra*), and green ash (*F. pennsylvanica*) are less common, and yellow birch (*Betula alleghaniensis*) is infrequent. On sandy ridges, the subcanopy includes sassafras (*Sassafras albidum*), black cherry (*Prunus serotina*), juneberry (*Amelanchier arborea*), red maple, and younger oaks. The shrub layer is generally patchy but locally dense. Michigan holly (*Ilex verticillata*) and buttonbush (*Cephalanthus occidentalis*) are common in the wettest areas. Juneberry, witch-hazel (*Hamamelis virginiana*), swamp rose (*Rosa palustris*), dwarf raspberry (*Rubus pubescens*), and swamp dewberry (*R. hispidus*) occur locally. Huckleberry (*Gaylussacia baccata*) occurs throughout the swamp and is locally dominant in drier areas with low sweet blueberry (*Vaccinium angustifolium*), witch-hazel, and wintergreen (*Gaultheria procumbens*).





A swamp white oak measuring over 1 m in diameter (left) is likely over 200 years old, although internal decay prevented age determination. A white pine stump (right) persists from logging in the late 1800s. Despite repeated logging and other natural and anthropogenic disturbances, the forest retains zones of large-diameter trees and very high native plant diversity, making it an important conservation asset. Photos by J.M. Lincoln.



An exceptionally large southern pin oak measuring approximately 1 m diameter in Meridian Swamp. Portions of the wet-mesic flatwoods exhibit old-growth characteristics, including large canopy trees and complex forest structure, while other areas support younger forests reflecting more recent timber harvests. Mature forests such as these were once widespread across the region but are now largely restricted to scattered remnants, many of which persist on public lands. Photo by J.M. Lincoln

The herbaceous layer is diverse and coverage varies considerably with water depth, microtopography, fine-scale gradients in soil texture and soil moisture with some areas of prolonged inundation having almost no vegetation and other areas being extremely dense. Ferns, especially cinnamon fern (*Osmundastrum cinnamomeum*) and sensitive fern (*Onoclea sensibilis*), are locally dominant. Other common ferns include marsh fern (*Thelypteris palustris*), royal fern (*Osmunda regalis*), and New York fern (*Amauropelta noveboracensis*). Sedges are locally dominant, particularly *Carex stricta* and *Cx. radiata, Cx. crinita*, *Cx. intumescens*, *Cx. lupulina*, and *Cx. alopecoidea*. Grasses, such as fowl manna grass (*Glyceria striata*), white grass (*Leersia virginica*), and blue-joint (*Calamagrostis canadensis*) occur in seasonally inundated openings and wet flats. Characteristic forbs include false nettle (*Boehmeria cylindrica*), northern bugle weed (*Lycopus uniflorus*), mad-dog skullcap (*Scutellaria lateriflora*), swamp goldenrod (*Solidago patula*), marsh violet (*Viola cucullata*), wild yam (*Dioscorea villosa*), Solomon-seal (*Polygonatum biflorum*), and partridge-berry (*Mitchella repens*).

The herbaceous layer of the sandy ridges is patchy and often sparse, with Pennsylvania sedge (*Carex pensylvanica*), bracken fern (*Pteridium aquilinum*), and poverty grass (*Danthonia spicata*) the most prevalent species. Other associated species include downy Solomon seal (*Polygonatum pubescens*), big-leaved aster (*Eurybia macrophylla*), wood anemone (*Anemone quinquefolia*), hog-peanut (*Amphicarpaea bracteata*), gaywings (*Polygala paucifolia*), starflower (*Lysimachia borealis*), downy rattlesnake plantain (*Goodyera pubescens*), fragrant bedstraw (*Galium triflorum*), autumn bent (*Agrostis perennans*), Canada mayflower (*Maianthemum canadense*), and panic grass (*Dichanthelium dichotomum*). Eighty-six plant species were documented at Meridian Swamp, all of which were native (Appendix 3). The total and native FQI were both 40.8, and the native Mean C was 4.4.



Threats and Management Recommendations

Our primary recommendation is to limit further fragmentation and maintain landscape connectivity by allowing Meridian Swamp and adjacent stands to mature. Maintaining forest cover between the two polygons and retaining forested buffers along timber harvest operations would strengthen connectivity. Mature and old trees, vernal pools, and natural community transitions should be protected from additional logging, road construction, and soil disturbance. Ditches cross portions of the western polygon, and nearby drainage may have locally lowered water levels or altered seasonal inundation. Opportunities to close unnecessary roads and disable or fill ditches warrant evaluation, particularly in the southern portion of the western polygon, following assessment of potential effects on the connected wetland complex.

No invasive plants were recorded within the occurrence, but common reed (Phragmites australis subsp. australis), glossy buckthorn (Frangula alnus), reed canary grass (Phalaris arundinacea), and coltsfoot (Tussilago farfara) occur along nearby roads, ditches, and disturbed areas. Invasive species management should prioritize these infestations and monitoring



Seasonal inundation is a defining characteristic of intact wet-mesic flatwoods and contributes to their distinctive vegetation composition and structure (top). Ditches within portions of Meridian Swamp (bottom) have altered natural hydrology, affecting the frequency, duration, and extent of flooding and potentially shifting forest composition and structure. Opportunities to restore natural hydrology by disabling or filling existing ditches should be investigated. Photo by J.M. Lincoln

of the swamp's margins for new occurrences. White-tailed deer (Odocoileus virginianus) browse limits woody regeneration, especially white oak and white pine, while emerald ash borer (Agrilus planipennis) and spongy moth (Lymantria dispar) affect canopy composition. The near absence of white oak regeneration raises concern about its persistence in the canopy and underscores the need to reduce browsing pressure and monitor seedling survival and recruitment.

We recommend repeated low-severity prescribed fire on sandy ridges and other fire-dependent upland inclusions to improve conditions for oak and pine recruitment, while retaining mature and old oaks and pines as seed sources and biological legacies. Meridian Swamp, adjacent Mason Meadow, and intervening uplands offer an opportunity for management as a connected complex. The oak-dominated ridge northwest of the meadow supports white oak and huckleberry, and charred stumps indicate past fire. During droughts, fire may have spread from these uplands into the swamp and meadow, producing patchy burns where saturated soils and deeper depressions interrupted its spread. This combination of open wetland, saturated soils, and adjacent uplands may historically have supported eastern massasauga (Sistrurus catenatus; Federal and State Threatened), now presumed extirpated from the game area. Periodic fire may have maintained open basking sites along these transitions.

Burn-unit boundaries should follow existing roads, trails, and other suitable landscape features wherever feasible, incorporating upland ridges, portions of Meridian Swamp, and Mason Meadow within connected units. New fire lines along upland-wetland ecotones should be avoided. Burns should occur while organic soils remain moist, allowing patchy fire to enter the flatwoods and meadow, extinguish naturally in saturated areas, and retain unburned refugia. Equipment use within the high-quality wetlands should be avoided.



An upland ridge dominated by mature white oak and black oak within Meridian Swamp. These fire-adapted forests would benefit from low-severity prescribed burns at intervals of approximately 5–10 years to reduce mesophytic competition and promote oak regeneration. Fires should be allowed to spread into adjacent wetlands and extinguish naturally in saturated areas, maintaining the ecological connections between upland and wetland communities. Photo by J.M. Lincoln

Rare Plants

Rare plants were opportunistically documented during natural community surveys. Three EOs representing three species are included in the game area records: three-awned grass (*Aristida longespica*; EO 4424), sedge (*Carex seorsa*; EO 28289), and whorled pogonia (*Isotria verticillata*; EO 8881) (Table 3). During the project, the sedge EO was newly documented in Marion Springs Swamp and the whorled pogonia EO was updated. The three-awned grass occurrence is a prior record last observed in 1988.



Seasonally inundated depressions within Marion Springs Swamp provide habitat for the state-threatened sedge, *Carex seorsa*. Protecting wetland hydrology and the surrounding forest is important for maintaining this population. Photo by J.M. Lincoln

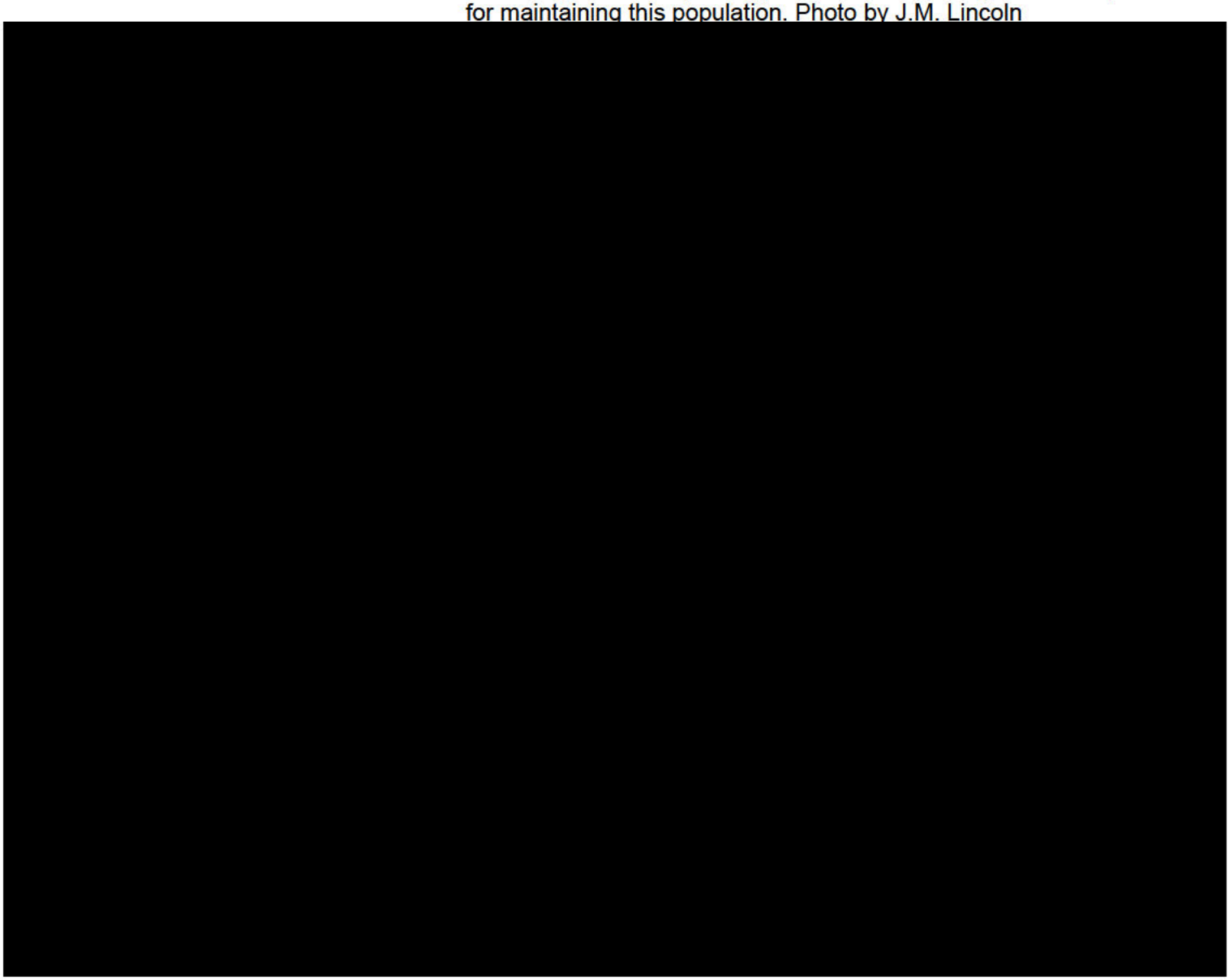


Figure 19. Location of rare plants documented within Gratiot-Saginaw State Game Area.

Rare Birds

Red-shouldered hawks were detected at a single point in Stand 31 of Compartment 8, and we recorded two active red-shouldered hawk nests (EOID 28453). We conducted forest songbird surveys at 61 points and recorded 12 singing male wood thrush at seven survey points spread across the SGA (Figure 20). These wood thrush observations are new element occurrences (EOID 28471, EOID 28472, EOID 28480) (Figure 20). A previously documented bald eagle nest in Compartment 6 was confirmed to be active (EOID 21583). Records for all rare birds were added or updated in the Natural Heritage Database.

We recorded a total of 49 bird species during point counts at the Gratiot-Saginaw State Game Area (Appendix 4). The 10 most detected species were: eastern wood-pewee (*Contopus virens*; 95%), red-eyed vireo (*Vireo olivaceus*; 94%), tufted titmouse (*Baeolophus bicolor*; 71%), brown-headed cowbird (*Molothrus ater*; 68%), scarlet tanager (*Piranga olivacea*; 68%), American crow (*Corvus brachyrhynchos*; 63%), white-breasted nuthatch (*Sitta carolinensis*; 63%), American robin (*Turdus migratorius*; 60%), blue jay (*Cyanocitta cristata*; 56%), and ovenbird (*Seiurus aurocapilla*; 52%).

The following 13 species were regularly observed (20–49% of points surveyed): great crested flycatcher (*Myiarchus crinitus*; 48%), red-bellied woodpecker (*Melanerpes carolinus*; 44%), yellow-billed cuckoo (*Coccyzus americanus*; 39%), downy woodpecker (*Dryobates pubescens*; 37%), black-capped chickadee (*Poecile atricapillus*; 35%), rose-breasted grosbeak (*Pheucticus ludovicianus*; 34%), veery (Catharus fuscescens; 32%), Acadian flycatcher (*Empidonax virescens*; 29%), chipping sparrow (*Spizella passerina*; 26%), mourning dove (*Zenaida macroura*; 26%), common grackle (*Quiscalus quiscula*; 23%), cedar waxwing (*Bombycilla cedrorum*; 21%), and yellow-throated vireo (*Vireo flavifrons*; 21%).



Rare bird surveys identified a previously undocumented red-shouldered hawk element occurrence within Gratiot-Saginaw State Game Area. This species nests in mature forests and forages in nearby wetlands, highlighting the value of large, contiguous forest and wetland complexes. Photo by A.P. Kortenhoven.

Two of the species detected, pileated woodpecker and wood thrush, are MDNR featured species for habitat management. Red-shouldered hawk and wood thrush are also species of greatest conservation need (SGCN; Derosier et al. 2015; Henehan et al. 2026) and are focal species for conservation efforts under the Landbird Habitat Conservation Strategy of the Upper Mississippi River and Great Lakes Region Joint Venture (Potter et al. 2007).



A wood thrush. Photo by Anneke Anglin.

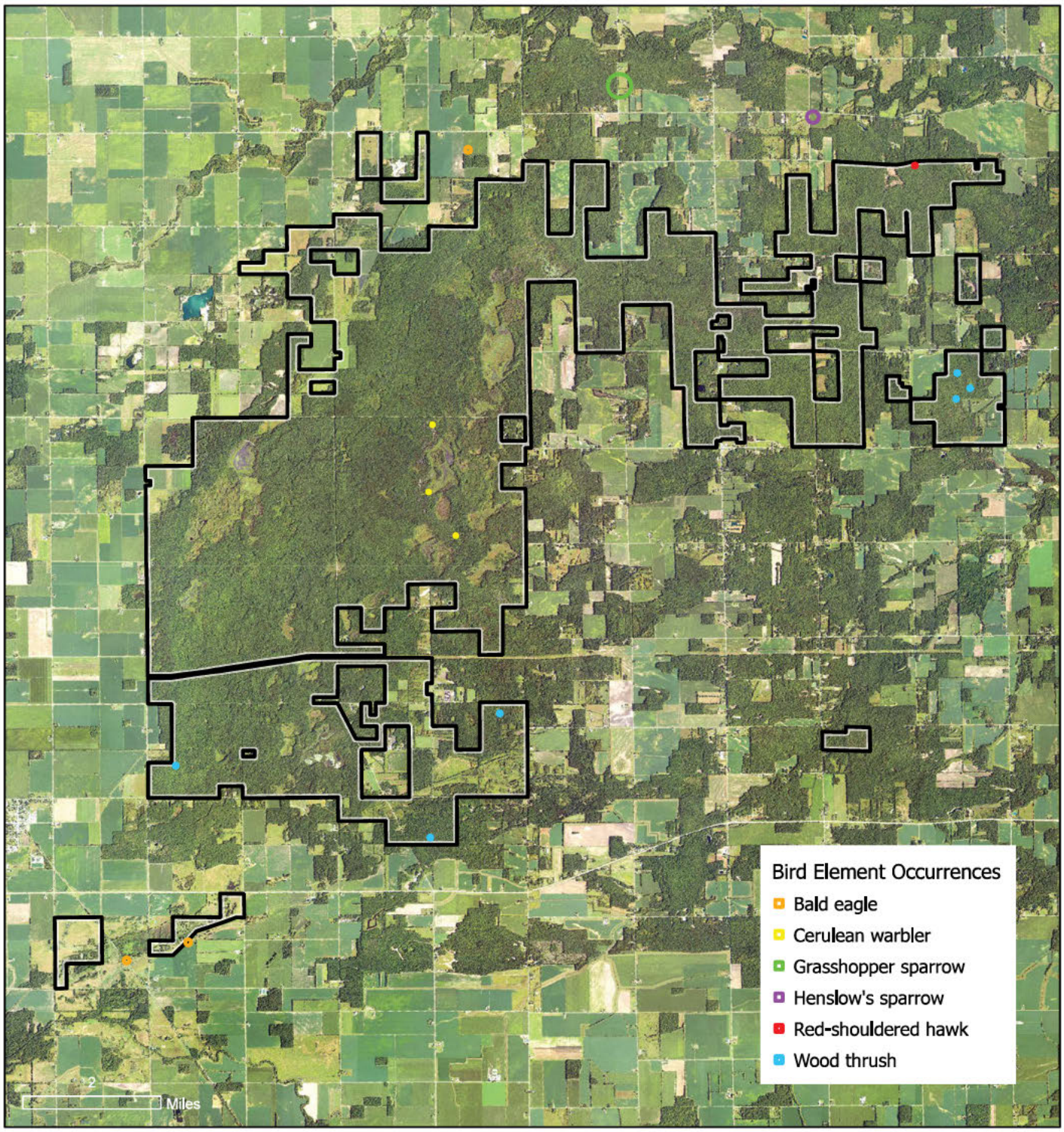


Figure 20. Location of rare birds documented within and nearby Gratiot-Saginaw State Game Area. Henslow's sparrow and grasshopper sparrow have been documented near the game area, but not within it.

Rare Insects

We documented a total of 115 occurrences of 8 bumble bee species during the 2 hr survey, including new documentation of black and gold bumble bee (*Bombus auricomus)* (State Special Concern, EOID 24528) and yellow bumble bee (*B. fervidus*) (State Special Concern, EOID 24529) at Gratiot-Saginaw SGA (Figure 21). We encountered a total of 12 blooming flower species during the survey (Table 6). However, bumble bees at the survey site were primarily utilizing a single species, *M. fistulosa*.

We did not capture any royal fern borers (*Papaipema speciosissima*) during these surveys. However, the site had abundant host plant resources.



Bumble bee survey habitat at Gratiot-Saginaw State Game Area on July 20th, 2021. New records for both *B. auricomus* and *B. fervidus* were recorded during standardized meander surveys. Photo by L.M. Rowe.

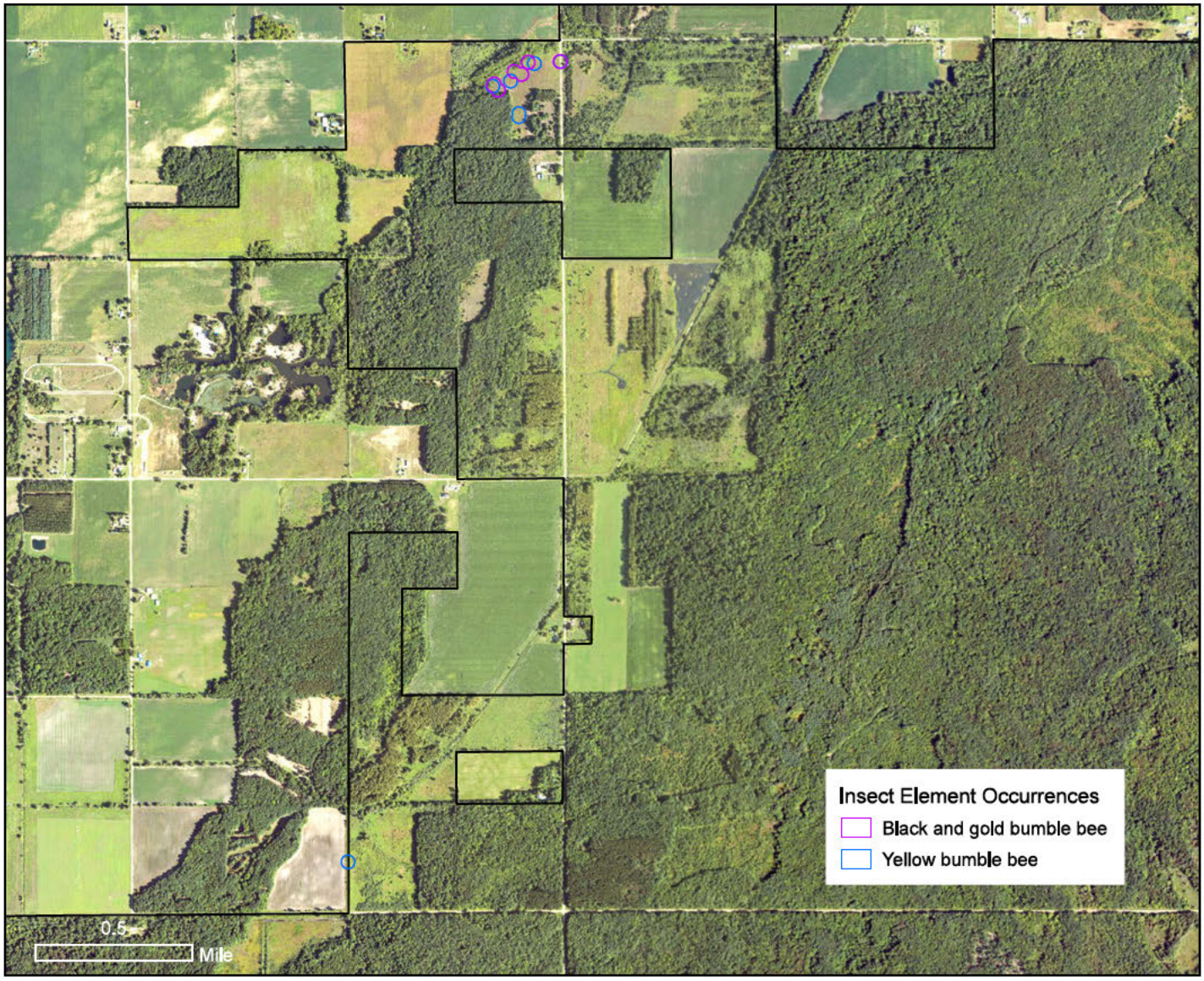


Figure 21. Location of rare insects documented within Gratiot-Saginaw State Game Area (Compartment 1).

Table 6. Bumble bee visits to flowering plants observed during surveys of an open field at Gratiot-Saginaw State Game Area. Values indicate the number of observed visits by each bumble bee species to each plant taxon.

Species	*Centaurea stoebe*	*Daucus carota*	*Monarda fistulosa*	*Ratibida pinnata*	*Trifolium sp.*	**Total**
Bombus auricomus	0	0	14	0	0	14
Bombus bimaculatus	0	1	46	1	1	49
Bombus borealis	0	0	1	0	0	1
Bombus citrinus	1	0	0	0	0	1
Bombus fervidus	0	0	20	0	0	20
Bombus griseocollis	1	0	16	0	0	17
Bombus impatiens	0	0	11	0	0	11
Bombus vagans	0	0	2	0	0	2
Total	2	1	110	1	1	115



A black and gold bumble bee foraging on wild bergamot at Gratiot-Saginaw State Game Area. Photo by L.M. Rowe.

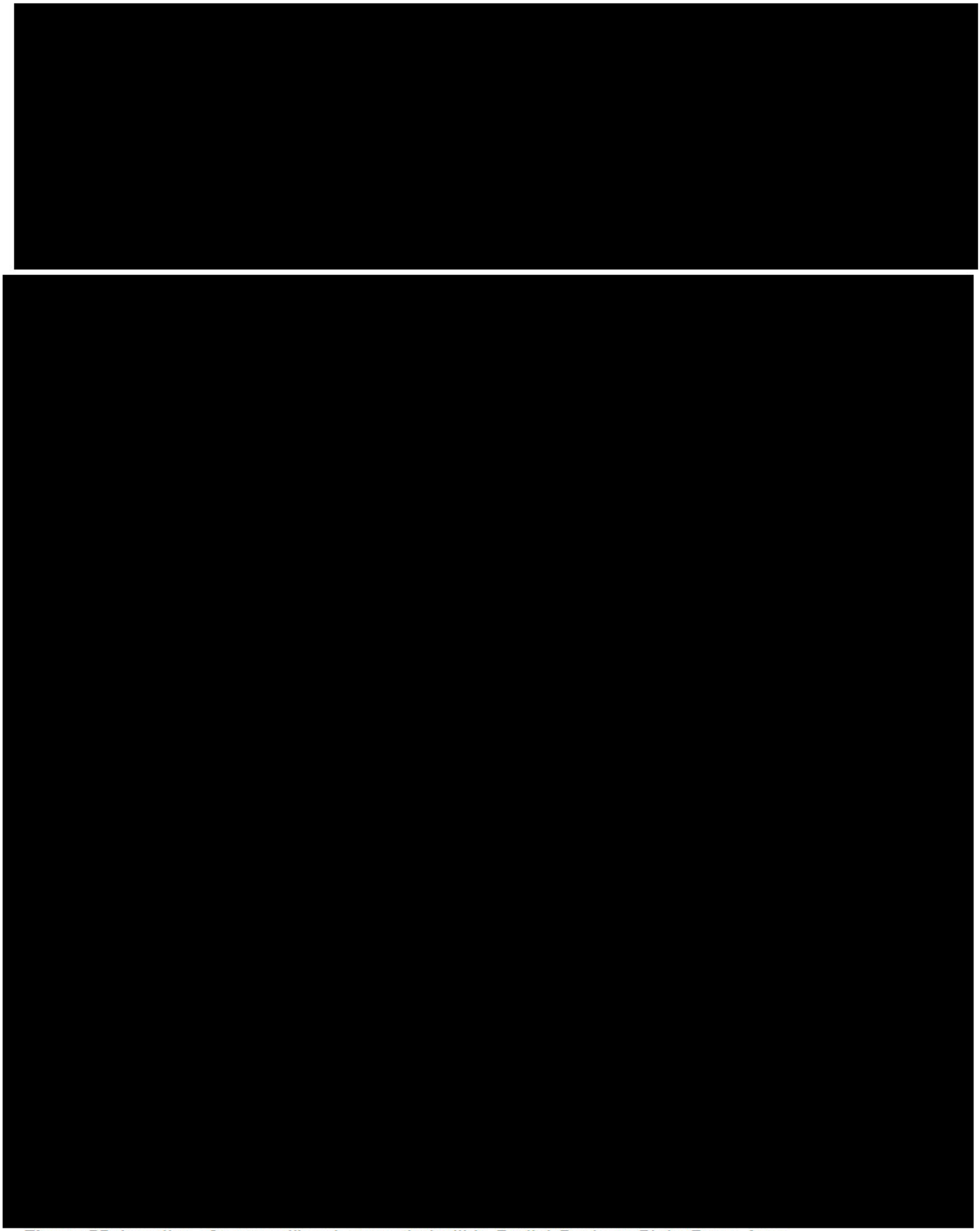


Figure 22. Location of rare reptiles documented within Gratiot-Saginaw State Game Area.

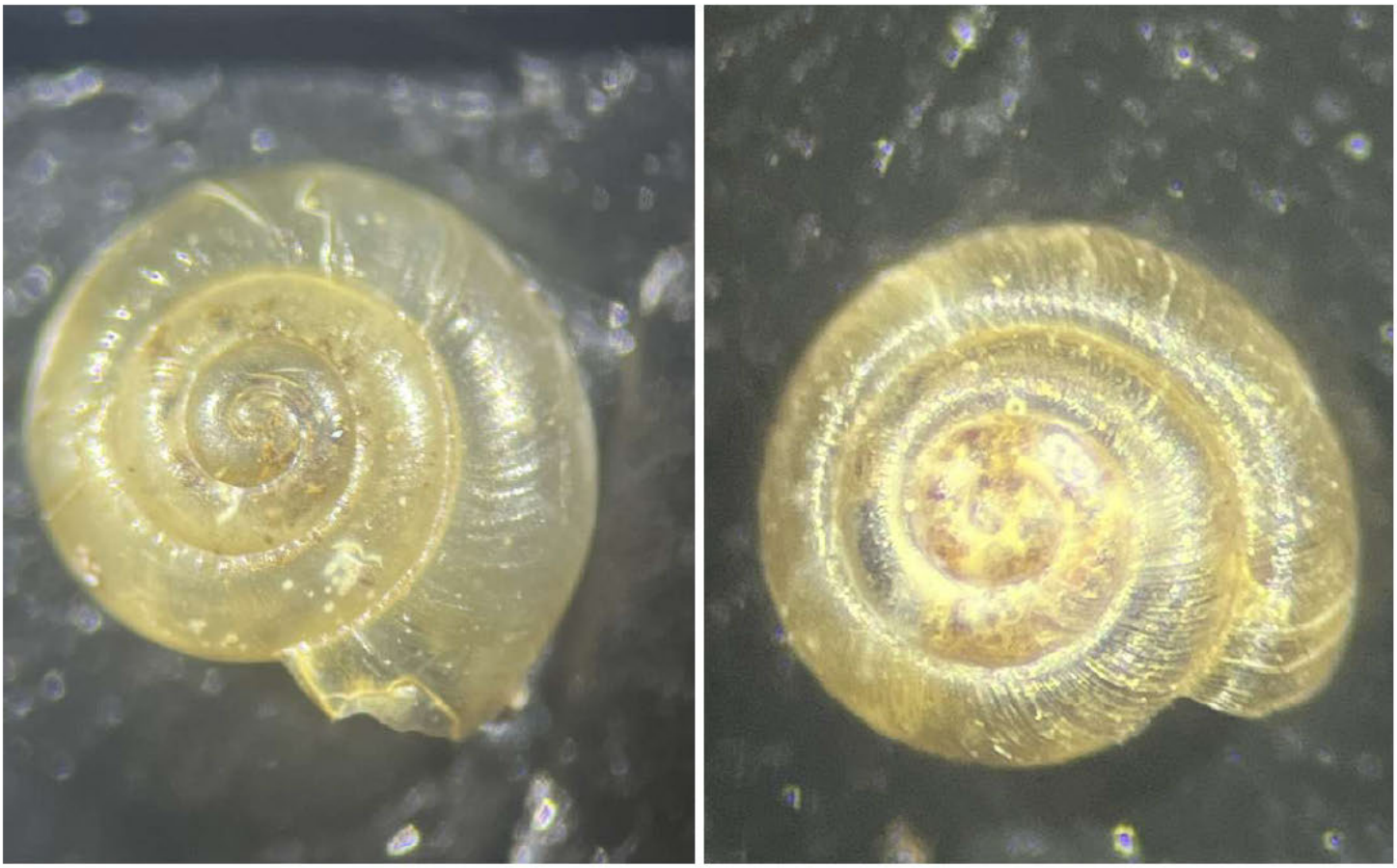
snapping turtle (*Chelydra serpentina*), and two unidentified snakes of the genus *Thamnophis*. Aquatic trapping surveys recorded twelve eastern snapping turtles and twenty painted turtles (*Chrysemys picta*). No other state-listed herpetofauna were documented during visual encounter or aquatic trapping surveys. Spotted turtles were not detected despite the presence of potentially suitable shallow wetland habitat and a previously documented occurrence within the game area. We did not conduct surveys during the optimal survey window for spotted turtle and this may have resulted in the lack of reconfirmation of this element occurrence (USFWS 2025). No eastern massasaugas were detected. No rare amphibians were detected during surveys.

Land Snails

Unusually dry conditions during the spring of 2021 pushed surveys into the summer to get more humid conditions. Surveys took place in late June, mid-July, and early August. A total of six gastropod species were identified (Table 7). Small spot (*Punctum minutissimum*) was the most common and abundant land snail found. Though none of the species found are listed as threatened or endangered or are species of special concern, the documentation of this survey effort and species found is valuable considering the very low level of survey effort given for land snails statewide in recent decades. Photographs representing each species found are provided to document these difficult to identify taxa (Appendix 2).

Table 7. Land snail species found in leaf litter samples collected from each survey site.

Species	Common Name	1	2	3	4	5	6	7	8	9	10	11	12
Gastrocopta pentodon	Comb snaggletooth						1			5			6
Mesodon thyroidus	White-lip globe		1										
Punctum minutissimum	Minute gem			3	2	5		3	4	22		3	2
Striatura ferrea	Black striate										1		
Striatura milium	Fine-ribbed striate	1						1	2	2			10
Zonitoides arboreus	Quick gloss						1						



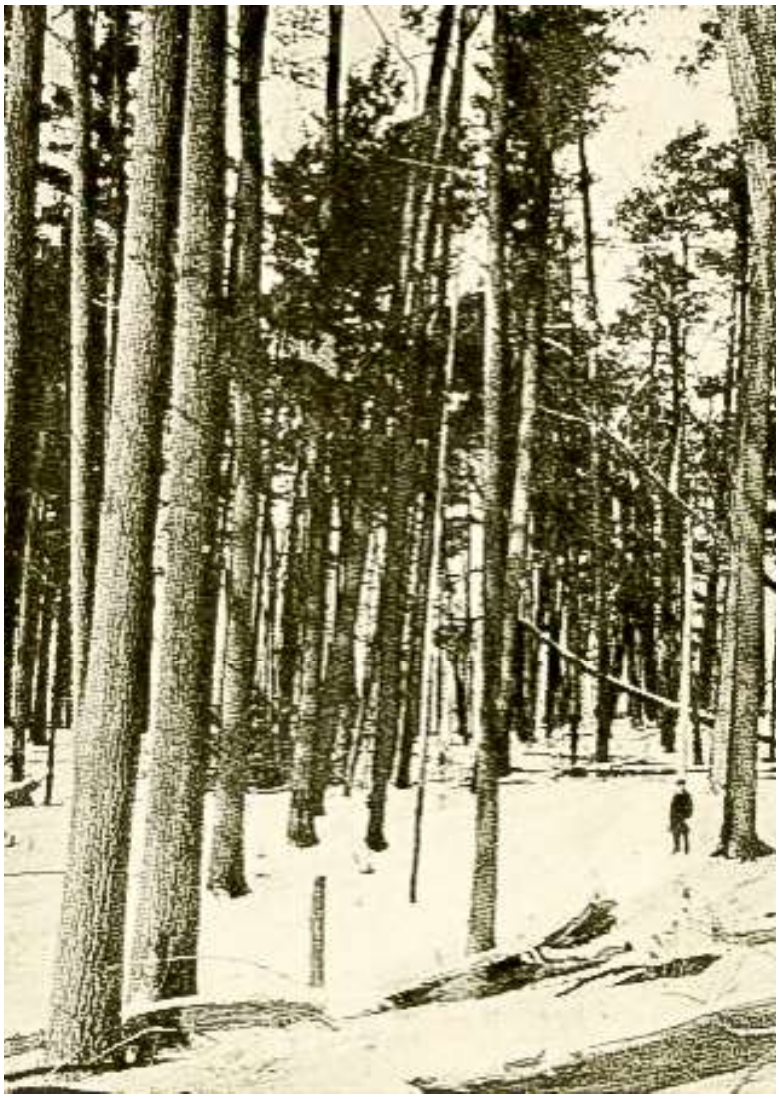
Quick gloss (left) and fine-ribbed striate (right). These diminutive land snails inhabit the leaf litter and decaying wood of forests, where they contribute to decomposition and nutrient cycling by feeding on fungi, microorganisms, and decaying organic matter. Their calcium-rich shells also provide an important source of nutrients for other wildlife. Photos by P.J. Badra.

DISCUSSION

Gratiot-Saginaw State Game Area (SGA) was established in 1939 to protect wildlife habitat and provide hunting opportunities (Michigan DNR 1990). This is now the second largest game area in the state and carries a conservation significance that extends beyond its founding purpose. Investments in wildlife habitat have helped retain thousands of acres of wetlands and forests within a landscape otherwise dominated by intensive agriculture. Game areas support game species and hunting traditions alongside rare plants and animals, diverse natural communities, and opportunities for fishing, hiking, birdwatching, and foraging. Stewardship of this public investment requires attention to the full range of native biodiversity and the ecological processes that sustain it. Evaluating natural communities and rare species helps identify where important conservation opportunities persist and shape how management can protect them for future generations.

Prioritizing stewardship of representative natural communities is critical to conserving native biodiversity and the ecological processes that sustain it. High-quality natural communities retain native species assemblages, structural features, and ecological relationships that may be diminished or absent from more altered habitats. Their conservation value extends beyond the presence of documented rare species (Noss et al. 2022). Stewardship within the game area should prioritize high-quality examples of both rare and regionally characteristic natural community types, with consideration of their size, condition, landscape context, and vulnerability to threats. Adjacent areas of natural cover with strong recovery potential would ideally be included to buffer, expand, and connect these sites. Protection of rare plant and animal populations complements this community-based approach and remains a priority wherever those populations occur. Together, these approaches conserve the broader matrix of native biodiversity while addressing the particular needs of vulnerable species (Cohen et al. 2015; Noss et al. 2022).

To that end, we provide the following management recommendations for your consideration: 1) establish priority conservation areas around high-quality natural communities, populations of rare taxa, mature forests, and adjoining habitats with strong recovery potential, while minimizing fragmentation and maintaining connections among these areas; 2) protect wetland hydrology and evaluate opportunities to restore hydrologic continuity where drainage and excavation have altered natural conditions; 3) control invasive species within and adjacent to conservation priority areas, emphasizing protection of relatively intact habitats and prevention of further spread; 4) restore fire as an ecological process within fire-dependent uplands and adjoining flatwoods and wetlands, with stewardship tailored to site conditions and sensitive species; and 5) monitor rare taxa and ecological responses to stewardship, assess the effects of deer herbivory, and address remaining survey needs.



Mature white pine forest in Gratiot County during the late 1800s lumbering era, when most of the county's merchantable pine was cut. In 1897, a local newspaper described timber being harvested south of Edgewood in Hamilton Township as the county's "last green pine timber." Although the landscape has changed substantially since this photograph was taken, opportunities remain to protect surviving natural communities and restore the ecological processes that sustained these forests. Photograph reproduced from Tucker (1913, p. 62).

These recommendations emphasize protecting the game area's best remaining habitats and coordinating hydrologic restoration, invasive species control, and prescribed fire to sustain and expand their ecological value. The following discussion is organized around these five priorities. Although their order reflects overall conservation importance, the sequence of stewardship actions will depend on site conditions, threats, and opportunities for implementation.

Establishing Priority Conservation Areas

We have identified 4,920 acres – 28.8% of Gratiot-Saginaw State Game Area – for consideration as Priority Conservation Areas (PCAs), where protecting native biodiversity and sustaining ecological processes should guide management (Figure 23). These areas include documented high-quality natural communities with a 150 ft buffer, large blocks of unfragmented forest, mature forests that have not been tilled or cleared, connections between high-quality sites, and wetlands that sustain hydrologic and ecological functions. Within PCAs, we recommend excluding clearcutting and avoiding activities that fragment habitats, damage soils, disrupt hydrology, or otherwise diminish ecological integrity. Stewardship would ideally focus on controlling invasive species, repairing altered hydrology, and applying prescribed fire where ecologically appropriate.

Natural community inventory provides a coarse-filter approach to biodiversity conservation, while rare-species surveys provide complementary fine-filter information (Noss 1987; Jenkins et al. 2021). Protecting high-quality communities before they degrade is a fundamental conservation priority because restoration may not fully recover lost biodiversity, structure, and ecological function (Gann et al. 2026). Plantings and other habitat enhancements can provide useful wildlife resources but cannot substitute for protecting remnant communities. Conservation priorities should therefore emphasize retaining existing ecological integrity while addressing species-specific needs throughout the game area.



Stand 5 in Compartment 7 supports mature canopy trees and especially diverse native vegetation despite a history of selective thinning. Although the stand did not meet the criteria for recognition as a high-quality natural community, it retains considerable conservation value. We recommend avoiding additional canopy thinning and incorporating this stand into a broader conservation strategy that protects mature, species-rich forests and maintains connectivity between high-quality natural communities. Photo by J.M. Lincoln

Maintaining large, continuous blocks of mature forest is particularly important within the agricultural landscape surrounding Gratiot-Saginaw SGA. Surveys documented 49 bird species using the game area's forests, including wood thrush and red-shouldered hawks. Wet-mesic flatwoods and southern hardwood swamp provide nesting habitat for forest songbirds, while mature forests and adjoining wetlands support nesting and foraging habitat for red-shouldered hawks. Fragmentation reduces forest-interior habitat and can increase nest predation and brood parasitism, reducing reproductive success even where birds remain present (Robinson et al. 1995; Donovan et al. 1995). Brown-headed cowbirds were recorded at 68% of point-count stations, underscoring the likelihood of brood parasitism as a potential pressure on forest songbirds. Cerulean warbler was documented in 2003 but has not been

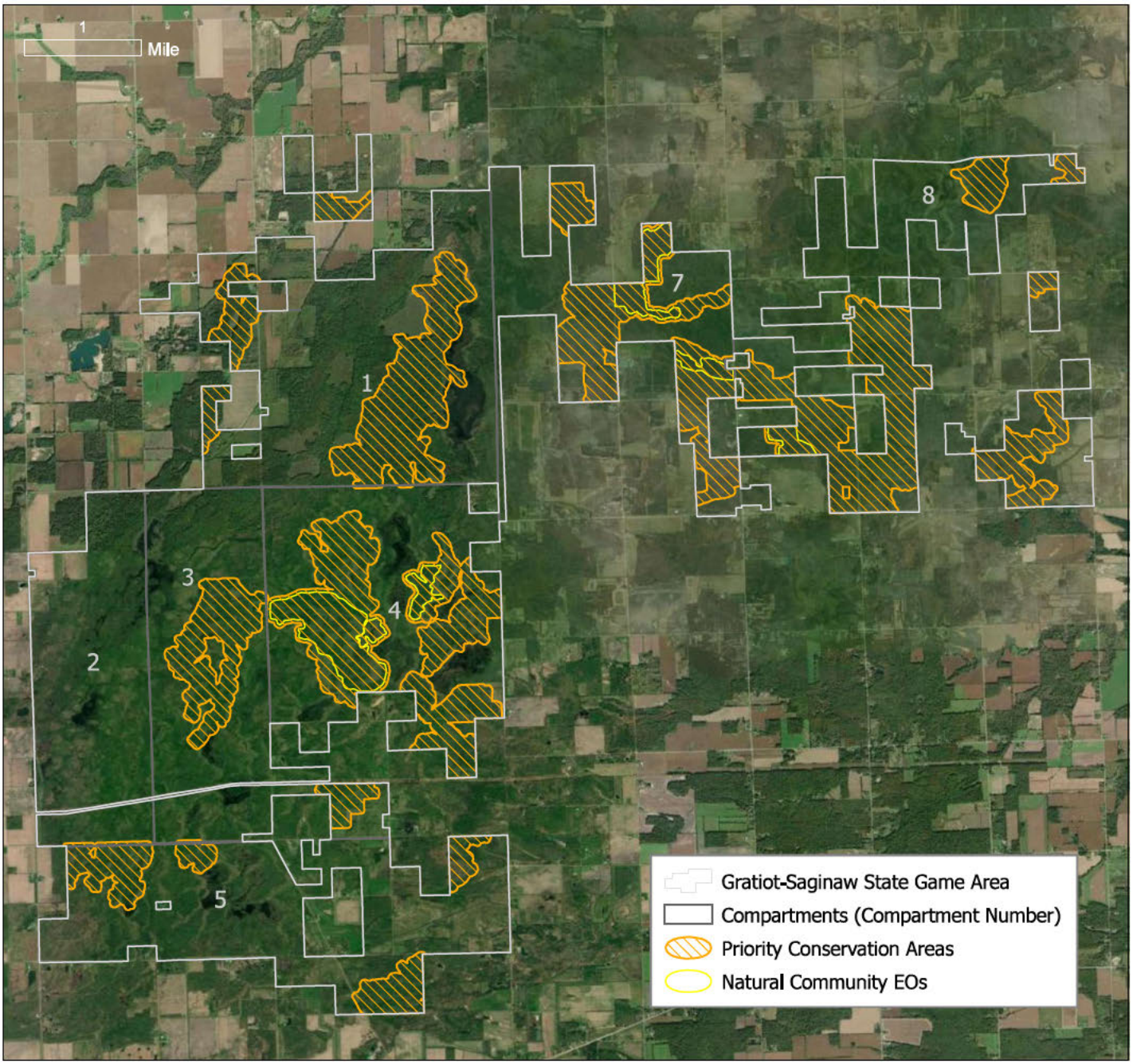


Figure 23. Proposed Priority Conservation Areas for Gratiot-Saginaw State Game Area. To protect high-quality natural communities, maintain landscape connectivity, and conserve populations of rare species, we recommend prioritizing ecological integrity within these areas. Management should emphasize minimizing forest fragmentation, protecting and restoring wetland hydrology, controlling invasive species, allowing mature forests to continue developing, and applying prescribed fire to fire-dependent habitats. Forestry and wildlife management activities should be planned to maintain native biodiversity, protect sensitive soils, and sustain the ecological processes that support these communities. Roughly 4,920 acres (28.8%) of the game area are recommended for designation as Priority Conservation Areas

detected following a subsequent forest treatment in the occupied stand. Although we cannot be certain of the cause of the lack of warbler observation in 2021, we speculate that this decline is due to the significant change in habitat caused by the logging event. We stress the importance of retaining and evaluating previously occupied habitat. Maintaining and expanding mature forest blocks, retaining large trees, and avoiding new roads and clearcuts within and around PCAs would protect habitat for cerulean warbler and songbirds associated with mature forest habitat while limiting additional fragmentation.

Most areas identified as PCAs do not meet MNFI criteria for natural community element occurrences but retain distinctive native composition, mature trees, or undisturbed soils that have locally persisted but have been eliminated from much of the surrounding landscape. Adjoining stands with strong recovery potential are included where they can buffer significant features, expand continuous habitat, or strengthen connections. The PCA map presents these areas together, although their condition and stewardship needs vary.

Maintaining and restoring connections among concentrations of PCAs should emphasize wetlands, stream corridors, and intervening natural cover. Long-term experimental evidence demonstrates that habitat corridors can increase plant colonization and reduce local extinction, with biodiversity benefits accumulating over decades (Damschen et al. 2019). For Blanding's turtles, protecting wetland habitat also requires retaining access to adjoining uplands and other wetlands used during the annual cycle. Forested stream buffers provide additional benefits by intercepting sediment, moderating water temperature, and sustaining aquatic habitat (Sweeney and Newbold 2014). We recommend protecting existing wetland and forest connections between PCAs and restoring intervening areas where feasible. Additional non-EO stands recommended for inclusion in PCAs are provided in Appendix 5.



Wet-mesic flatwoods in Stands 134 and 135 support diverse native vegetation despite its small size and the relatively young age of the forest between 88 and 109 years old). Although the stands do not qualify as a high-quality natural community, they retain considerable conservation value and have been included within a Priority Conservation Area. We recommend protecting Stand 135 and adjacent Stand 134 from timber harvest, maintaining forested buffers to prevent further fragmentation, and investigating opportunities to restore natural hydrology. Photo by J.M. Lincoln

Protecting Wetlands

Wetlands and open water constitute 64.4% of Gratiot-Saginaw SGA, and all high-quality natural communities documented within the game area are wetland types. These systems provide habitat to some of the game area's rare plants and animals and protect water quality across the headwaters of two watersheds. Despite their conservation importance, most wetlands throughout the game area have been extensively altered by drainage, excavation, and impoundments. Relative to uplands, these features also contribute disproportionately to ecosystem services such as protecting water quality and nutrient cycling. Because of the value of wetlands, we recommend managers focus on protecting and stabilizing wetland systems. Protecting remaining wetland integrity and restoring natural hydrologic processes should therefore be central management priorities.

Our management recommendations for protecting wetlands include 1) preventing further wetland degradation from drainage, excavation, and other manipulations that have extensively altered wetlands throughout the game area; 2) maintaining broad forested buffers around wetlands and along streams to protect them from adjacent timber harvest and other disturbances; 3) where timber harvest occurs in forested wetlands, preventing rutting, soil compaction, and disruption of surface water movement; 4) evaluating opportunities to disable or fill unnecessary ditches and restore the natural timing, duration, and extent of inundation; and 5) allowing beavers (*Castor canadensis*) to persist within the game area, except where their activities threaten infrastructure or documented conservation priorities.

Wetland management within Gratiot-Saginaw SGA has historically emphasized creating open-water and edge habitat for waterfowl. By 1990, the game area contained 40 artificial impoundments totaling 717 acres and 306 excavated potholes, together with extensive dikes and level ditching (Michigan DNR 1990). These projects provided selected wildlife habitat features while altering native wetland soils, vegetation, hydrology, and continuity. Their habitat benefits should therefore be considered alongside the loss and modification of natural wetland communities. We recommend avoiding further drainage, excavation, and spoil deposition within wetlands and directing future management toward protecting remaining wetland integrity and investigating the potential for restoring natural hydrologic processes by filling ditches and removing impoundments.



Standing dead trees within an artificial impoundment at Gratiot-Saginaw State Game Area. Prolonged inundation has resulted in the loss of the former forest canopy, creating open-water habitat with standing snags. Although impoundments provide habitat for some wildlife species, they can substantially alter native wetland vegetation, soils, and hydrology. We recommend protecting remaining intact wetlands and restoring natural hydrologic processes as priorities for future management. Photo by J.M. Lincoln.

The high-quality natural communities documented within Gratiot-Saginaw State Game Area persist within a landscape dissected by roads and an extensive network of deep ditches. These features fragment forest blocks, interrupt wetland continuity, and alter the movement and storage of water across the former lake plain. Maintaining broad forested buffers around wetlands and along streams would minimize additional disturbance to wetlands associated with timber harvest. Where logging occurs in forested wetlands, operations should prioritize the prevention of rutting, soil compaction, and disruption of surface water movement.

Selected road removal, crossing modification, and ditch filling could reconnect large blocks of natural vegetation and restore the natural timing, duration, and extent of inundation across multiple natural community occurrences. Such work should begin with an assessment of road necessity, ditch function, drainage ownership, and the potential effects of inundation on adjacent lands and infrastructure. Priority should be given to locations where hydrologic reconnection would link high-quality remnants, expand interior habitat, and improve ecological function across the game area. We provide potential targets in Appendix 6.

Beavers historically shaped the wetlands on the landscape. Remnant dams between upland ridges were observed and provide evidence of past activity. Repeated occupation and abandonment of beaver impoundments would have redistributed surface water and generated a shifting mosaic of shallow ponds, flooded forest, mudflats, sedge meadows, and shrub swamps. Active and abandoned beaver wetlands provide habitat for waterfowl and herptiles, with changing vegetation and water levels supporting different assemblages through pond succession (McKinstry et al. 2001; Aznar and Desrochers 2008). Allowing these processes to operate would support wetland habitat diversity within the game area's extensive natural cover. We recommend allowing beavers to shape wetland hydrology and vegetation unless it threatens necessary infrastructure or conflicts with specific conservation objectives, such as protecting a rare species population.



A ditch within Stand 29 of Compartment 4 in Meridian Swamp. Ditching has altered natural hydrology, affecting the frequency, duration, and extent of flooding and potentially shifting forest composition and structure. We recommend investigating opportunities to restore natural hydrology by disabling or filling existing ditches. Photo by J.M. Lincoln.

Controlling Invasive Species

We recommend prioritizing invasive species control within high-quality natural communities, rare species habitats, and Priority Conservation Areas (PCAs), including nearby infestations that threaten these sites. Invasive plants can alter native species composition, vegetation structure, nutrient cycling, and disturbance regimes, with consequences that extend beyond the displacement of individual native species (Ehrenfeld 2010). Common reed (*Phragmites*), reed canary grass, and glossy buckthorn occur along roads and ditches within the game area, creating potential sources for invasion of adjoining habitats. Treatment priorities include the common reed infestation in Compartment 4, Stand 81. Focusing control efforts on relatively intact habitats increases the likelihood of ecological recovery because other disturbances and invasions remain limited (Prior et al. 2018).

Invasive species surveys and control are important steps before timber harvest. Harvest operations can create conditions favorable to invasion, while machinery can transport seeds, roots, and other plant material between sites (LeDoux and Martin 2013).

Where invasive shrubs are established, treatment before canopy reduction helps limit their expansion following increased light availability. Equipment cleaning, minimal soil disturbance, protection of wetland hydrology, and follow-up surveys and treatment are essential components of management prescriptions. Incorporating these measures into project planning and budgets provides for prevention and sustained control before infestations expand.

Prompt treatment of new infestations offers the best opportunity for eradication while populations remain small and localized (Rejmánek and Pitcairn 2002). Established infestations require sustained treatment and monitoring for regrowth, recolonization, and replacement by other invasive species. Measures of success include recovery of native vegetation and habitat condition as well as reductions in invasive cover; control alone does not consistently produce ecological recovery (Prior et al. 2018; Pile Knapp et al. 2023). Treatment methods must minimize damage to native vegetation, and crews need information on rare species locations and training in control methods



The invasive common reed growing in a ditch (left) and glossy buckthorn along the edge of a young forest (right). Invasive species are particularly prevalent along roads, ditches, and disturbed forest edges, where they can spread into adjacent natural areas. We recommend prioritizing invasive species treatment along these corridors, within and around documented high-quality natural communities, and before implementing forestry treatments to prevent further spread. Photos by J.M. Lincoln.

appropriate for sensitive habitats and wetlands. Coordination with the appropriate Cooperative Invasive Species Management Area and neighboring landowners would support treatment of nearby source populations and continued surveillance.

Preventing deliberate introductions on public lands is another important component of invasive species management. Horticultural introductions account for most invasive woody plant species in the Midwest, demonstrating the lasting consequences of planting decisions (Culley and Feldman 2023). Before proposing plantings, project managers should evaluate whether existing native vegetation and natural regeneration can meet stewardship objectives. Where planting is warranted, species selection and source material need to reflect regional flora and site conditions. Plantings can then complement the protection and recovery of native communities while limiting the risk of introducing invasive species.

Autumn olive, multiflora rose, and other non-native species now recognized as invasive were historically planted on game areas for their perceived benefits to wildlife. These introductions created lasting threats to native communities and continuing demands for control. Future planting decisions must account for effects on native biodiversity as well as benefits to selected wildlife species. We recommend that DNR require the use of species native to the region in habitat plantings, prioritizing Michigan genotypes where appropriate and available.



Spongy moths on the trunk of an American beech (left) and a mature oak forest experiencing nearly complete canopy defoliation during the 2021 field season (right). During a return visit in 2025, several mature oaks were found dead, likely due to the cumulative impacts of repeated spongy moth outbreaks. Management options for spongy moth remain uncertain, and these outbreaks represent the latest in a series of invasive pests and diseases affecting the game area's forests, including Dutch elm disease and emerald ash borer. Photos by J.M. Lincoln.

Applying Prescribed Fire

Fire was historically part of the Gratiot-Saginaw landscape, as indicated by charred stumps and oak-dominated ridges supporting huckleberry and other fire-associated vegetation within the surrounding swamp matrix. Restoring prescribed fire to these sites can promote oak regeneration, increase forage for white-tailed deer, and improve foraging and brood-rearing habitat for wild turkey (Brose et al. 2013; Harper et al. 2016). These benefits provide opportunities to integrate native biodiversity conservation with game-species management. MNFI's prescribed fire needs model identifies potential priority areas (Cohen et al. 2021; Figure 24), while the site evaluations in this report provide direction for targeting burns to maintain oak-dominated vegetation, support rare species habitat, and restore wetland-upland transitions.

Prescribed fire has an important but precise role in stewardship at Gratiot-Saginaw SGA and its application should not be as widespread as in other game areas. Upland ridges occur within an extensive swamp matrix, and evidence of historical fire varies among sites. Oak-dominated vegetation, huckleberry, and locally observed charred stumps indicate past fire influence, but do not establish a uniform historical fire regime across the game area. We recommend focusing prescribed fire on sites where field evidence and specific conservation objectives support its use, particularly maintaining oak-dominated vegetation, evaluating potential benefits to whorled pogonia, and maintaining open conditions along selected wetland–upland ecotones. Burn frequency and extent should reflect site conditions and observed responses rather than a generic schedule; however, we generally recommend applying consistent prescribed fire to highest priority areas every 2 to 7 years (Harper et al. 2016). Given the challenges of consistently implementing prescribed fire across large areas, a fire-return interval of 5 to 10 years is a practical

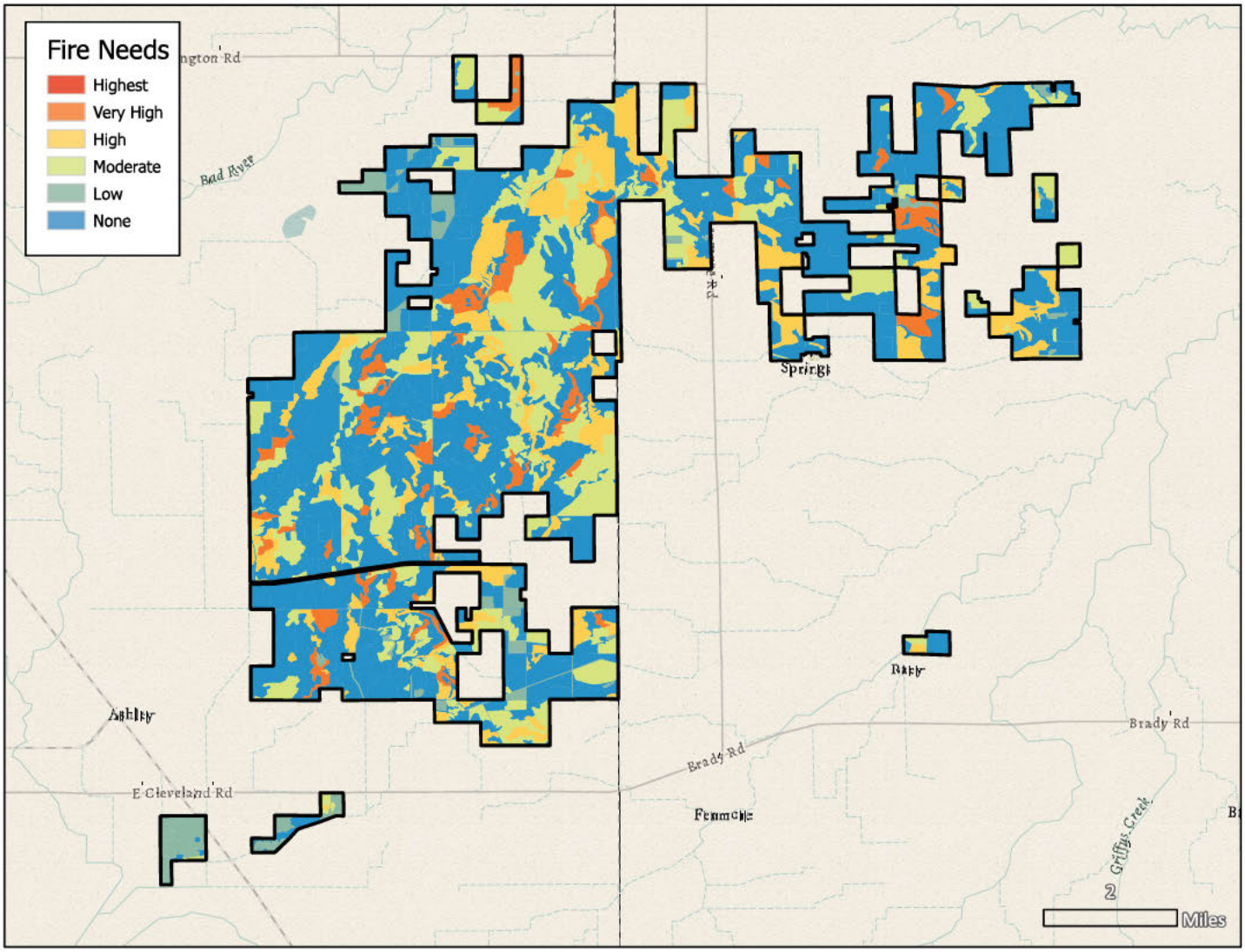


Figure 24. Prescribed fire needs assessment of Gratiot-Saginaw State Game Area. Upland forests generally exhibit a high or very high need for prescribed fire, while most forested wetlands have a fire need of "none." However, some wetlands contain fire-adapted upland inclusions, and prescribed burns should be allowed to spread into adjacent wetlands and extinguish naturally in saturated areas.

management target for priority fire-dependent sites within the game area, with timing adjusted to vegetation responses and stewardship objectives.

Although direct evidence of Indigenous cultural burning has not been established for these sites, their oak-dominated composition and associated ground-layer vegetation indicate a need for consistent fire. We recommend repeated low- to moderate-severity prescribed burns within the identified oak-dominated uplands, retaining mature oaks and avoiding abrupt changes to canopy structure. A single burn is not expected to reverse the effects of over a century of fire suppression; repeated applications are needed to reduce competing mesophytic species and improve conditions for oak recruitment (Brose et al. 2013). Deer herbivory will continue to constrain recruitment, and vegetation responses may develop slowly after prolonged fire exclusion. Initial burns should emphasize gradual recovery, favoring multiple low-severity burns over single high-severity burns. This approach is aimed at protecting soils and mature trees, particularly white oaks already stressed by spongy moth defoliation.

We recommend a carefully controlled experimental burn within a portion of the white oak–huckleberry habitat supporting the whorled pogonia orchid. Reports of increased emergence and flowering following low-severity burns elsewhere provide precedent, although the appropriate season, frequency, and long-term effects remain uncertain (Fryer 2019). The objective of burning the habitat that supports the orchid is to maintain the conditions that sustain the population while minimizing risk of negative consequences through high fire severity. Initial treatment should use low-severity dormant-season fire after plant senescence or before emergence, retain patches of unburned litter, and avoid prolonged heating or consumption of the organic horizon. Occupied habitat should be mapped before treatment, with a substantial portion left unburned for comparison. Ignition fuels should not be applied directly onto areas where the orchid grows. Monitoring should document emergence, flowering, fruiting, herbivory, and habitat conditions before and for multiple years after treatment, recognizing that temporary dormancy can complicate interpretation of plant counts. Additional burns will depend on documented responses rather than a predetermined rotation.

Broadly, we recommend establishing permanent burn-unit boundaries along existing roads, trails, streams, and other suitable containment features, avoiding new fire lines through sensitive habitats or along wetland-upland ecotones. Where targeted oak-dominated uplands adjoin wetlands, units can include the transition between them so fire can move across the gradient and extinguish naturally in saturated areas. At Mason Meadow, this approach would allow patchy burning from the adjoining ridge into meadow margins. Such transitions provide the combination of open basking areas, sheltered cover, and adjoining wetland habitat used by eastern massasaugas and other herptiles. Although massasaugas are presumed



A fire-adapted upland ridge (foreground) occurs adjacent to the Mason Meadow southern wet meadow along its northwestern margin. We recommend implementing a prescribed fire along this upland ridge and allowing it to spread to the adjacent wet meadow. We emphasize the importance of burning uplands and wetlands in synchrony and avoiding the construction of fire lines along the ecotone. Periodic low-severity fire can help maintain open, structurally diverse habitat along this transition, providing important basking and thermoregulation opportunities for reptiles, including rare species associated with wetland margins. We recommend protecting these ecotones and allowing fire to extinguish naturally in saturated areas. Photo by J.M. Lincoln.

extirpated from the game area, maintaining these habitat features remains a valid restoration objective.

We recommend favoring late-fall burns after reptiles have entered overwintering sites, with timing determined by local conditions and species activity rather than calendar dates alone. Fall movements toward hibernacula can concentrate snakes near wetland margins before dormancy, making early-fall burns inappropriate where snakes remain active. Burns should occur under conditions that support patchy surface fire while protecting organic soils from prolonged combustion. We also recommend retaining unburned refugia within and adjoining treatment areas and staggering burns so connected habitat remains available for fire-sensitive animals. Ignition patterns should limit prolonged heating and preserve cover; slow-moving backing fires should not automatically be considered safer for animals with limited mobility (Edmonds et al. 2024).

Monitoring

Monitoring should be implemented to determine whether stewardship is maintaining native biodiversity, reducing threats, and restoring ecological processes within Gratiot-Saginaw SGA. We recommend prioritizing monitoring efforts in high-quality natural communities, rare species populations, and areas receiving invasive species treatment, hydrologic restoration, or prescribed fire. Establishing conditions before treatment and repeating observations afterward will allow managers to evaluate outcomes and adjust subsequent actions. Evaluations can include native vegetation composition and regeneration, invasive species abundance, deer herbivory, and the timing and duration of wetland inundation. Treatment success is best evaluated through recovery of native vegetation and habitat conditions, rather than completion of management activities alone. Periodic early-detection surveys for invasive species should also target roads, ditches, equipment access routes, and recently disturbed areas.

Deer herbivory warrants particular attention because it can limit both rare plant persistence and recovery following stewardship. Research demonstrates that sustained browsing can alter forest composition and favor invasive plants (Knight et al. 2009; Frerker et al. 2014). Within the game area, monitoring should evaluate browse pressure on rare plants and recruitment of canopy trees, particularly oaks. At the site of the whorled pogonia population, monitoring should precede experimental burning and continue for multiple years afterward, comparing treated and untreated portions of occupied habitat. Counts should distinguish vegetative, flowering, and fruiting stems and record herbivory, recognizing that dormancy complicates interpretation of annual changes in emergence (Fryer 2019).

Gratiot-Saginaw SGA supports an extensive mosaic



Herbicide application along a roadside ditch in Gratiot-Saginaw State Game Area, likely conducted as part of county road maintenance rather than DNR management activities. This treatment affected native vegetation in an area where invasive species were not readily apparent, while several nearby ditches supporting invasive plants remained untreated. Although roadside herbicide treatments can be valuable for controlling invasive species, improved coordination with county road commissions could help target priority infestations, minimize impacts to native vegetation, and improve the effectiveness of management efforts. Photo by J.M. Lincoln.

of uplands and wetlands that provides habitat for Blanding's turtle. Although surveys documented five adults, these observations alone do not establish successful recruitment or long-term population viability. Long-lived adults can persist for decades where recruitment is limited or absent, masking population declines (Compton 2007). Additional monitoring can assess population distribution and age structure, identify nesting areas, and evaluate nesting success and recruitment. Determining whether females cross roads or enter adjacent agricultural fields to reach nesting sites would help identify threats and guide habitat protection. Excavated turtle nests observed within the game area warrant targeted investigation of nest predation and evaluation of nest protection measures. Additional spotted turtle surveys should emphasize spring sampling to better resolve the status of the historical occurrence.

Periodic forest bird surveys will ideally repeat established point-count methods to track wood thrush and other forest-interior songbirds, with targeted surveys of previously occupied cerulean warbler habitat and continued checks of red-shouldered hawk nesting areas. Repeated surveys would help distinguish persistent occupancy from occasional use and document responses to changes in forest cover and structure. Where forestry treatments are planned, surveys before and after treatment, paired with surveys in comparable untreated stands, would strengthen evaluation of management effects.

Prescribed fire monitoring should document burn extent and severity, retention of unburned refugia, oak regeneration, competing woody vegetation, and responses of rare species. These observations can guide subsequent burn timing and frequency, particularly where prolonged fire exclusion, deer herbivory, or tree stress may constrain recovery. Hydrologic restoration should likewise include observations of water levels and vegetation before and after ditch modification, with attention to both targeted wetlands and adjoining habitats. Monitoring would best be incorporated into project budgets and schedules so that management proceeds as a sustained program of treatment, evaluation, and adjustment.





A young oak forest with sparse understory vegetation (left) and a white pine sapling exhibiting extensive browsing by white-tailed deer (right). Fire suppression, deer herbivory, and historical land use have likely contributed to diminished native plant diversity and regeneration across many of the game area's upland forests. White pine is generally a low-preference winter food for deer, and heavy browsing may indicate substantial pressure on other available species. We recommend monitoring vegetation composition and tree regeneration to better understand the cumulative impacts of fire exclusion and deer herbivory and evaluate the effectiveness of future management. Photos by J.M. Lincoln.

CONCLUSIONS

Although state game areas were established principally to provide hunting access and maintain wildlife habitat, their conservation value extends beyond game species. As Michigan's second largest state game area, Gratiot-Saginaw State Game Area provides an opportunity to conserve native biodiversity within a landscape otherwise extensively altered by agriculture, logging, and wetland drainage. Large blocks of public land support native ecosystems, rare species, and ecological processes that have been lost across much of southern Michigan.

Conservation scientists from Michigan Natural Features Inventory conducted surveys for high-quality natural communities and rare species between 2021 and 2025. Significant findings include mature forests in the wet-mesic flatwoods of Marion Springs and Meridian Swamps; diverse wetland vegetation at Mason Meadow; the extensive population of whorled pogonia; and populations of red-shouldered hawk, wood thrush, and Blanding's turtle. Marion Springs Swamp supports the highest documented plant species richness of any wet-mesic flatwoods occurrence in Michigan, while Meridian Swamp is the largest documented occurrence of this community type in the state. Together, these findings demonstrate the conservation value of the game area's remaining natural communities and associated habitats.

Despite its size, Gratiot-Saginaw SGA has comparatively few documented natural community and rare species element occurrences relative to other large state game areas. Although differences in survey effort may contribute to this disparity, extensive wetland manipulation, conversion of mature forests to early-successional habitat, and protracted fire suppression have likely diminished its capacity to support some natural communities and rare species.

The assemblages of native vegetation, mature forest structure, and ecological relationships represent a natural heritage that has been diminished across much of the surrounding landscape. Protecting these communities and the processes that sustain



Extensive agriculture dominates the landscape surrounding Gratiot-Saginaw State Game Area, where wetlands have been drained, forests fragmented, and natural cover reduced to small, isolated patches. Once part of a vast, largely unbroken forested landscape, the game area now serves as an important refuge for biodiversity and ecological processes that have been lost or diminished across much of the surrounding region.
The game area's extensive forests and wetlands provide a living connection to natural history and an important opportunity to sustain that ecological legacy for future generations. Photo by J.M. Lincoln.

them should be a fundamental objective of wildlife management at Gratiot-Saginaw SGA. Maintaining hydrology, applying prescribed fire, controlling invasive species, addressing deer herbivory, and monitoring rare species and forest regeneration are necessary to carry that natural heritage forward.

The stewardship challenges confronting managers have shifted substantially since the 1990 master plan, which emphasized early-successional habitat for deer and modifying wetlands for waterfowl. Today, excessive deer herbivory is limiting forest regeneration, while many historically altered wetlands support invasive species and degraded vegetation. These changes call for reassessing past habitat objectives in light of current ecological conditions. Prescribed fire can maintain diverse fire-adapted woodlands, increase herbaceous vegetation, and promote oak regeneration that sustains deer and turkey. Similarly, beaver activity within large, unfragmented wetland complexes creates a range of habitats that waterfowl can utilize. These processes can provide habitat for traditional game species while supporting a much broader assemblage of native biodiversity.

Surrounded by an agricultural landscape where extensive, mature forests are increasingly uncommon, Gratiot-Saginaw SGA provides important habitat for wildlife species requiring large, contiguous blocks of forest. Its importance extends beyond the quality of individual natural communities to the scale and continuity of forest cover that is largely absent from the surrounding landscape. Protecting these features while restoring the ecological processes that sustain them offers a comprehensive approach to wildlife stewardship, one that ensures resiliency and fulfills the broad conservation responsibilities of Michigan's public lands.



An old swamp white oak, toppled by a storm, remains within the forest it helped shape. The canopy gap and large-diameter coarse woody debris it creates are characteristic features of mature forests and provide habitat for numerous organisms. Within the extensive forests of Gratiot-Saginaw SGA, these processes can unfold at scales rarely possible in the fragmented woodlots beyond its boundaries. Allowing forests to mature and sustaining these natural processes are important roles of public lands, which also give people opportunities to experience ecosystems largely absent from the surrounding landscape. Photo by J.M. Lincoln.

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APPENDICES

Appendix 1. General Land Office Survey Records from Gratiot-Saginaw State Game Area.

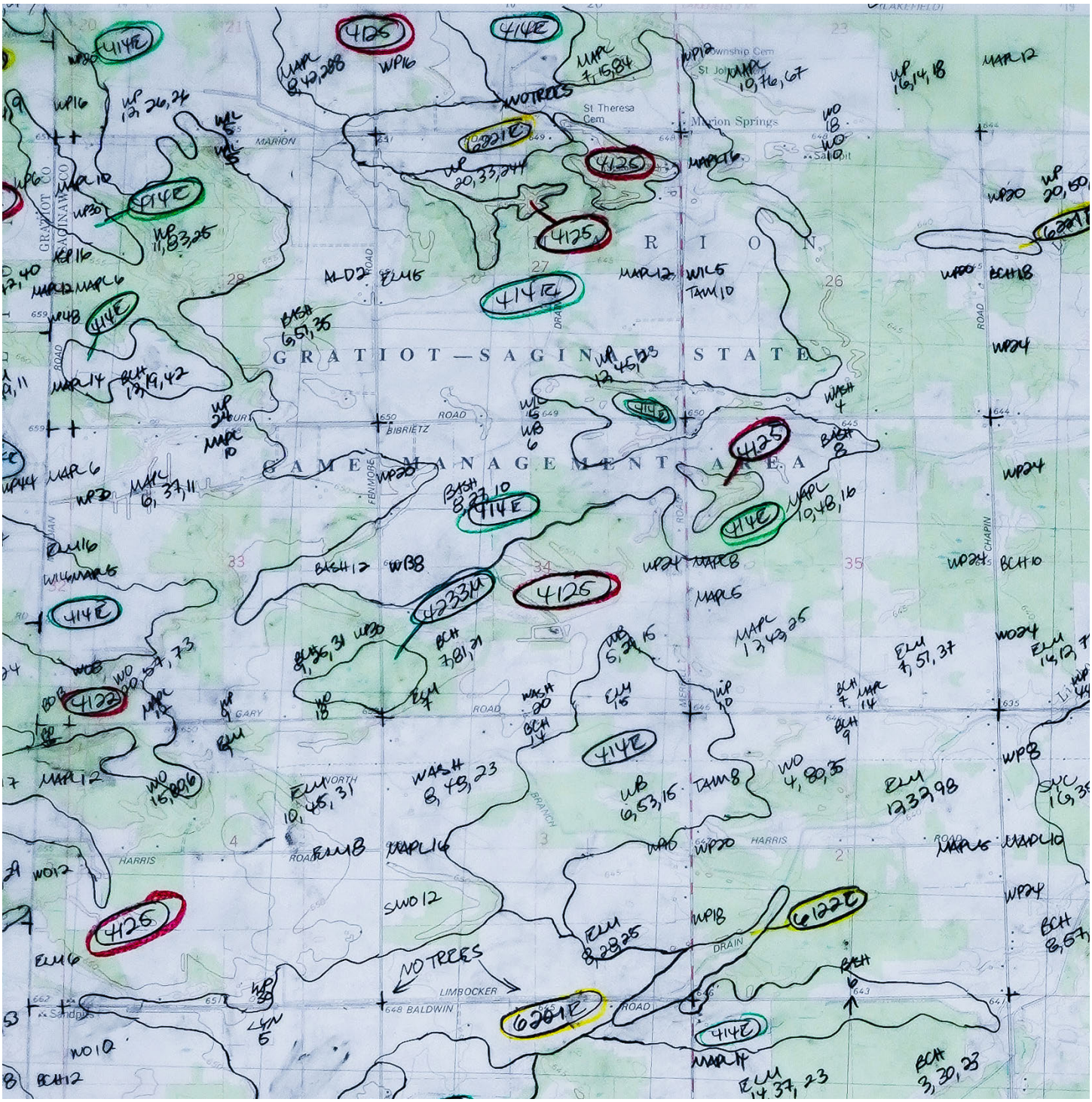


Figure A1-1. Historical survey notes and tree diameters for a portion of Gratiot-Saginaw State Game Area. Tree records and vegetation notes recorded by General Land Office surveyor Thomas Robinson in 1831, were transcribed onto mylar overlays of topographic maps by Michigan Natural Features Inventory ecologists. These notes and maps provided the basis for mapping circa-1800 vegetation. Tree abbreviations include WP = white pine, MAPL = maple, BASH = black ash, BCH = beech, ELM = elm, TAM = tamarack, WO = white oak, BO = black oak, WASH = white ash, WIL = willow, and SWO = swamp white oak. Numbers following tree abbreviations indicate recorded diameters in inches. Where three numbers occur together, they represent tree diameter, compass bearing in degrees, and distance from the survey corner in links (1 link = 0.66 ft).

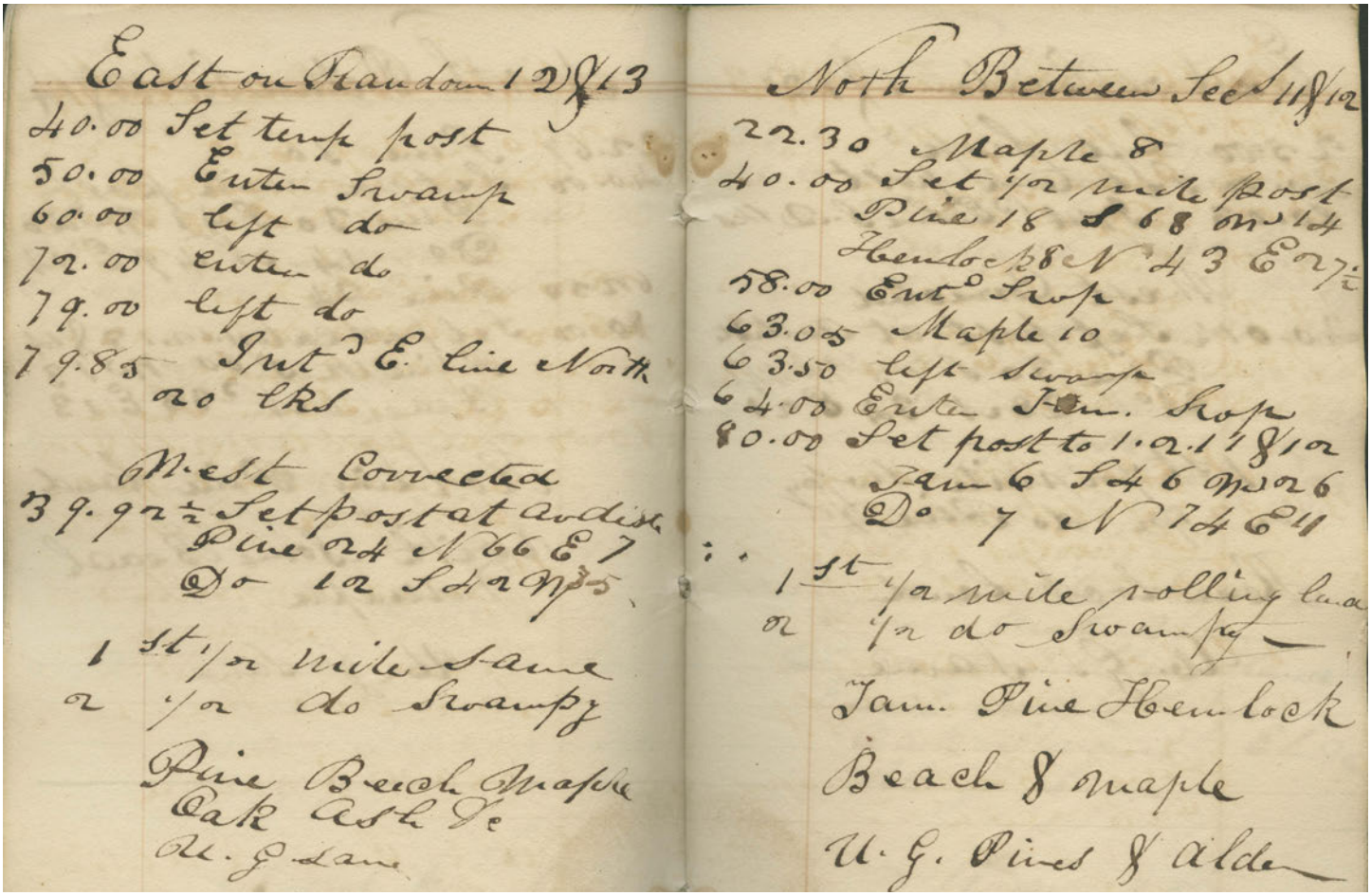


Figure A1-2. Field notes recorded by General Land Office surveyor Thomas Robinson in 1831. Along this survey line, Robinson repeatedly entered and left swamp over short distances, documenting the fine-scale interspersion of wetlands and better-drained forest within the historical landscape. A transcription of the notes is provided below. Source: Thomas Robinson, *Notes from the Internal Lines Survey of Hamilton Township, Gratiot County,* 1831, item IntlinesVol736_08, RG 87-155, Archives of Michigan.

Left Page:
East on Random (Sections) 12 & 13
40.00 Set temporary post
50.00 Enter Swamp
60.00 left do [ditto]
72.00 Enter do [ditto]
79.00 left do [ditto]
79.85 Intersected E. line North
20 Chs [chains]

West Corrected
39.92½ Set post at [unclear]
Pine 24 N 66 E 7
Do [ditto] 12 S 29 W 5

1st ½ mile same
2nd ½ do [ditto] Swampy

Pine Beech Maple
Oak Ash &c.
U.G. [undergrowth] same

Right Page:
North Between Sec. 11 & 12

22.30 Maple 8
40.00 Set ½ mile post
Pine 18 S 68 W 14
Hemlock 8 N 43 E 27½
58.00 Enter Swp [swamp]
63.05 Maple 10
63.50 left Swamp
64.00 Enter Hem[lock] Swp [swamp]
80.00 Set post to 1, 2, 11 & 12
Tam[arack] 6 S 46 W 26
Do [ditto] 7 N 74 E 11

1st ½ mile rolling land
2nd ½ do [ditto] Swampy

Tam[arack], Pine, Hemlock
Beech & Maple
U.G. [undergrowth] Pine & Alder

Appendix 2. Land Snails Documented at Gratiot-Saginaw State Game Area



Figure A2-1. Comb snaggletooth (*Gastrocopta pentodon*), shell approx. 2 mm in length.

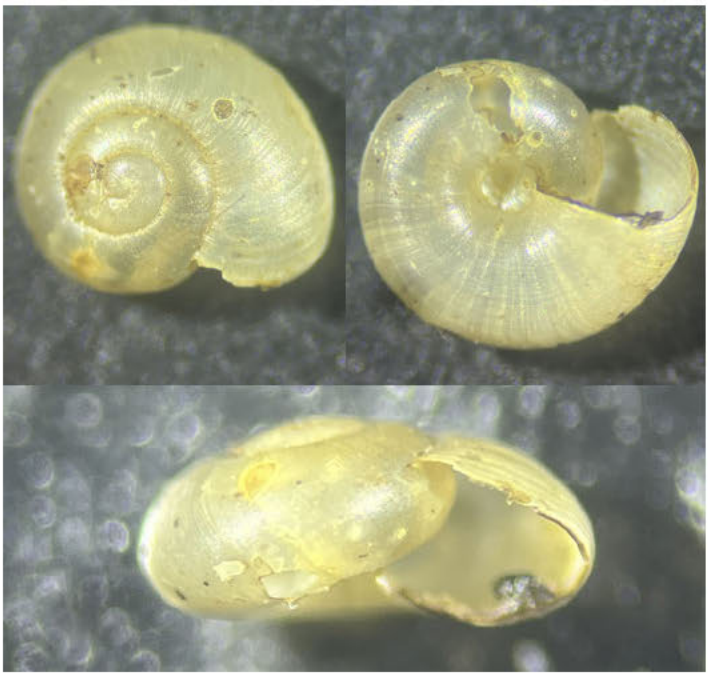


Figure A2-2. Black striate (*Striatura ferrea*), shell approx. 2.5 mm in width.



Figure A2-3. Minute gem (*Punctum minutissimum*), shell approx. 1 mm in width.



Figure A2-4. Fine-ribbed striate (*Striatura milium*), left; Minute gem (*Punctum minutissimum*), right; shells approx. 1-2 mm in width.

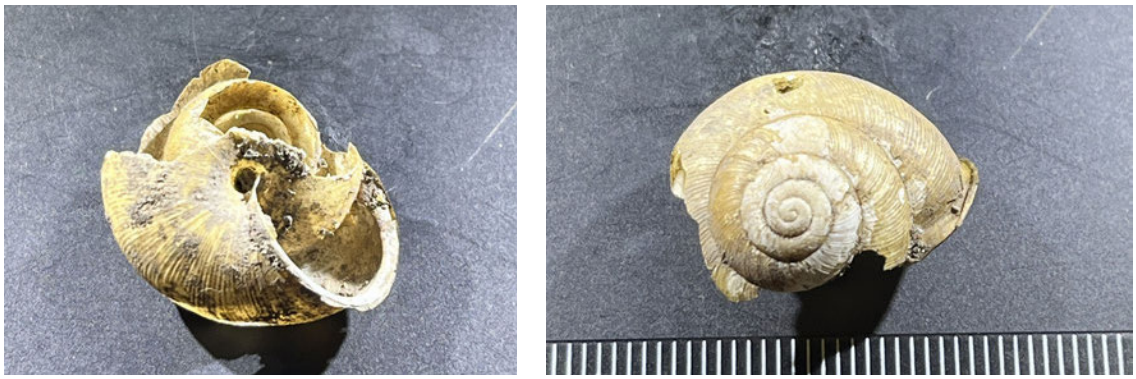


Figure A2-5. White-lip globe (*Mesodon thyroidus*), scale in mm.

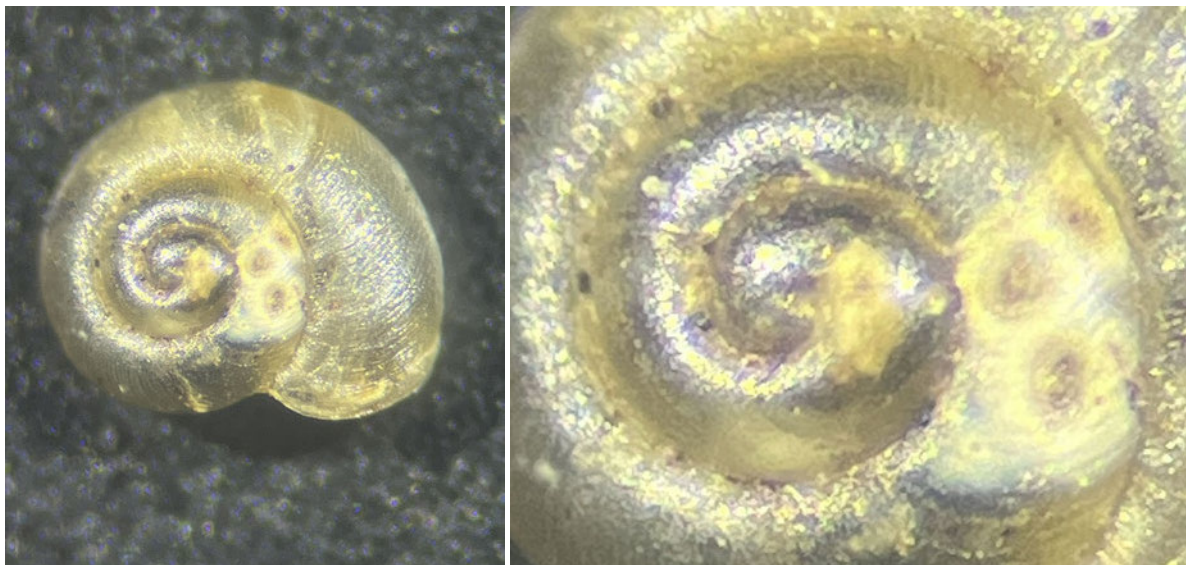


Figure A2-6. Fine-ribbed striate (*Striatura milium*), shell approx. 2 mm in width. Close-up shows lack of spiral lines on the protoconch, which differentiates it from Median striate (*Striatura meridionalis*), a species of special concern in MI.

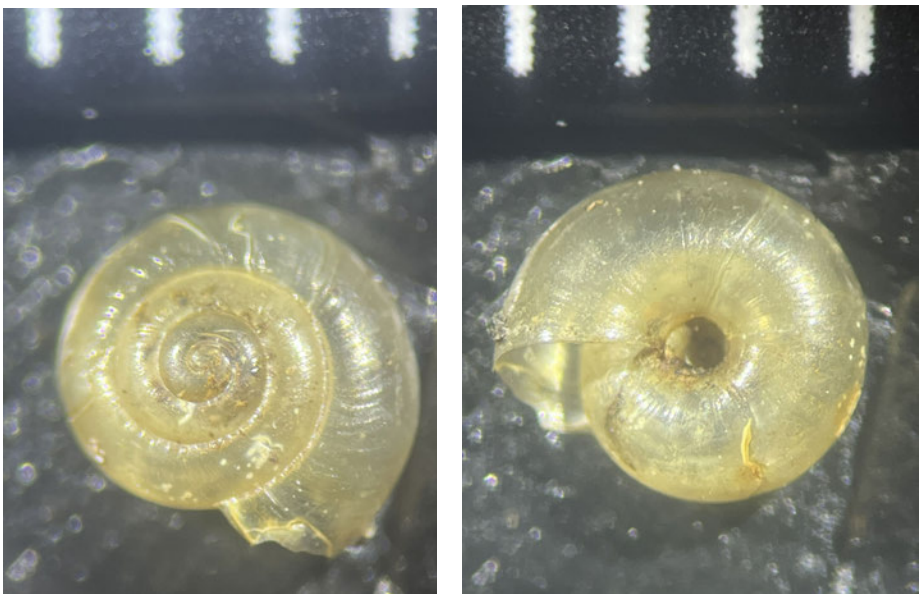


Figure A2-7. Quick gloss (*Zonitoides arboreus*), scale in mm.

Appendix 3. Plant species observed within the natural communities documented at Gratiot-Saginaw State Game Area.

Figure A3-1. Plant species observed within Mason Meadow, Southern Wet Meadow (EOID 28611).

Scientific name	Common name	Status	C
Alnus incana	speckled alder	Native	5
Boehmeria cylindrica	false nettle	Native	5
Calamagrostis canadensis	blue-joint	Native	3
Carex comosa	sedge	Native	5
Carex lacustris	sedge	Native	6
Carex stricta	sedge	Native	4
Carex utriculata	sedge	Native	5
Cephalanthus occidentalis	buttonbush	Native	7
Cicuta maculata	water hemlock	Native	4
Dulichium arundinaceum	three-way sedge	Native	8
Eleocharis obtusa	spike-rush	Native	3
Eleocharis palustris	spike-rush	Native	5
Epilobium leptophyllum	fen willow-herb	Native	6
Galium trifidum	small bedstraw	Native	6
Ilex verticillata	michigan holly	Native	5
Juncus canadensis	canadian rush	Native	6
Juncus effusus	soft-stemmed rush	Native	3
Lythrum salicaria	**purple loosestrife**	**Non-native**	**0**
Nyssa sylvatica	black-gum	Native	9
Onoclea sensibilis	sensitive fern	Native	2
Persicaria amphibia	water smartweed	Native	6
Persicaria punctata	smartweed	Native	5
Pilea pumila	clearweed	Native	5
Quercus palustris	pin oak	Native	8
Rosa palustris	swamp rose	Native	5
Sagittaria latifolia	common arrowhead	Native	4
Salix exigua	sandbar willow	Native	1
Salix lucida	shining willow	Native	3
Schoenoplectus acutus	hardstem bulrush	Native	5
Scirpus cyperinus	wool-grass	Native	5
Sium suave	water-parsnip	Native	5
Solanum dulcamara	**bittersweet nightshade**	**Non-native**	**0**
Spiraea alba	meadowsweet	Native	4
Thelypteris palustris	marsh fern	Native	2
Toxicodendron vernix	poison sumac	Native	6
Triadenum fraseri	marsh st. johns-wort	Native	6
Typha latifolia	broad-leaved cat-tail	Native	1
Verbena hastata	blue vervain	Native	4

Figure A3-2. Plant species observed within Marion Springs Swamp, Wet-Mesic Flatwoods (EO ID 27362).

Scientific name	Common name	Status	C
Acer rubrum	red maple	Native	1
Acer saccharinum	silver maple	Native	2
Acer saccharum	sugar maple	Native	5
Amelanchier arborea	juneberry	Native	4
Anemone quinquefolia	wood anemone	Native	5
Apios americana	groundnut	Native	3
Aralia nudicaulis	wild sarsaparilla	Native	5
Asclepias incarnata	swamp milkweed	Native	6
Barbarea vulgaris	**yellow rocket**	**Non-native**	**0**
Betula alleghaniensis	yellow birch	Native	7
Brachyelytrum aristosum	northern shorthusk	Native	7
Cardamine bulbosa	spring cress	Native	4
Carex arctata	sedge	Native	3
Carex bromoides	sedge	Native	6
Carex brunnescens	sedge	Native	5
Carex crinita	sedge	Native	4
Carex folliculata	sedge	Native	10
Carex grayi	sedge	Native	6
Carex grisea	sedge	Native	3
Carex intumescens	sedge	Native	3
Carex laxiculmis	sedge	Native	8
Carex laxiflora	sedge	Native	8
Carex normalis	sedge	Native	5
Carex pedunculata	sedge	Native	5
Carex projecta	sedge	Native	3
Carex seorsa	sedge	Native	10
Carex stipata	sedge	Native	1

Figure A3-2 (continued). Plant species observed within Marion Springs Swamp, Wet-Mesic Flatwoods

Scientific name	Common name	Status	C
Carex stricta	sedge	Native	4
Carex tenera	sedge	Native	4
Carpinus caroliniana	blue-beech	Native	6
Carya cordiformis	bitternut hickory	Native	5
Carya ovata	shagbark hickory	Native	5
Celtis occidentalis	hackberry	Native	5
Cephalanthus occidentalis	buttonbush	Native	7
Chelone glabra	turtlehead	Native	7
Cicuta bulbifera	water hemlock	Native	5
Cinna latifolia	wood reedgrass	Native	5
Claytonia virginica	spring-beauty	Native	4
Coptis trifolia	goldthread	Native	5
Corylus americana	hazelnut	Native	5
Crataegus punctata	dotted hawthorn	Native	1
Cryptotaenia canadensis	honewort	Native	2
Cypripedium acaule	pink lady-slipper; moccasin flower	Native	5
Dichanthelium boreale	northern panic grass	Native	7
Dioscorea villosa	wild yam	Native	4
Elaeagnus umbellata	**autumn-olive**	**Non-native**	**0**
Elymus virginicus	virginia wild-rye	Native	4
Equisetum arvense	common horsetail	Native	0
Eutrochium purpureum	green-stemmed joe-pye-weed	Native	5
Fagus grandifolia	american beech	Native	6
Festuca subverticillata	nodding fescue	Native	5
Floerkea proserpinacoides	false mermaid	Native	7
Fraxinus nigra	black ash	Native	6
Fraxinus pennsylvanica	red ash	Native	2
Galium concinnum	shining bedstraw	Native	5
Galium obtusum	wild madder	Native	5
Gaultheria procumbens	wintergreen	Native	5
Gaylussacia baccata	huckleberry	Native	7
Geranium maculatum	wild geranium	Native	4
Glechoma hederacea	**ground-ivy**	**Non-native**	**0**
Glyceria striata	fowl manna grass	Native	4
Hamamelis virginiana	witch-hazel	Native	5
Ilex verticillata	michigan holly	Native	5
Iris versicolor	wild blue flag	Native	5
Juncus pylaei	pylaies soft rush	Native	3
Laportea canadensis	wood nettle	Native	4
Lilium michiganense	michigan lily	Native	5
Lindera benzoin	spicebush	Native	7
Lycopus uniflorus	northern bugle weed	Native	2
Lysimachia quadrifolia	four-leaved loosestrife	Native	8
Lysimachia terrestris	swamp-candles	Native	6
Maianthemum canadense	canada mayflower	Native	4
Medeola virginiana	indian cucumber-root	Native	10
Monotropa uniflora	indian-pipe	Native	5
Nyssa sylvatica	black-gum	Native	9
Onoclea sensibilis	sensitive fern	Native	2
Osmunda cinnamomea	cinnamon fern	Native	5
Osmunda regalis	royal fern	Native	5
Ostrya virginiana	ironwood; hop-hornbeam	Native	5
Panax trifolius	dwarf ginseng	Native	8
Parthenocissus quinquefolia	virginia creeper	Native	5
Persicaria hydropiperoides	mild water-pepper	Native	5
Phryma leptostachya	lopseed	Native	4
Pilea pumila	clearweed	Native	5
Pinus strobus	white pine	Native	3
Platanthera aquilonis	northern green orchid	Native	5
Poa alsodes	bluegrass	Native	9
Poa palustris	fowl meadow grass	Native	3
Polygonatum pubescens	downy solomon seal	Native	5
Polystichum acrostichoides	christmas fern	Native	6
Populus deltoides	cottonwood	Native	1
Prenanthes altissima	tall white lettuce	Native	5
Pteridium aquilinum	bracken fern	Native	0
Quercus alba	white oak	Native	5
Quercus bicolor	swamp white oak	Native	8
Quercus macrocarpa	bur oak	Native	5
Quercus palustris	pin oak	Native	8
Quercus rubra	red oak	Native	5
Quercus shumardii	shumard oak	Native	8
Ranunculus hispidus	swamp buttercup	Native	5

Figure A3-2 (continued). Plant species observed within Marion Springs Swamp, Wet-Mesic Flatwoods

Scientific name	Common name	Status	C
Rosa palustris	swamp rose	Native	5
Rubus hispidus	swamp dewberry	Native	4
Sanicula marilandica	black snakeroot	Native	4
Sassafras albidum	sassafras	Native	5
Sium suave	water-parsnip	Native	5
Smilax hispida	bristly greenbrier	Native	5
Solidago canadensis	canada goldenrod	Native	1
Solidago patula	swamp goldenrod	Native	6
Spiraea alba	meadowsweet	Native	4
Symphyotrichum lateriflorum	calico aster	Native	2
Thalictrum dasycarpum	purple meadow-rue	Native	3
Amauropelta noveboracensis	new york fern	Native	5
Thelypteris palustris	marsh fern	Native	2
Tilia americana	basswood	Native	5
Toxicodendron radicans	poison-ivy	Native	2
Trientalis borealis	star-flower	Native	5
Trillium grandiflorum	common trillium	Native	5
Ulmus americana	american elm	Native	1
Vaccinium angustifolium	low sweet blueberry	Native	4
Viburnum acerifolium	maple-leaved viburnum	Native	6
Viburnum lentago	nannyberry	Native	4
Viola cucullata	marsh violet	Native	5
Viola sororia	common blue violet	Native	1
Zanthoxylum americanum	prickly-ash	Native	3

Figure A3-3. Plant species observed within Meridian Swamp, Wet-Mesic Flatwoods (EO ID 27360).

Scientific name	Common name	Status	C
Acer rubrum	red maple	Native	1
Acer saccharinum	silver maple	Native	2
Agrimonia gryposepala	tall agrimony	Native	2
Agrostis perennans	autumn bent	Native	5
Amelanchier arborea	juneberry	Native	4
Amphicarpaea bracteata	hog-peanut	Native	5
Anemone quinquefolia	wood anemone	Native	5
Betula alleghaniensis	yellow birch	Native	7
Betula papyrifera	paper birch	Native	2
Boehmeria cylindrica	false nettle	Native	5
Brachyelytrum aristosum	northern shorthusk	Native	7
Calamagrostis canadensis	blue-joint	Native	3
Carex alopecoidea	sedge	Native	3
Carex bromoides	sedge	Native	6
Carex canescens	sedge	Native	8
Carex crinita	sedge	Native	4
Carex gracilescens	sedge	Native	5
Carex grayi	sedge	Native	6
Carex interior	sedge	Native	3
Carex intumescens	sedge	Native	3
Carex leptalea	sedge	Native	5
Carex lupulina	sedge	Native	4
Carex pensylvanica	sedge	Native	4
Carex radiata	straight-styled wood sedge	Native	2
Carex stricta	sedge	Native	4
Carpinus caroliniana	blue-beech	Native	6
Cephalanthus occidentalis	buttonbush	Native	7
Coptis trifolia	goldthread	Native	5
Danthonia spicata	poverty grass; oatgrass	Native	4
Dendrolycopodium obscurum	ground-pine	Native	5
Dichanthelium dichotomum	panic grass	Native	7
Dichanthelium implicatum	panic grass	Native	3
Dioscorea villosa	wild yam	Native	4
Equisetum arvense	common horsetail	Native	0
Eurybia macrophylla	big-leaved aster	Native	4
Fraxinus nigra	black ash	Native	6
Fraxinus pennsylvanica	red ash	Native	2
Galium obtusum	wild madder	Native	5
Galium triflorum	fragrant bedstraw	Native	4
Gaultheria procumbens	wintergreen	Native	5
Gaylussacia baccata	huckleberry	Native	7
Glyceria striata	fowl manna grass	Native	4
Goodyera pubescens	downy rattlesnake plantain	Native	7
Hamamelis virginiana	witch-hazel	Native	5

Figure A3-3 (continued). Plant species observed within Meridian Swamp, Wet-Mesic Flatwoods

Scientific name	Common name	Status	C
Ilex verticillata	michigan holly	Native	5
Iris virginica	southern blue flag	Native	5
Leersia virginica	white grass	Native	5
Lilium michiganense	michigan lily	Native	5
Lycopus uniflorus	northern bugle weed	Native	2
Maianthemum canadense	canada mayflower	Native	4
Medeola virginiana	indian cucumber-root	Native	10
Mitchella repens	partridge-berry	Native	5
Nyssa sylvatica	black-gum	Native	9
Onoclea sensibilis	sensitive fern	Native	2
Osmunda cinnamomea	cinnamon fern	Native	5
Osmunda regalis	royal fern	Native	5
Pinus strobus	white pine	Native	3
Polygala paucifolia	gay-wings	Native	7
Polygonatum biflorum	solomon-seal	Native	4
Polygonatum pubescens	downy solomon seal	Native	5
Populus deltoides	cottonwood	Native	1
Populus grandidentata	big-tooth aspen	Native	4
Potentilla simplex	old-field cinquefoil	Native	2
Prunus serotina	wild black cherry	Native	2
Pteridium aquilinum	bracken fern	Native	0
Quercus alba	white oak	Native	5
Quercus bicolor	swamp white oak	Native	8
Quercus palustris	pin oak	Native	8
Quercus rubra	red oak	Native	5
Rosa palustris	swamp rose	Native	5
Rubus flagellaris	northern dewberry	Native	1
Rubus hispidus	swamp dewberry	Native	4
Rubus pubescens	dwarf raspberry	Native	4
Sassafras albidum	sassafras	Native	5
Scutellaria lateriflora	mad-dog skullcap	Native	5
Smilax hispida	bristly greenbrier	Native	5
Solidago patula	swamp goldenrod	Native	6
Solidago rugosa	rough-leaved goldenrod	Native	3
Symphyotrichum lateriflorum	calico aster	Native	2
Symphyotrichum ontarionis	lake ontario aster	Native	6
Amauropelta noveboracensis	new york fern	Native	5
Thelypteris palustris	marsh fern	Native	2
Trientalis borealis	star-flower	Native	5
Ulmus americana	american elm	Native	1
Vaccinium angustifolium	low sweet blueberry	Native	4
Viola cucullata	marsh violet	Native	5

Appendix 4. Bird species documented during point-count surveys at Gratiot-Saginaw State Game Area. Species are arranged in descending order by the proportion of survey points at which they were detected.

Common Name	Scientific Name	Proportion of Points
Eastern Wood-Pewee	*Contopus virens*	95%
Red-eyed Vireo	*Vireo olivaceus*	94%
Tufted Titmouse	*Baeolophus bicolor*	71%
Brown-headed Cowbird	*Molothrus ater*	68%
Scarlet Tanager	*Piranga olivacea*	68%
American Crow	*Corvus brachyrhynchos*	63%
White-breasted Nuthatch	*Sitta carolinensis*	63%
American Robin	*Turdus migratorius*	60%
Blue Jay	*Cyanocitta cristata*	56%
Ovenbird	*Seiurus aurocapilla*	52%
Great-crested Flycatcher	*Myiarchus crinitus*	48%
Red-bellied Woodpecker	*Melanerpes carolinus*	44%
Yellow-billed Cuckoo	*Coccyzus americanus*	39%
Downy Woodpecker	*Picoides pubescens*	37%
Black-capped Chickadee	*Poecile atricapillus*	35%
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	34%
Veery	*Catharus fuscescens*	32%
Acadian Flycatcher	*Empidonax virescens*	29%
Chipping Sparrow	*Spizella passerina*	26%
Mourning Dove	*Zenaida macroura*	26%
Common grackle	*Quiscalus quiscula*	23%
Cedar Waxwing	*Bombycilla cedrorum*	21%
Yellow-throated Vireo	*Vireo flavifrons*	21%
Blue-gray Gnatcatcher	*Polioptila caerulea*	19%
Common Yellowthroat	*Geothlypis trichas*	15%
Song sparrow	*Melospiza melodia*	15%
Wood Thrush [3]	*Hylocichla mustelina*	15%
Hairy Woodpecker	*Picoides villosus*	13%
Indigo Bunting	*Passerina cyanea*	11%
Red-winged Blackbird	*Agelaius phoeniceus*	11%
American Goldfinch	*Spinus tristis*	10%
Northern Cardinal	*Cardinalis cardinalis*	10%
Northern Flicker	*Colaptes auratus*	10%
Sandhill Crane	*Antigone canadensis*	10%
Swamp Sparrow	*Melospiza georgiana*	10%
Brown Creeper	*Certhia americana*	8%
Eastern Towhee	*Pipilo erythrophthalmus*	8%
Pileated Woodpecker [1]	*Dryocopus pileatus*	8%
Field Sparrow	*Spizella pusilla*	6%
Red-tailed Hawk	*Buteo jamaicensis*	6%
Yellow Warbler	*Setophaga petechia*	6%
American Redstart	*Setophaga ruticilla*	5%

Appendix 4 (continued). Bird species documented during point-count surveys at Gratiot-Saginaw State Game Area. Species are arranged in descending order by the proportion of survey points at which they were detected.

Common Name	Scientific Name	Proportion of Points
Belted Kingfisher	*Megaceryle alcyon*	5%
Black-throated Green Warbler	*Setophaga virens*	5%
Cooper's Hawk	*Astur cooperii*	5%
Eastern Kingbird	*Tyrannus tyrannus*	5%
Gray Catbird	*Dumetella carolinensis*	5%
Red-shouldered Hawk [2]	*Buteo lineatus*	5%
Ruby-throated Hummingbird	*Archilochus colubris*	5%

1 a DNR featured species

2 a DNR featured species and species of greatest conservation need

3 a DNR featured species and species of greatest conservation need and a joint venture focal species

Appendix 5. Priority Conservation Areas identified within Gratiot-Saginaw State Game Area. Compartment and stand numbers associated with Priority Conservation Areas identified for Gratiot-Saginaw State Game Area.

Compartment	Stand numbers	Stands (n)
1	12, 22, 29, 41, 47, 86, 95, 121, 138, 140, 142, 143, 145	13
3	41, 43, 50, 52, 53, 64, 134, 135, 147, 148, 150, 152, 153	13
4	17, 20, 31, 75, 85, 109, 114, 120, 132, 137	10
5	1, 6, 9, 31, 116, 119, 122, 149, 151, 174	10
7	5, 24, 27, 31, 33, 37, 43, 60, 62, 73, 76, 77, 82	13
8	33, 38, 42, 46, 49, 50, 51, 52, 60, 62, 65, 67, 75, 76, 79, 85, 86, 87, 91, 95, 96, 99, 107, 120	24
Total		**83**

Appendix 6. Potential Locations for Hydrological Restoration at Gratiot-Saginaw State Game Area Compartment and stand numbers identifying locations recommended for investigation of potential hydrological restoration.

Compartment	Stand numbers
4	29, 73, 101
7	4, 8, 37
8	62, 75, 95