Management Plan

Lloyd & Mabel Johnson Preserve

June 2010

LEGACY LAND CONSERVANCY

LEGACY Land Conservancy

Protecting and Preserving Southern Michigan

Management Plan for the Lloyd & Mabel Johnson Preserve

Pittsfield Township, Washtenaw County, Michigan

Prepared by Elizabeth Durfee
June 2010

This document expands on the research and recommendations provided in the Baseline Documentation Report prepared by Catherine Marquardt in 2007, and the reports prepared by Herpetological Resource and Management, LCC in 2008, and by the University of Michigan students in the Ecological Restoration course in 2008. The plan contains a description of the preserve, management objectives, and management actions. Management actions are broken down into short term (0-3 years), mid term (3-8 years), and long term goals (8 years or more), as well as immediate and annual needs. Where possible the personnel, time, and cost needed to implement specific management actions are estimated and additional resources and references are suggested.

Thank you to Dana Wright and the Legacy Land Conservancy Staff and steward David Read for their assistance with the preparation of this document.

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INTRODUCTION

Legacy Land Conservancy Preserves

Legacy Land Conservancy (Legacy) seeks to preserve land that varies in location and represents a variety of functions and ecosystem types. The specific characteristics of the property and availability of assets and resources, such as funding or a preserve adopter, also influence the selection of properties to preserve.

General Property Description

The Lloyd and Mabel Johnson Preserve (Johnson Preserve) is located northeast of the intersection of Platt and Morgan Roads in Pittsfield Township, Washtenaw County, Michigan, approximately 0.25 miles west of US-23, 0.5 mile south of I-94 and 1 mile north of US-12 (Michigan Avenue). The Johnson Preserve is 51.6 acres and configured in an "L" shape and has approximately 486 feet of frontage on the east side of Platt Road (Map 1).

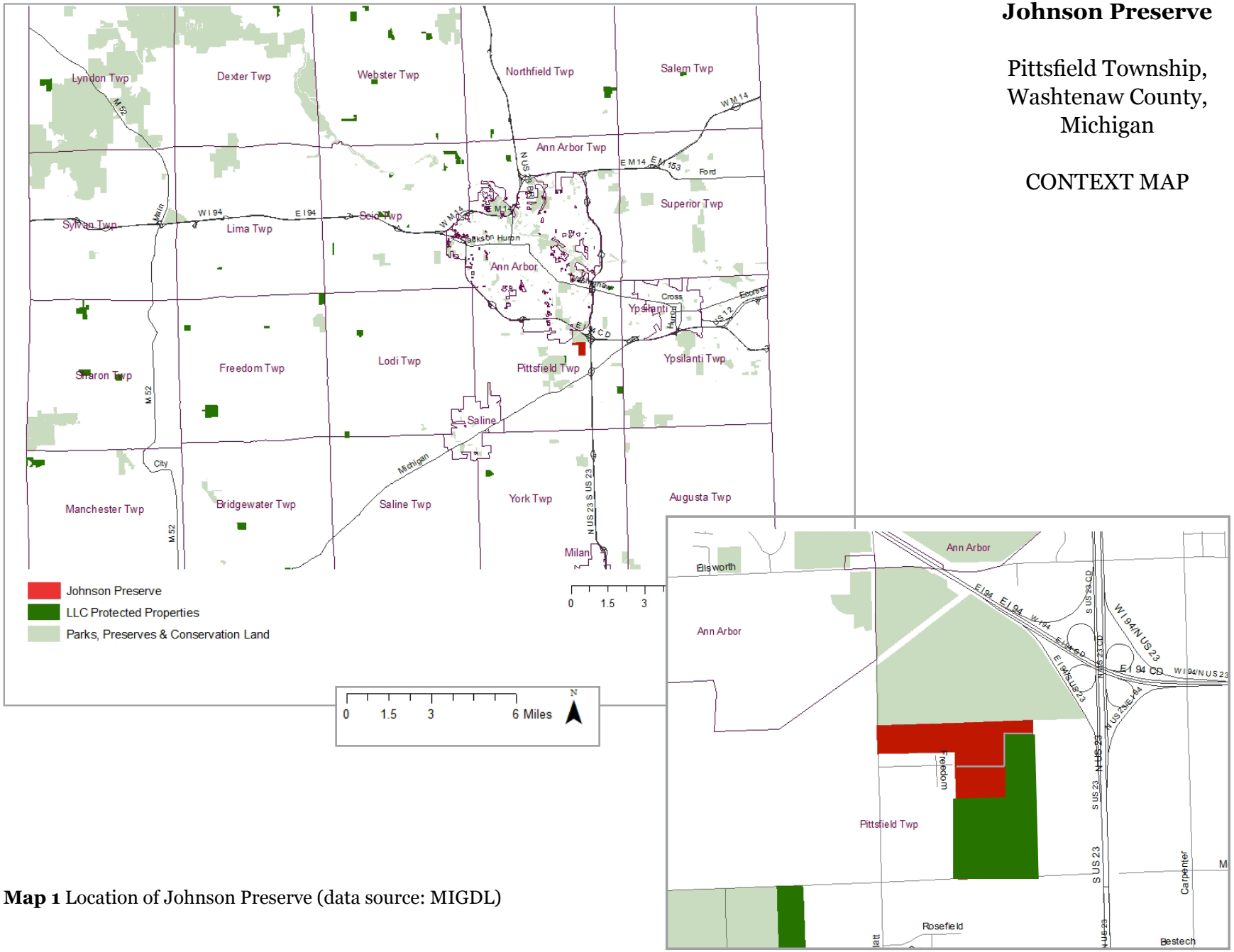
The Johnson Preserve consists of a mature forest remnant and several agricultural fields. Approximately 40 percent of the preserve is wooded and there is a wetland within the northern, wooded area. The western portion of the property is cultivated and the eastern portion of the site is mature oak/hickory forest with a strong 10-20 year-old invasion of buckthorn. Fifteen acres are currently leased to and farmed by Broadview Farms under an annually renewed license to farm. Early succession forest occupies fence row areas between the four crop fields.

Electrical lines run along Platt Road, and the western border of the eastern portion of the site. With the exception of a cell phone tower and accessory structures in the northwest corner of the subject property, no buildings are present.

Johnson Preserve

Pittsfield Township,
Washtenaw County,
Michigan

CONTEXT MAP



Map 1 Location of Johnson Preserve (data source: MIGDL)

Land Use History

Prior to European settlement, the Lloyd & Mabel Johnson Preserve was covered by oak-hickory forest or dry-mesic southern forest (See Appendix I). Clearing of land for logging and agriculture, as well as fire suppression during the 1800 - 1900's have contributed to a decline in the aerial extent of oak-hickory forest in southern Michigan. The areas adjacent to the Johnson Preserve to the north were farmed in the last century, and are now early succession forest with a high prevalence of invasive shrubs. The Johnson Preserve is wet a good portion of the year and has mostly been left. The acres which have been amenable to farming are currently being farmed.

Acquisition

The property was donated to Legacy Land Conservancy by the Lloyd and Mabel Johnson Foundation, Inc., a non-profit corporation of 10315 East Grand River, Ste 301, Brighton, MI 48116, on November 11, 2007.

Surrounding Uses

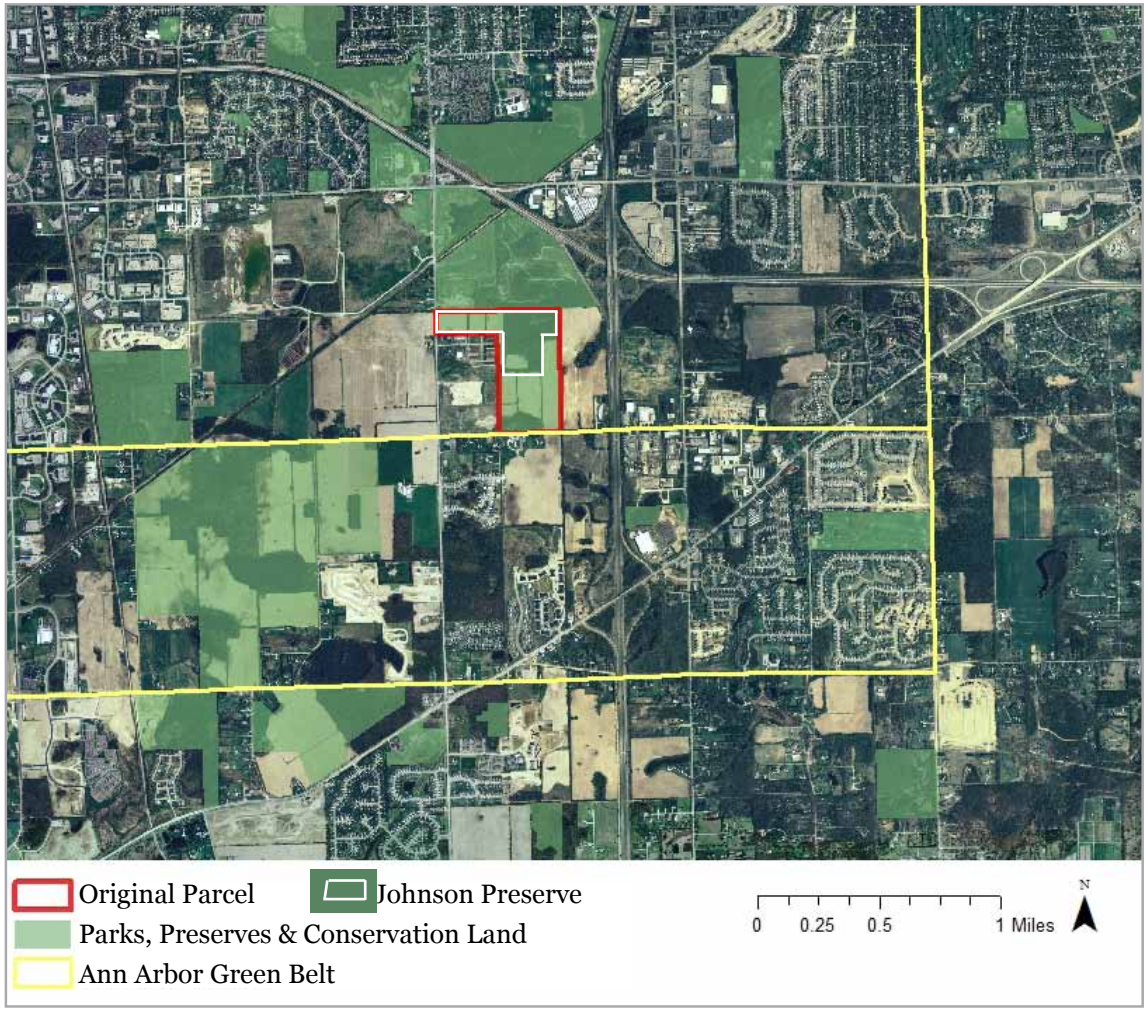
Surrounding land uses include park land, scattered office and commercial uses and residential development at Michigan Avenue and Platt Road, a small industrial park located on private Platt Lane, and agriculture. Adjoining land uses include community park woodlands, and quarry to the north; agricultural properties, commercial buildings and residential properties to the south; agricultural properties to the east; a sand pit to the northeast; and agricultural properties and commercial buildings to the west (Map 2).

Connectivity

Lillie Park, a 148-acre Pittsfield township recreational area borders the preserve to the north. The park, a reclaimed gravel pit and agricultural field, contains three miles of ADA accessible trails, play structures, lakes, and picnic areas and is frequently used by the surrounding community for passive recreation.

The Johnson Preserve is located less than 1 mile from the Pittsfield Preserve, a 535-acre park that supports a Great Blue Heron colony of over 40 nests, a buttonbush swamp harboring threatened species, and numerous small wetlands, forest remnants, and open meadows. The Lloyd & Mabel Johnson Preserve is also located within the Ann Arbor Greenbelt boundary, which increases the likelihood that the future land conservation efforts in the area may create larger areas of contiguous habitat for native species.

Pittsfield Township's Platt Road Greenway, which will connect residential developments with recreational and open spaces around Lillie Park through the City of Ann Arbor's sidewalk and bike lane networks, connects to the County Farms Park on Washtenaw Avenue and Gallup Park along the Huron River, and other local parks including the Lloyd & Mabel Johnson Preserve. Additionally, the Preserve is located less than ½ mile from the rails to trails greenway.



Johnson Preserve

Pittsfield Township,
Washtenaw County,
Michigan

SURROUNDING
LAND USE

Map 2 Aerial Image of the Johnson Preserve and surrounding land uses (data source: MI DTMB, City of Ann Arbor)

Classification and Purpose

The Lloyd & Mabel Johnson Preserve is an accessible preserve that serves to protect nature, provide residents with passive recreational and educational opportunities and demonstrate opportunities to partner with other local organizations. Additional parking and new trails will encourage further use of the preserve.

The purpose of this management plan is to provide a framework to guide management of the Johnson Preserve. The plan provides current and future land managers, stewards, and the community at large with information about the preserve to aid in ensuring long term protection.

The management objectives for the Johnson Preserve include protecting the ecological integrity of the preserve, maintaining the preserve as an opportunity for recreation and education, and using the preserve to model partnerships between land protection programs and other organizations.

Preserve: Johnson
Location: Pittsfield Township, Washtenaw County

Assets/ Characteristics	High Quality	Low Acquisition Costs	Low Stewardship Costs	Preserve Adopter Potential	Size		
Function	Teaching Tool/ Educational Opportunity	Research Potential	Urban Preserve	Proximity to other Protected Land	Community Use		
Ecosystem	Prairie	Woodland	River Corridor	Fen	Bog	Marsh	Farmland	Organic Farmland

SITE DESCRIPTION

Soils

The site is composed of glacial debris left over from the last major period of glaciation, which receded from this part of Michigan around 14,000 years ago. Glacial till in this area is composed of unstratified sand, gravel, silt, and clay in eskers, kames and moraines, while sorted silts, sand and gravel are found in outwash plains and alluvial fans.

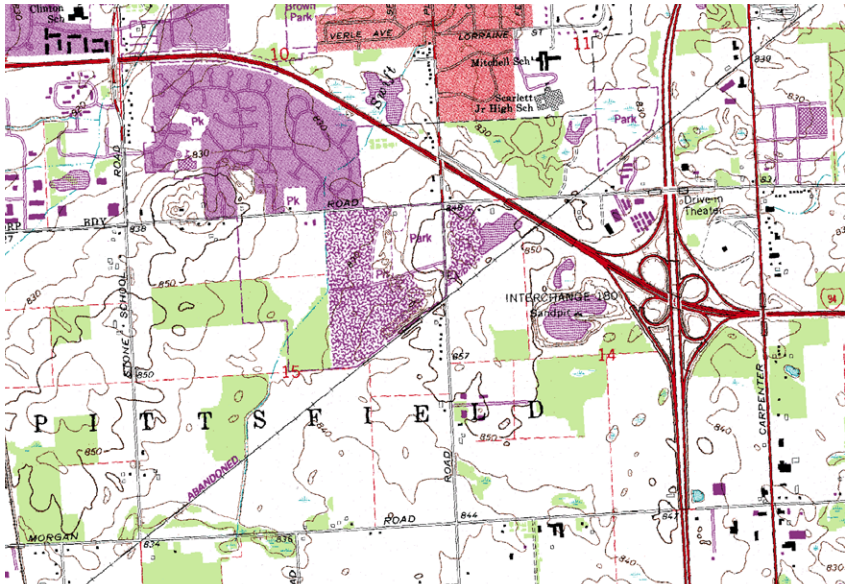
Soil types, identified by the U.S. Department of Agriculture soil survey, include Morley Loam, Blount Loam, and Pewamo Clay (Map 3).

MoB Morley Loam, 2 to 6 percent slopes: Well drained and moderately drained soils formed in loamy textured glacial till. Soils have a high available water capacity and permeability is moderately low or low. Most of the acreage is used for crops. Some small areas are in woodland.

BbB Blount Loam, 2 to 6 percent slopes: Poorly drained, nearly level soils formed in loamy textured glacial till. Soils have a high available water capacity and permeability is moderately low. Most of the acreage is used for crops. Some small areas are in woodland.

Pe Pewamo Clay Loam: Soil is in depressional areas and broad low-lying areas. This soil has a high water table and is too wet for crop production unless drained. Runoff is very slow. Depressional areas are subject to flooding by runoff from adjacent areas. Most of the acreage is wooded. Some small areas are farmed.

Map 3 Johnson Preserve Soil Types (data sources: USGS, MI DTMB)



Ecology

See Appendix I for a summary of the different ecological habitats present.

Topography

The topography is fairly level and undulating, or gently rolling. Elevation ranges from about 840-850' above mean sea level. Wooded areas contain pit and mound micro topography (Maps 4 and 5).

Hydrology

A drainage ditch running through the southern woodland appears to flow to the southwest and empty into the ditch on the edge of the property. The closest permanent surface water body is the Swift Run Marsh, approximately 1.0 mile north/northwest. Groundwater is assumed to flow in a north/northwesterly direction. The site is designated as an area of minimal flooding by FEMA. Pooled water was present throughout much of the site in May and June, 2010.

Map 4 Aerial image of Johnson Preserve with contour lines (above)
Map 5 Pittsfield Township topographical map clip
(data sources: MI DNRE, MI DTMB)

MANAGEMENT OBJECTIVES

Overview of Goals

The primary management goals for the Johnson Preserve include:

- **Identify a Preserve Adopter to aid in preserve management and to help lead stewardship activities.**
- **Maintain and enhance the ecological integrity of the preserve, particularly the higher quality areas surrounding the button bush swamp.**
- **Connect the trail system to Pittsfield Township's Lillie Park trail system and coordinate management strategies.**
- **Build partnerships with Pittsfield Township and local organizations for developing the preserve's resources.**
- **Identify opportunities to use the agricultural fields for a start up Community Supported Agriculture (CSA) farm or community farming program and to restore the southern field into an oak savannah.**
- **Increase public access and provide the community with the opportunity to utilize the preserve for recreation and educational purposes .**
- **Investigate opportunities to secure long term funding for the preserve.**

Existing Resources & Assets

- Annual allocated funds
- Preserve fund balance: $4584.59
- Relationship with Therapeutic Riding Program
- Legacy Stewardship Committee and volunteers
- Leased agricultural land

Management Obligations

Legacy is required to monitor the preserve annually. Photo monitoring points have been established.

Improvements

Trails create recreational, educational, and physical fitness opportunities for visitors, as well as enhance the marketability of an area. Trails provide hands-on learning opportunities in an outdoor classroom for people of all ages to explore and enjoy freely or for organized educational opportunities such as nature hikes, bird watching, or plant identification.

Currently, the existing trail is marked by logs and tree limbs and is, in areas, indistinguishable. In addition, areas of the trail, particularly near the hedgerows and in the wetland, experience flooding. Constructing a boardwalk would increase year-round accessibility and use.

Parking, signage, and educational information would also enhance visitors' experiences.

Trail system:

- Maintain and improve existing trail
  - Ensure trails are properly marked and navigable
- Expand existing trail system
  - Connect northern woodland loop trail to Lillie Park trails
  - Establish new trail to the southern portion of the preserve

Parking:

- Provide parking along the dirt road adjacent to the southern border of the agricultural fields

Visitor Amenities:

- Create signs
  - Erect a sign with information about the preserve and a map at the preserve entrance
  - Place interpretive signs within different ecological habitats to educate and inform visitors
  - Construct a bench near the button bush swamp to provide visitors with a place to rest and observe birds and other wildlife

Invasive Species Control

- Prevent establishment of new invasive species
- Remove autumn olive and honeysuckle from field perimeters
- Establish regular workdays for buckthorn removal focusing on the area surrounding the button bush swamp and the southern field
- Coordinate with Pittsfield Township to establish a plan for managing woody invasives at the northern boundary of the preserve and southern boundary of Lillie Park
- Utilize volunteers and multiple methods of invasive species removal such as hand pulling, cutting and applying herbicide, and prescribed burns to control invasives

Buttonbush Swamp Management

- Maintain natural hydrological function to ensure protection of the wetland and button bush swamp
- If nearby road construction or development is not preventable, seek to mitigate impacts on the hydrological cycle
- Provide habitat for wildlife by promoting native plant diversity
- Remove patches of buckthorn and Japanese barberry surrounding the swamp

Woodland Restoration

- Manage buckthorn in wooded area to promote native understory
- Provide habitat for wildlife by promoting native plant diversity
- Remove autumn olive and honeysuckle from perimeter of field and Lillie Park
- Thin canopy to allow more sunlight and promote native herbaceous species
- Remove and transplant native species from within the trail
- Burn to reduce invasive species and promote native species

Agricultural Fields

Western Fields

- Utilize existing agricultural fields to demonstrate the value of preserving farmland
- Investigate opportunities to utilize the northern fields for community-oriented farming purposes such as:
  - A location for a new community supported agriculture farm in Pittsfield Township
  - Demonstration plots for research or educational purposes (rain garden, specialty crops, etc.)
  - Community garden plots for residents
  - A startup farm to increase availability of fresh local food
  - A nursery garden for native plants and trees
  - A site for educational workshops about farming
- Identify opportunities to establish partnerships with organizations
- Maintain and enhance soil quality with sustainable, organic farming practices

Southern Field Restoration

- Establish native vegetation in the southern field. The southern field lacks the accessibility and visibility of the fields to the northwest and as a result is not as suitable for a community-oriented farming venture. Restoring the field to a more natural landscape would provide diverse habitat for wildlife and create more interest for visitors, in addition to improving the ecological quality of the preserve.

Establishing a gradient from woodland to oak savanna to prairie may be appropriate for this southern portion of the agricultural land (Figure 8).

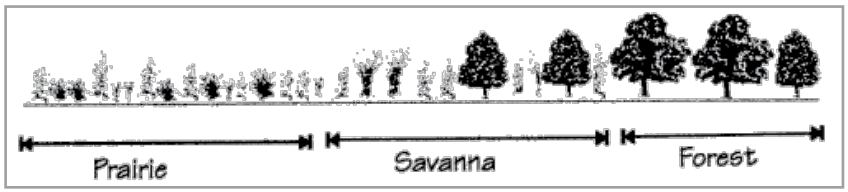
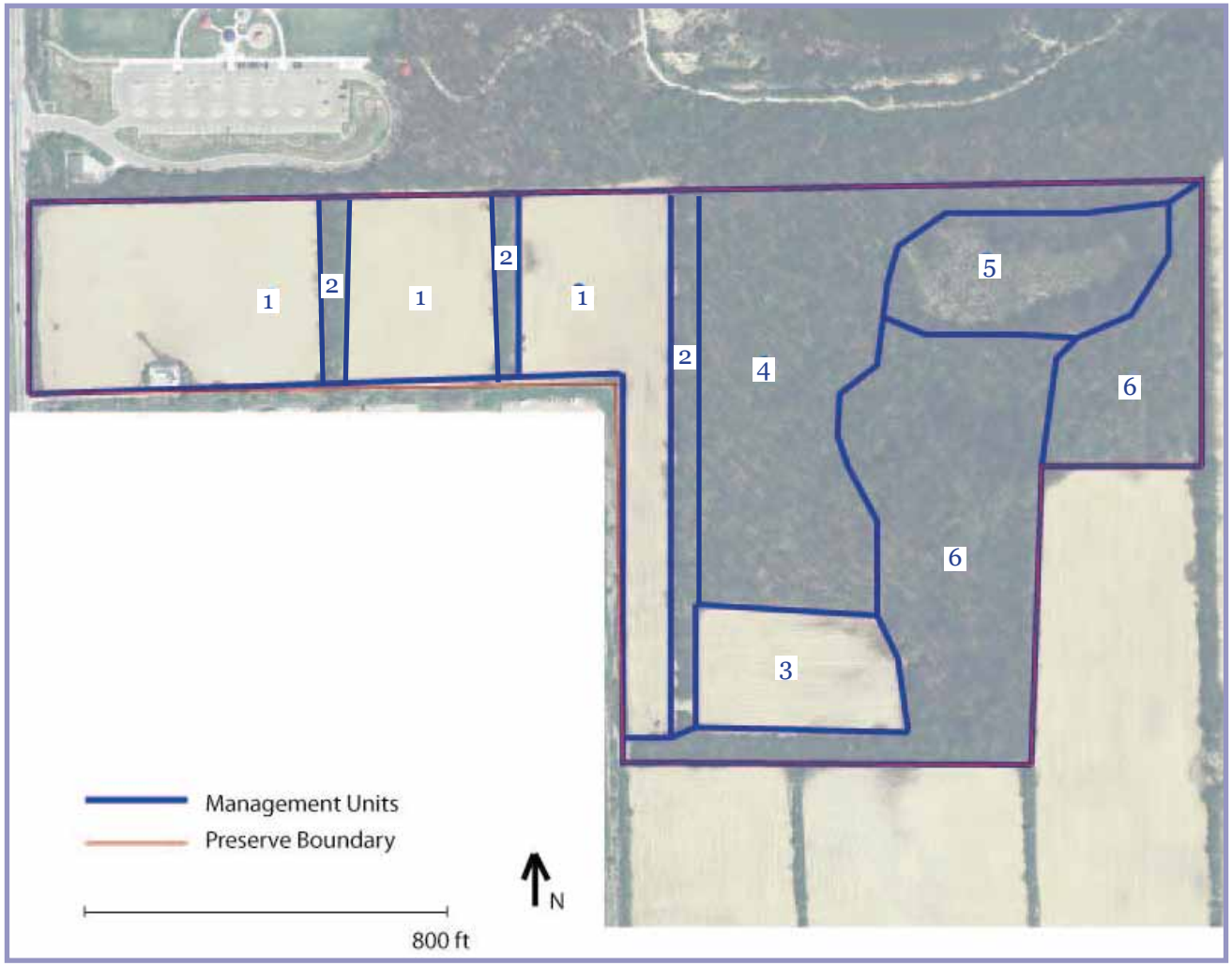


Figure8 Image of prairie, savanna, forest structure (image source: http://www.dnr.state.mi.us/publications/pdfs/huntingwildlifehabitat/landowners_guide/habitat_mgmt/grassland/Prairie_Restorations.htm)

IMPLEMENTATION

Management Units

Six units have been created for management purposes. Management units are based on ecological communities identified by a Johnson Preserve Habitat Mapping survey completed by Herpetological Resource and Management, LCC in 2008 and the Baseline Documentation Report prepared by Catherine Marquardt in 2007, as well as by management needs. See Map 6.



Map 6 Johnson Preserve management units (data source: MI DTMB)

Management Actions

1. **Conduct a detailed biological survey** of plants and animals. In order to identify all species present within an area it is necessary to conduct a survey at least 3 times, during different seasons. The time required to conduct a survey is variable by plant community, travel time, size, accessibility of site, and surveyor. An inventory of 10 acres would take approximately 2 hours, times 3 visits would amount to approximately 30-40 minutes/acre. Approximately 20 acres of the Johnson Preserve are wooded and would require an estimated 10-15 hours to inventory. The remaining acreage consists of agricultural fields and hedgerows, which would require less time to inventory. If fields are to be restored to prairie or savanna, however, a more thorough survey to identify any existing native grasses and wildflowers may be desired. Approximately 30% additional time would be required for office work. The cost to contract a professional is also variable and may range from $60-100/hour. In total, an investment of approximately 20 hours and $1200-$2000 may be required for a professional plant inventory.

Time Frame:	**Immediate**
Personnel Needed:	**Contract Professional**
Estimated Cost:	**$1200-$2000**
Approximate Time:	**20 Hours**
Resources:	**Greg Vaclavek,** **Native Plant Nursery LCC** **734-677-5860** **plants@nativeplant.com** **David Mindell** **PlantWise** **734-665-7168** **Plantwise@aol.com**

2. Identify a preserve adopter and establish a regular steward group to assist Legacy with managing volunteer work days and monitoring of the preserve.

Time Frame:	**Immediate**
Personnel Needed:	**Staff**

3. Collect GPS points to map out:

a) Rare species (1-2 hours)
b) Trail system (1-2 hours)
c) Management zones (2-3 hours)

Time Frame:	**Within 0-3 years**
Personnel Needed:	**Staff or volunteer**
Estimated Cost:	**$50-$200 for GPS equipment**
Approximate Time:	**5-9 Hours total**
Tools:	**GPS unit**
Resources:	**http://www.thegpsstore.com/Garmin-BirdsEye-Satellite-Imagery-Card-P2330.aspx, http://www.thegpsstore.com/Handheld-GPS-C2.aspx**

4. Maintain and update a species list on the website to track species and attract visitors to the preserve. A list of species identified within the preserve should be maintained and publicly available. Once established, this list could easily be updated as necessary by a staff member, office volunteer, or an intern.

Time Frame:	**Within 3-8 years**
Personnel Needed:	**Staff or volunteer**
Approximate Time:	**2-3 Hours to create, 1 Hour to update**

5. Conduct annual photo monitoring. Legacy is required to photo monitor annually. This will allow changes in the preserve to be monitored over time.

Time Frame:	**Annual**
Personnel Needed:	**Staff or volunteer**
Approximate Time:	**2 Hours**

6. Remove invasive woody species from woodland (Units 4, 5, 6) and hedgerows (Unit 2):

Buckthorn is pervasive throughout the wooded areas as well as in the hedgerows. Due to the extent of invasion in the Johnson Preserve, eradication will be a long term process. Honeysuckle and autumn olive should also be removed from the hedgerows and perimeters of fields.

The amount of time required to remove buckthorn, honeysuckle, and autumn olive is dependent on the size of the tree, density of the understory, pervasiveness of buckthorn, number of volunteers, how much prep work is required, and whether cut trees are dragged away, chipped, or left on site (see appendix E for specific removal methods). Buckthorn seed can remain viable for as long as 5 years in the soil and follow up is necessary. After cutting, buckthorn logs can be left to decompose, left in scattered piles for wildlife to use, or used to mark trails or to fence off particular areas. If buckthorn is chipped on site it can be used on trails.

Management Unit:	**2**
Time Frame:	**Initiate within 3-8 years**
Personnel Needed:	**Staff, 5-10+ volunteers**
Approximate Time:	**Total of 6-10 Full workdays**
Tools:	**Handsaws, loppers, chainsaw, herbicide**

Management Unit:	**4**
Time Frame:	**Initiate within 3-8 years**
Personnel Needed:	**Staff, 5-10+ volunteers**
Approximate Time:	**2-5 workdays/year - 5 years**
Tools:	**Handsaws, loppers, chainsaw, herbicide**

Management Unit:	**5**
Time Frame:	**Initiate within 0-3 years**
Personnel Needed:	**Staff, 5-10+ volunteers**
Approximate Time:	**Total of 6-10 Full workdays**
Tools:	**Handsaws, loppers, chainsaw, herbicide**

Management Unit:	**6**
Time Frame:	**Initiate within 3-8 years**
Personnel Needed:	**Staff, 5-10+ volunteers**
Approximate Time:	**2-5 workdays/year - 5-8 years**
Tools:	**Handsaws, loppers, chainsaw, herbicide**

- Prescribed burns can be an effective method to kill some invasive species. Depending on the nature of the site and prep time required, burning can take less than an hour to an entire day plus travel time, setup, and time to acquire permits. Wooded sites with steep terrain, limited or no vehicular or water access, and many downed logs are more expensive, while flat prairies are less expensive. Insurance costs are significant. Restoring Nature With Fire estimates a cost of approximately $2500-3000 per burn.

  Burn the upland woodland in Units 4 and 6 to reduce invasive species and promote native species. Repeated, hot burns may be necessary to inhibit/remove young buckthorn. Burning the area north of the swamp where fewer buckthorn are present will be beneficial to the native herbaceous plants. Spring burns (late March-early May) are appropriate for controlling buckthorn seedlings. Burning every other year may be required to fully eradicate buckthorn in the woodland.

Management Units:	**4,6**
Time Frame:	**Initiate soon after invasive shrubs have been removed and repeatedly every other year for 8-10 years.**
Personnel Needed:	**PlantWise, or Restoring Nature With Fire**

Lloyd & Mabel Johnson Preserve

Pittsfield Township,
Washtenaw County,
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APPROXIMATE
LOCATION OF
INVASIVE SPECIES

Map 7 Johnson Preserve invasive species removal needs (data source: MI DTMB)

7. Repair existing trail and build new trails to establish a well-marked, accessible trail system.

The Johnson Preserve's current trail system follows the entire northern border of the fields as well as the southern and eastern borders of the west field (see Appendix E for trail map). In order to provide visitors with the opportunity to view the fields as well as to protect crops from foot traffic, trails should be improved.

Trails should be clearly marked. After new portions of the trail are blazed ,precaution should be taken to transplant native herbaceous plants to surrounding areas. Trails should be a minimum of five feet wide and a maximum of seven feet wide. Trail construction can occur at any time except during freezing temperatures and is an activity that is easily performed by a group of volunteers. Trail maps should be created and placed at entrance.

Trails require annual maintenance including pruning, mulching, downed tree removal, and checking signs for repair needs.

a) Maintain trail through woodland.

i. Patches of Jack-in-the-pulpit, wild geranium, sedges, and May apples lie within patches of the existing trail. These should be transplanted to the side of the trail by a group of volunteers.

Time Frame:	**Immediately**
Personnel Needed:	**10-15 Volunteers**
Approximate Time:	**3-6 Hours**
Tools:	**Shovels, crates or tarp to move transplants**

ii. Poison ivy should be removed from the trail. Plants can be cut and roots dug up, black plastic can be placed down on top of vines, or an herbicide can be sprayed on the plant.

Time Frame:	**Immediately**
Personnel Needed:	**1-2 Staff**
Approximate Time:	**8-16 Hours**
Tools:	**Shovels, herbicide**

c) Educational signage should be placed at key locations such as trail entrances and intersections. Information provided on the signs should include wayfinding maps and restoration activity. Interpretive signs increase the educational experience of preserve users and help visitors learn about local flora, fauna, ecosystems, specific projects, demonstrations or restoration activities, or potentially hazardous conditions. A small kiosk or sign and trail map at the entrance can convey important information to visitors including maps, information about Legacy Land Conservancy and the Johnson Preserve, unique species or hazardous (such as poison ivy) to be on the look out for, emergency numbers, and a donation box.

Time Frame:	**Within 3-5 years**
Personnel Needed:	**Staff, volunteer, or student to design signs**
Approximate Time:	**2-4 hours each sign**
Estimated Cost:	**$200 - $300**

d) A new trail could be constructed to allow visitors to access the southern portion of the site where the field restoration will occur.

e) Ensuring that the trail is accessible may require the installation of a boardwalk. Approximately 120' of boardwalk may be needed to traverse the wettest portion of the trail.

A boardwalk supported on the ground every 4' with lateral 6" x 6" or 4" x 4" (depending on depth of water) beams cut in 2" sections with two side by side 2" x 6" forming the walking surface would be appropriate for Johnson Preserve.
A range of materials are used for boardwalks including:

- Lumber pressure treated with water sealant
- ACQ (Alkaline-Copper-Quat) pressure treated lumber
- Fiberglass reinforced plastic (FRP) lumber
- recycled plastic

Plastic composites may be environmentally safer, however they are typically more expensive and can become brittle in the cold.
If wood is used, rough sawn lumber is less slippy when wet.

Time Frame:	**Within 3-8 years**
Personnel Needed:	**Staff, 3-5 volunteers**
Approximate Time:	**8-10 Workdays**
Tools:	**Pruners, loppers, paint for marking trail, chainsaw, herbicide**
Time Frame:	**Within 0-3 years**
Personnel Needed:	**Staff, 5-7 Volunteers**
Estimated Cost	
ACQ Pressure treated lumber:	**$10 per linear foot x 120 feet= $1200**
Recycled plastic from Bear Board:	
Approximate Time:	**2-3 Workdays per boardwalk section**
Tools and Material:	**Saws, lumber,screws and cordless drills, shovels, pickaxe**
Resources:	http://www.actontrails.org/BoardwalkDesign.pdf http://atfiles.org/files/pdf/BMPmanual2004.pdf

Map 8 Johnson Preserve existing and proposed trails (data source: MI DTMB)

8) Until future projects are implemented fields should continue to be used for cultivation. The lease agreement could require future tenants to engage in compatible farming practices that will meet the needs of the renter while also offering complementary ecosystem support of the Johnson Preserve. Prohibiting chemical fertilizers is recommended. Off season cover crops are recommended, such as winter wheat, winter barley, or annual rye, which replenish nutrients and provide browsing material. In the future, there is potential that Therapeutic Riding, Inc. would sell or donate horse manure to the farmers as compost.

See Johnson Preserve student reports for additional agriculture information. See Appendix F for recommended cover crops for the preserve.

9) Utilize fields for community based agricultural program. Fields could be used for community supported agriculture, as garden plots for local residents, or subdivided and used by organizations or groups to explore innovative agricultural methods.

Time Frame:	**Within 3-8 years**
Personnel Needed:	**Staff, community partner, student group**

a) Discuss community gardening plots with officials and community members of Pittsfield Township.

b) Seek opportunities to partner with local organizations to establish educational and demonstrational sustainable food projects. See Appendix G for resources and potential partnership opportunities.

c) Investigate the opportunity to form a community land trust and the legal structure associated with establishing a separate non-profit. Seek opportunities to utilize student groups to prepare a business plan model and investigate optimal land use and business strategies for this property (Appendix G).

d) Identify barriers and resources such as property taxes, management needs and requirements, tools and equipment, and water sources.

- Pittsfield Township's current ordinances permit the use of a private well for irrigation purposes only. If domestic water is needed, the parcel would need access into the utility service district water and sewer mains would need to be constructed. For additional information contact Mike Luptowski, Utilities Director, Pittsfield Township 734.822.2109.

  The ability to construct and utilize a well on site (as opposed to utilizing municipal water mains) increases the feasibility of small scale organic farms significantly. A well ($5000-6000) with 4.5 foot deep water lines may cost a total of approximately $14,000.

10. Restore southern agricultural field (Unit 3).

Establishing native prairie and oak savanna communities is a long term, resource and management intensive process. The site is highly modified and lacks seed bank of native grasses and forbs. Establishing a native community will involve removing exotics, seeding in early successional native species, burning, and gradually introducing more diversity of native species each year. Burning, tilling, and herbicide will be required to prepare the site.

See Appendix H for additional information.

Time Frame:	**Initiate within 3-8 years, long term project**
Personnel Needed:	**Staff, volunteers, contract professionals**
Estimated Cost:	**Seeds and plants - $5000**
Resources:	**Dave Borneman http://www.restoringnaturewithfire.com/contactus.html** **David Mindell http://www.plantwiserestoration.com/** **Bill Schneider, WildType http://www.wildtypeplants.com/**

a) To prepare field closely mow, rake, and allow vegetation to re-grow to approximately 6-8 inches tall. Apply glyphosate to kill existing vegetation. Applying after the first frost is most effective. Shallow till to remove weeds. Pack soil.

b) Hand sowing seeds is the most inexpensive and may be manageable given the size of the field. Alternatively, a seed hand drill or mechanical broadcaster could be purchased or borrowed. To ensure seeds are in contact with soil, rolling or culipacking may be required.

A mix of 5-8 species of grass and 15-20 flowering species is recommended. Seeding rates for grasses and forbs are 10-14 lbs/acre and 0.5-2 lbs/acre, respectively. Collecting and using local genotypes is optimal. Approximately 35 lbs of grass seed and 2 lbs of forb seed would be needed for the approximately 3.5 acre southern field.

See Appendix H for native seed mix suppliers.

c) Native grasses often require at least three full years to establish themselves and may be sparse and only 6-8" tall during the first year. Native grasses, such as big blue stem, little blue stem, Indian grass, and switchgrass and forbes should be mixed to provide diversity. Soil pH should be tested to determine soil suitability for native grasses and forbes. Native grasses, such as those listed above, require a pH above 5.5.

d) Managing competition is crucial in the first two growing seasons. The unit should be monitored for unwanted species after planting. Hand pulling and burning are effective methods to manage most weeds.

e) The field (or sections of the field) should be burned on a 2-3 year rotation

f) Burn sections of the woodland adjacent to the fields on a 2-3 year rotation to remove invasive species and encourage native sedges and grasses.

(references: IA State Extension, MI DNRE)

11. Construct a parking area. A parking area should be constructed near the cell tower. This may require using a small portion of the east field (Unit 1). However it will encourage visitor use, provide a place for visitors to park, and increase the preserve's capacity to support future parking demands uses such as agricultural demonstrations or guided walks.

At a minimum, parking near the cell tower should be expanded to fit at least 4-5 vehicles, approximately 36'x11' to 45'x11' (396-495 sq ft). Gravel would be the least expensive material and could be delivered and spread by volunteers.

Time Frame:	**Within 0-3 years**
Personnel Needed:	**3-5 Volunteers**
Estimated Cost:	**$400 ($1/sq ft)**
Approximate Time:	**2-3 hours**
Tools and Materials:	**Gravel, shovels, metal rake**

13. Organize a stewardship campaign to raise funds for preserve management.

Time Frame:	**Within 3-8 years**
Personnel Needed:	**Staff**

14. Investigate opportunities to work with students on ecological restoration projects.

Time Frame:	**Within 3-8 years**
Personnel Needed:	**Staff, students**
Resources:	**Potentially interested UM professors/staff: Bob Grese, Don Zac, George Kling, Dan Brown, Shannon Brines, Christopher Ellis**

15. **Evaluate effectiveness of management strategies.** Compare data from biological surveys with species diversity and abundance from other local natural areas, such as those managed by Natural Area Preservation. Monitor for wetland indicator species.

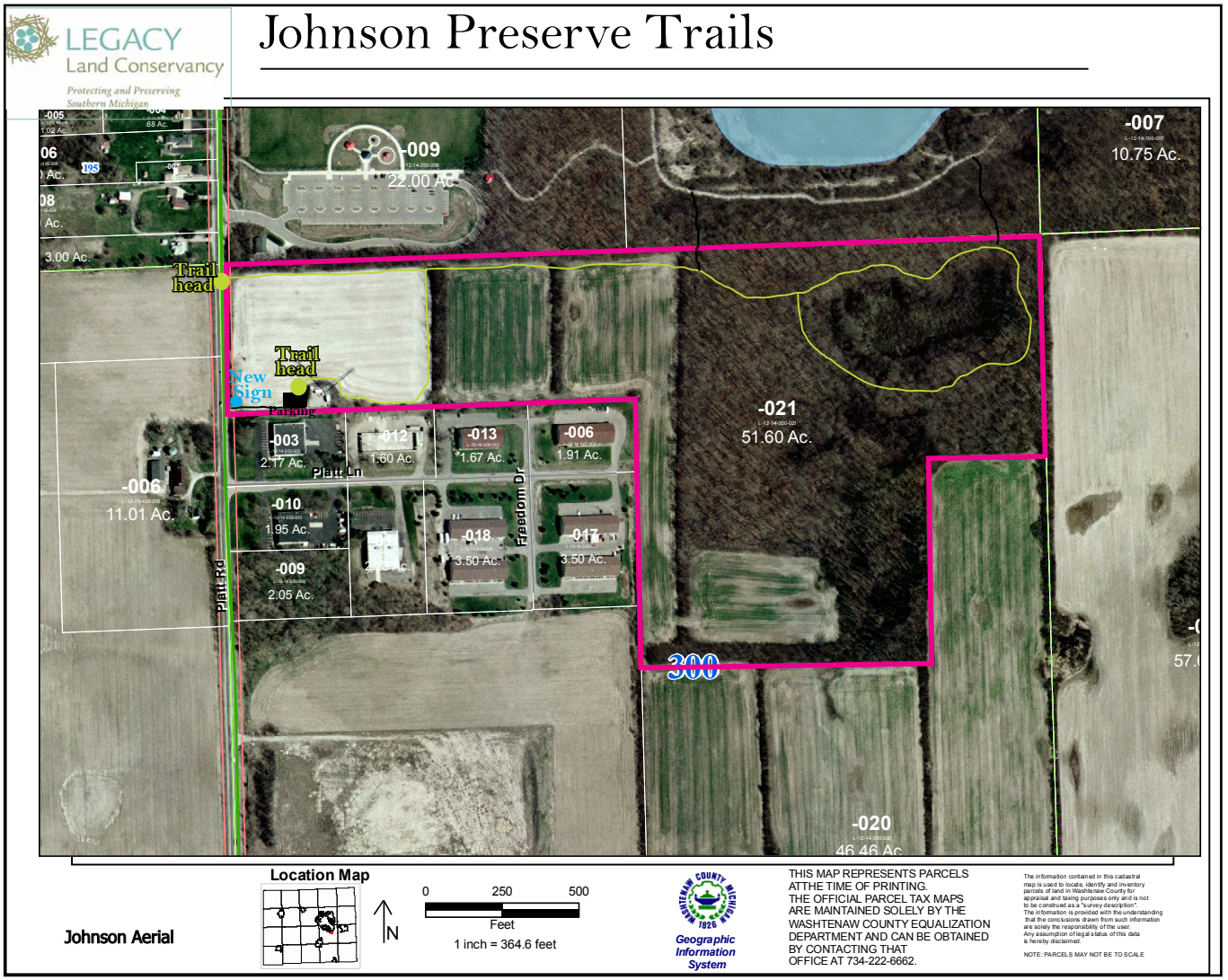
16. **Update management plan** every 3-5 years or as needed. If rare or uncommon species are discovered, management should be modified to prioritize their habitat/the species, and to ensure that we do not harm the species. Evaluate success of agricultural restoration plan and modify management strategies as necessary.

CONCLUSION

The Lloyd & Mabel Johnson Preserve is unique property consisting of actively farmed agricultural fields, oak-hickory forest, and shrub swamp. The preserve's location adjacent to Pittsfield Township's Lillie Park and the new Platt Road Greenway present an opportunity to partner with the Township to increase the recreational and educational opportunities for the community. Management activities for the preserve include protecting the buttonbush swamp, removing buckthorn and other woody invasives from the woodland and hedgerows, and potentially restoring agricultural land to a native prairie or oak savanna community. Regular work days should be established to undertake invasive species removal as well as trail maintenance in the preserve. The preserve also provides an opportunity to establish partnerships with local organizations and utilize the agricultural fields for community-based agricultural purposes.

APPENDIX A

Map and Directions



Directions:

To reach the property from US 23 and Washtenaw Ave., travel west on Washtenaw Ave., then turn south (right) onto Platt Road. Travel south on Platt Road past Ellsworth. The Preserve entrance is the 4th driveway to the left off of Platt Road beyond Ellsworth and is just south of Lillie Park South parking lot. Parking is available next to the cell phone tower.

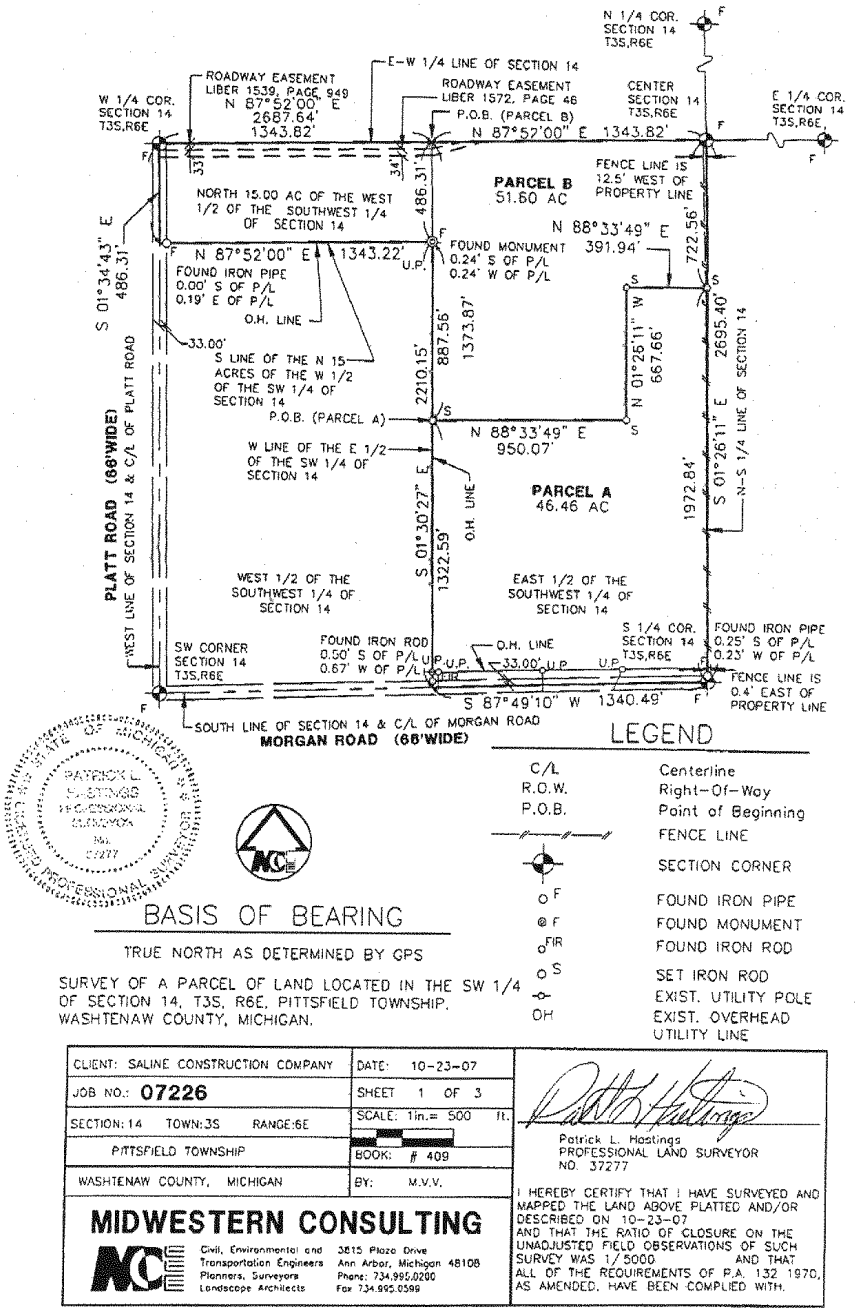
APPENDIX B
Legal Description and Sketch of Johnson

Legal Description:

Parcel A: Commencing at the west ¼ corner of Section 14, T3S, R6E, Pittsfield Township, Washtenaw County, Michigan; thence north 87052'00" east 1343.82 feet along the east-west ¼ line of said Section 14; thence south 01030'27" east 1373.87 feet along the west line of the east ½ of the southwest ¼ of Section 14 to the point of the beginning; thence north 88033'49" east 391.94 feet; thence south 01026'11" east 1972.84 feet along the north-south ¼ line of said Section 14 to the south line of said Section 14 and the centerline of Morgan Road (66' wide); thence north 01030'27" west 1322.59 feet along the west line of the east ½ of the southwest ¼ of section 24 to the point of beginning, being a part of Section 14, T3S, R6E, Pittsfield Township, Washtenaw County, Michigan.

Parcel B: Beginning at the west ¼ corner of Section 14, T3S, R6E, Pittsfield Township, Washtenaw County, Michigan; thence north 87052'00" east 2687.64 feet along the east-west ¼ line of said Section 14 to the center of said Section 14; thence south 01026'11" east 722.56 feet along the north-south ¼ line of said Section 14; thence south 99033'49" west 391.94 feet; thence south 01026'11" east 667.66 feet; thence south 88033'39" west 950.07 feet; thence north 01030'27" west 887.56 feet along the south line of the north 15 acres of the west ½ of the southwest ¼ of said Section 14; thence north 01034'43" west 486.31 feet along the west line of said Section 14 and the centerline of Platt Road (66' wide) to the point of beginning, being a part of the southwest ¼ of Section 14, T3S, R6E, Pittsfield Township, Washtenaw County, Michigan (see Appendix A for legal sketch).

The property includes: "(1) all improvements, fixtures and appurtenances located thereon; (ii) all easements rights, appurtenances and except as otherwise provided herein, any other rights that benefit the Property; (iii) all available rights to divisions under the Michigan Land division Act; and (iv) all rights of Foundation in and to the Cell Tower Lease (defined below). The property shall be subject to liens for taxes not yet due and payable, the rights of the tenant under the Cell Tower Lease and all other items of record."



APPENDIX C

Invasive Species Identification

Early successional forest, consisting primarily of gray dogwood and other pioneer shrubs and trees such as multiflora rose and box elder, occupies fence row areas between the crop fields.

Invasive species:

- Decrease biodiversity
- Compete with native plants and decrease diversity and quality of native plants and wildlife
- Hybridize with native species
- Alter abiotic processes such as flooding or fire regimes, soil characteristics, or microbial activity, and water levels
- Reduce property values
- Threaten recreational land and water uses

Invasive species removal or control is typically a primary objective of a natural area restoration plan. The predominant invasive species in the Johnson Preserve include Buckthorn (*Rhamnus frangula*), Honeysuckle (*Lonicera maackii*.), and Autumn Olive (*Elaegnus umbellate*). Buckthorn is pervasive throughout the wooded areas and hedgerows, with larger individuals bordering fields (Figure 7). Honey suckle is present along fields. Autumn olive is present along the western border of the wooded area as well as surrounding the agricultural corridor that runs the length of the preserve from north to south. Left unmanaged, these species will likely dominate native species and lead to a change in composition and structure of native habitats.

Common Buckthorn

Common Buckthorn (*Rhamnus cathatica*) is a shrub or tree that was likely introduced to North America before 1800 but did not become widespread until the early 1900's. It

Figure 7 Buckthorn seedlings in the Johnson Preserve

was frequently cultivated for hedges, forestry uses, and as cover for wildlife. Buckthorn can grow up to 22 feet in height with a diameter of 10 inches. It forms dense thickets and competes with native shrubs and herbs for space and light. Due to its density and growth habit, buckthorn can crowd and shade out native vegetation and prevents native tree and shrub regeneration, often eliminating native understory plants entirely. Buckthorn has dark grey to brown bark with

a yellow to orange inner layer. Leaves are oval shaped with upcurled veins and toothed margins, dark and glossy green, and stay on long. Twigs often have a spine on the tip. Small dark fruits are a source of food for birds and other wildlife.

Honeysuckle

Honeysuckle (*Lonicera spp.*) was introduced to the Americas in the early 1800's for wildlife habitat as well as ornamental and privacy shrubbery. Possessing the traits of a good shrub (hardiness, quick growth, and dense growth), honeysuckle quickly invaded Michigan's natural areas and is a significant problem in Washtenaw woodland parks. Invasive honeysuckle species have few natural predators (such as grazers, parasites or diseases) in their non-native range, are spread easily by birds and animals, have a longer growing season than Michigan native shrubs, and have a high tolerance to low light conditions. Bush honeysuckles may produce a chemical that inhibits the growth of surrounding flora. These characteristics contribute to the shrub's rapid spread at the expense of biodiversity.

Several species of honeysuckle inhabit Washtenaw County natural areas. Honeysuckle grow up to 20 feet tall, with multiple stems coming from the ground, each stem forming a long arch. Leaves are opposite and lanced shaped and appear earlier in the spring and stay on later in the fall than most native species. Bark has distinct vertical grooves. This shrub blooms in May and June with sweet smelling blossoms. Flowers can be white, pink or red. The wood of a honeysuckle smells like honey when cut. Fruit is red or orange in color and will remain on the tree well into fall.

Autumn Olive

Native to China, Korea and Japan, autumn olive (*Elaegnus umbellate*) was introduced in the United States for cultivation in 1830. Autumn olive grows well on a variety of soils including sandy, loamy and somewhat clayey textures with a pH range of 4.8-6.5. It does not appear to grow well on very wet or very dry sites. It does very well on infertile soils because its root nodules house nitrogen fixing actinomycetes. Mature trees tolerate light shade, but produce more fruits in full sun. Seedlings may be shade intolerant.

Autumn olive is one of the earlier shrubs to break dormancy, putting out foliage in mid-March in southern Illinois and advancing north with the season about 100 miles per week. It grows rapidly, producing fruits in 3-5 years. Flowers are fragrant and pollinated by a variety of insects. Most fruits are eaten by birds or fall to the ground by early winter. Autumn olive produces a large amount of seed: each tree produces 2-8 pounds of seed per year and the number of seeds per pound ranges from 20,000-54,000.

Autumn olive exhibits prolific fruiting, rapid growth, is widely disseminated by birds, and can easily adapt to many sites. It is vigorous and competitive against native species and resprouts after cutting. Due to its nitrogen-fixing capabilities, it has the capacity to adversely affect the nitrogen cycle of native plant communities that may depend on infertile soils.

APPENDIX D
Control Methods

Mechanical

Hand cutting is the most common form of mechanical control of invasive species and involves cutting down the shrub and leaving the stump. Management of seedlings that sprout from the cut stump is essential, as resprouted buckthorn or honeysuckle seedlings can be quite vigorous. Girdling involves removing a band of bark, two inches wide for a smaller shrubs or six to eight inches wide for lager shrubs, around the trunk of the shrub (Czarapata 2005). Girdling kills the plant by preventing the flow of nutrients between the roots and the photosynthesizing foliage of the shrub. Since girdling kills the plant more slowly than cutting it down outright, it may reduce the number of resprouts. However, girdling is often less satisfying for stewardship volunteers because visible change to the system is minimal when compared with cutting and removal of entire shrubs.

Chemical

Chemical control is often used in conjunction with mechanical control methods and is especially effective in controlling buckthorn and honeysuckle. Herbicides such as glyphsate or triclopyr can be applied to cut stumps to discourage resprouting (Czarapata 2005). Application method, season of treatment, and ambient temperature vary with the type of herbicide used. Chemical control can be used on its own to control honeysuckle seedlings, though less effective than a chemical and mechanical approach. Herbicide can be sprayed or sponged onto the foliage of honeysuckle seedlings (Plant Conservation Alliance 2006). Restoration practitioners should exercise caution to avoid movement of the herbicide beyond the targeted area, also known as 'herbicide drift.' Herbicide drift can kill or damage native plants, but some invasives like buckthorn cannot be controlled without the use of herbicides (Czarapata 2005). While chemical control is more costly than hand cutting, it is often necessary and can still be used by land managers on a budget. Other local stewardship groups that currently use herbicides to control invasive plants may be able to provide training in herbicide use at a low cost.

Prescribed burns

Historically, fire was a common feature of Midwestern ecosystems. Restoring a fire regime to natural areas can be effective in reducing invasive plant density, stimulate growth of native plants, return nutrients to the soil, promote germination of dormant seeds, and enhance wildlife habitat (Czarapata 2005). If fire is used to control buckthorn on the Johnson preserve, it may be necessary to have fairly hot fires several years in a row to eliminate resprouting and exhaust the seedbank. After invasive plant populations are under control, fire should be used less frequently to allow insect and native plant communities to recover. Dry oak leaves are the predominant fuel for Midwestern woodland fires, therefore prescribed burns are mort effective in late fall or early spring. Prescribed burning is the most expensive invasive plant control option and requires extensive planning and resources, as well as specific burn plans for each area burned. Prescribed burns are typically conducted mid to late spring or in the fall. A late spring burn will control woody vegetation as well as cool season grasses, however it is not as good for wildflowers. Weather must be considered when planning and implementing burns. A relative humidity between 50-70% and temperature between 40-60 degrees F is ideal for burns.

When starting a burning regime, it will be necessary to implement an education program about the use of fire in ecosystem restoration. It will also be necessary to contact the surrounding areas and notify them about the plan to burn and what the impacts will be (see www.firecouncil.org, Michigan Prescribed Fire Council and Plantwise www.plantwiserestoration.com/burn.html for more info).

Reference: Czarapata, E. 2005. Invasive Plants of the Upper Midwest. The University of Wisconsin Press. Canada.

APPENDIX E
Recommended Cover Crops

- Buckwheat (*Fagopryrum esculentum*), a broadleaf, rapid growing summer annual that flowers 5-6 weeks, grows 3-6 feet tall, and is good for building organic matter and increasing calcium and phosphorus availability.

- Winter Rye (*Secale cereale*), a cold-tolerant, hardy, and productive annual grass that tolerates a wide range of soil conditions, germinates and grows quickly to 4-5 feet, and improves soil structure with its fibrous roots. Cost: approximately $50.

- Crimson Clover (*Trifolium incarnatum*), a winter annual legume, planted in late summer, goes dormant in winter, and produces brilliant red flowers in spring, it attracts bees and other beneficial insects and fixes over 200lb/acre of nitrogen.

- Hairy Vetch (*Vivia villosa*), an extremely cold tolerant, adaptable and vigorous winter annual legume that grows 2-3 ft tall and can be planted early spring to late fall.

APPENDIX F
Resources and Potential Partnerships

Food System Economic Partnership (FSEP)
- Jennifer Fike, ExecutiveDirector
  fikej@fsepmichigan.org, 734-222-6859
- Jane Bush, Business Development Specialist
  bushj@fsepmichigan.org, 517.231.2240
- Tamara Harmon, contact for assisting individuals with identifying properties suitable for busines development in Wayne County, 313-224-0982

Food Gatherers
- Eileen Spring, President and CEO
  eileen@foodgatherers.org

Slow Food Ann Arbor
- leadership@slowfoodhuronvalley.com
- http://www.slowfoodhuronvalley.com/Welcome.html

MSU Extension
- http://www.msue.msu.edu/portal/

MSU Mott Group for Sustainable Food Systems
- http://www.mottgroup.msu.edu/

UM School of Natural Resources and Environment (SNRE)
- Lisa Yee-Litzenberg, contact for SNRE master's project ideas
  yeeha@umich.edu, 734-615-1633
  http://www.snre.umich.edu/current_students/masters_projects/submit_idea

APPENDIX G
Native Planting Resources

Native Seed Suppliers

Michigan Wildflower Farm

- Wetland mix –grasses and forbes:
  6lb/acre at $300/lb, estimated cost $6,300
  http://www.michiganwildflowerfarm.com/images/WetlandMix.pdf

- Woodland edge mix – grasses and forbes:
  10lb/acre at $200/lb, estimated cost $7000
  http://www.michiganwildflowerfarm.com/images/WoodlandEdgeMix.pdf

Native Connections

- Wet mesic prairie mix - grasses and forbes:
  $998/acre, estimated cost $3500
  http://nativeconnections.net/native_connections_2010.pdf

- Wet meadow mix:
  $1270/acre, estimated cost $4400
  http://nativeconnections.net/native_connections_2010.pdf

Additional Prairie Planting and Restoration Information

MI DNRE guides:

- http://www.michigandnr.com/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/Habitat_Mgmt/Grassland/Grass_Planting.htm
- http://www.michigandnr.com/publications/pdfs/huntingwildlifehabitat/Landowners_Guide/Habitat_Mgmt/Grassland/Grass_Planting.htm

UMN Extension wet prairie information:

- http://www.extension.umn.edu/distribution/horticulture/components/3238a.html

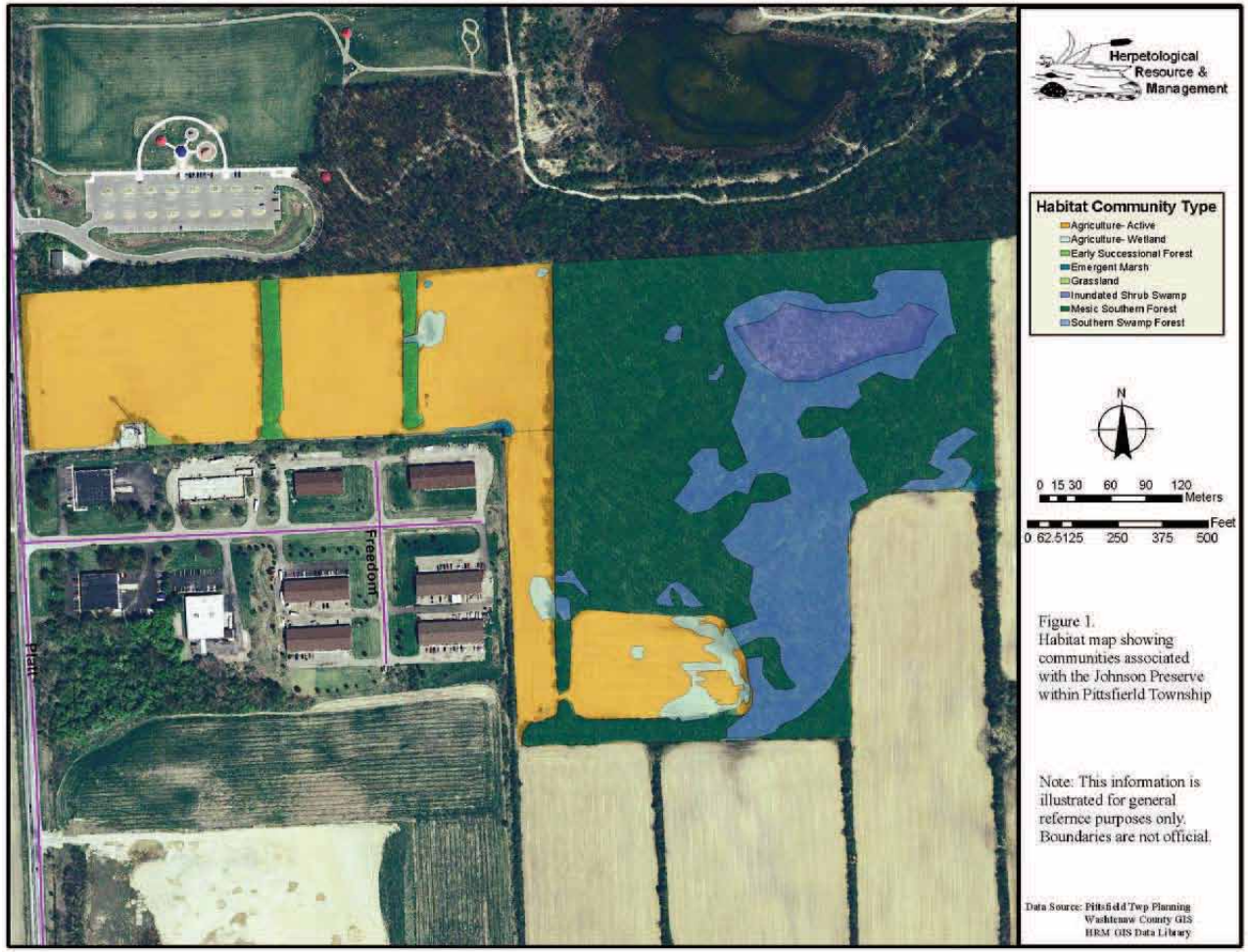
IA State Extention:

- http://www.extension.iastate.edu/Publications/PM1351G.pdf

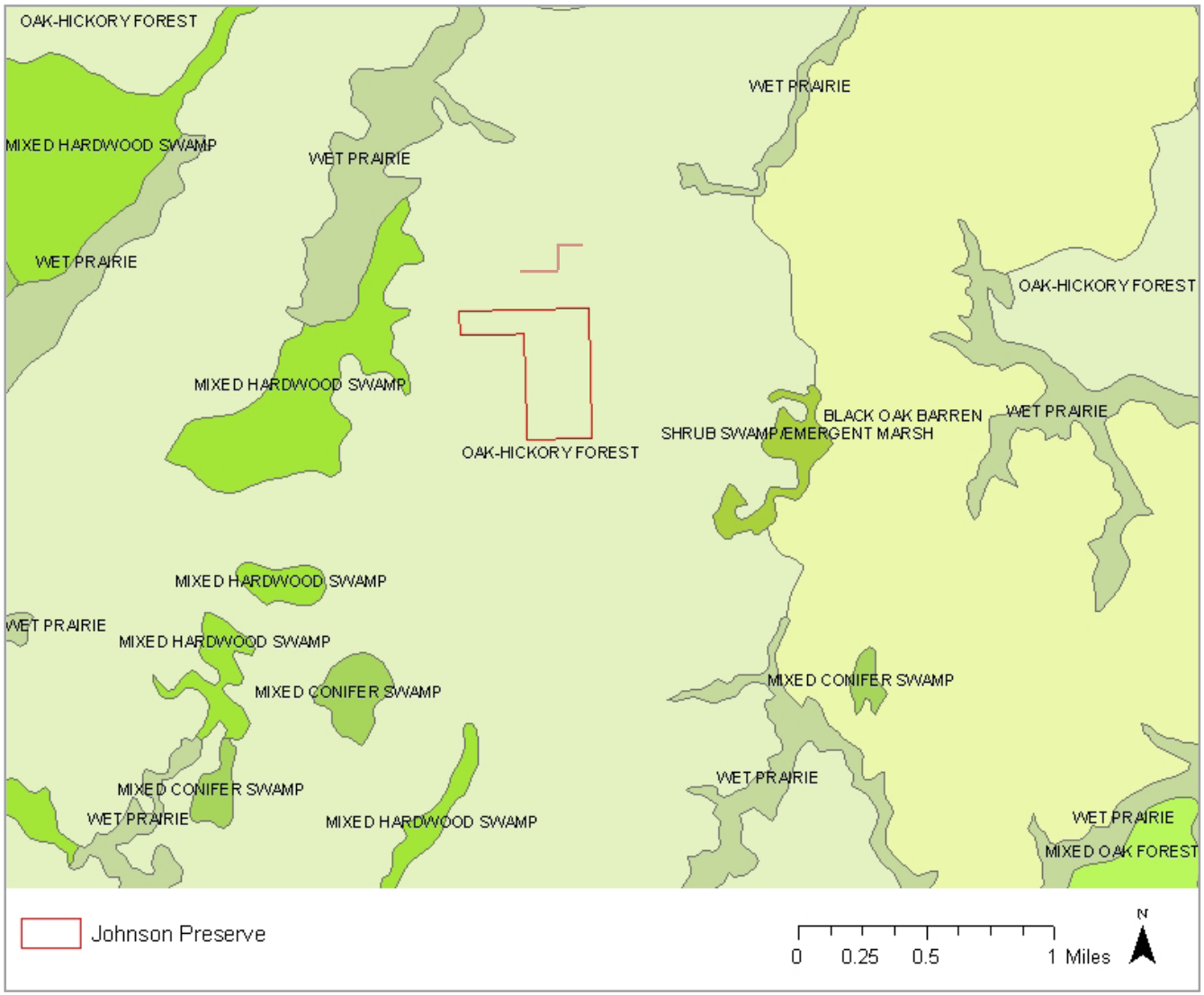
APPENDIX H

Habitat/Community Types

The following discussion of ecosystems present within the preserve is based on the Johnson Preserve Habitat Mapping survey completed by Herpetological Resource and Management, LCC in 2008 and the Baseline Documentation Report prepared by Catherine Marquardt in 2007. See Appendix B for ecosystem map created by Herpetological Resource and Management, LCC. See student reports and existing management plans for additional information and species list.



Map 9 Present day community types (data source: Herpetological Resource Management)



Map 10 Historic land cover circa 1800 (data source: SEMCOG)

Johnson Preserve

Pittsfield Township,
Washtenaw County,
Michigan

LAND COVER
CIRCA 1800

Ecological communities include:

- Dry mesic-southern forest
- Southern hardwood swamp
- Inundated shrub swamp
- Tracts of active agricultural land
- Agricultural wetland
- Patches of early successional forest

Figure 1 Southern mesic forest in the Johnson Preserve

a) Dry-mesic southern forest

Southern dry-mesic forest best characterizes the woodlands on the preserve. The southern woodland is more wet than the northern. Green ash and American elm are the most abundant trees in the canopy in depressional areas, where standing water appears to be present for a good portion of the growing season. Dry-mesic species, such as red oak and box elder, occur on the higher and, therefore, drier areas of the woodland. This woodland was most likely a hardwood swamp at one time, but the understory is thicker than the canopy and is dominated by common buckthorn. The hydrology most likely changed with the invasion of buckthorn and the land being converted to agriculture which have impacted the natural communities, water uptake and evaporation.

The woodland in the northern portion of the property is home to more mature hardwoods. The canopy is dominated by red oak, with abundant white oak and shagbark hickory. The understory is dominated by invasive shrubs. Common buckthorn is the most prevalent, but honeysuckle is thick in some portions of the woods. Due

to the season of the site survey, the diversity of herbaceous species is unknown.

Dry-mesic southern forests are dominated by oak or oak-hickory forest types and are fire dependent. The state rank for this ecosystem type is S3, indicating that it is vulnerable in the state for one of several reasons including: a restricted range, relatively few occurrences, recent and widespread declines, or there are other factors making it vulnerable to extirpation from Michigan. Dry-mesic southern forests are ranked G4 globally, indicating that they are apparently secure and uncommon but not rare. Natural disturbance factors influencing dry-mesic southern forest include fire, windthrow, insects, and pathogens. The canopy of dry-mesic southern forest is typically dominated by white and black oak with hickories, red maple, white ash, black cherry, scarlet oak, basswood, and sassafras. The native shrub layer is typically characterized by far scattered serviceberry, which hazel, and choke cherry.

Frequent, low intensity fires are important to maintaining the community structure of dry-mesic southern forests. Fire suppression can result in invasion of non native species. Prescribed burns and monitoring and removal of invasive species are important to maintaining the quality of this ecosystem.

Figure 2 Southern mesic forest is a fire dependent community (image source: http://web4.msue.msu.edu/mnfi/images/communities/4187.jpg)

Figure 3 Southern swamp forest in the Johnson Preserve

b) Southern Hardwood Swamp

A southern hardwood swamp is a minerotrophic forested wetland occurring in Lower Michigan on mineral or occasionally organic soils dominated by a mixture of lowlands hardwoods. This type of community occupies shallow depressions and high order stream drainages on a variety of landforms. The state rank for this ecosystem is S3, indicating that it is vulnerable in the state for one of several reasons including: a restricted range, relatively few occurrences, recent and widespread declines, or there are other factors making it vulnerable to extirpation from Michigan. The global rank of G3 indicates that the southern hardwood swamp is vulnerable and at moderate risk of extinction due to restricted ranges, relatively few occurrences, recent and widespread declines or other factors.

Water levels in this ecosystem fluctuate seasonally, with standing water typically occurring throughout the winter and spring. Due to anaerobic conditions from standing water, trees are typically shallow rooted and prone to frequent blow down. Windthrow creates a pit and mound mircrotopography allowing for a diverse over story and generates fine scale gradients of soil moisture and chemistry.

As floodwater drains in the spring, both the mucky pools and exposed tree tip mounds provide different habitat conditions, fostering high plant biodiversity. Groundwater seepage affects species composition and structure. Fire in this type of ecosystem is likely to be rare or infrequent, but may take place in periods of extended drought, particularly when adjacent to areas characterized by fire dependent upland communities.

The canopy layer in southern hardwood swamp is typically dominated by silver maple and green ash, with red maple and pin oak. Hackberry, sycamore, cottonwood, sugar maple, white ash, black ash, tulip tree, quaking aspen, swamp white oak, bur oak, red oak, basswood, and American elm are often present. The shrub layer is typically characterized by spicebush, elderberry, winterberry, and buttonbush.

Prolonged flooding in southern hardwood swamps will lead to tree mortality, followed by dominance of shrubs, sedges, and grasses that require light. It is important to manage and protect upland communities by maintaining natural hydrologic processes and quality. The Johnson Preserve's southern hardwood swamp community is buffered by forest; however, nearby agriculture and roads, which can alter hydrology and result in water quality impairment, threaten the species composition and increase vulnerability to invasive species.

Management strategies that seek to protect ecological quality should aim to leave large tracts of this community type undisturbed and to foster natural processes such as flooding, windthrow, and senescence. Invasive species including privet, Japanese barberry, autumn olive, multiflora rose, and buckthorn are currently a threat to this community type and regular monitoring (and removal, as necessary) of these

Figure 4 Inundated shrub swamp in the Johnson Preserve

species is necessary.

c) Inundated Shrub Swamp

Inundated shrub swamps are characterized by poor drainage with nearly continuous inundation or saturation. This community type has a scattered shrub layer dominated by buttonbush and has sparse herbaceous cover. The state rank for this ecosystem type is S3, indicating that it is vulnerable in the state for one of several reasons including: a restricted range, relatively few occurrences, recent and widespread declines, or there are other factors making it vulnerable to extirpation from Michigan. Inundated Shrub Swamps are ranked G4 globally, indicating that they are apparently secure and uncommon but not rare.

This community occupies kettle holes of ice-contact topography. This community is an intermediate successional stage between open emergent marsh and swamp forest. The community becomes established as shrubs tolerant of prolonged, inundated conditions invade open wetlands. Hydrologic cycling and prolonged flooding allow the shrub swamp to persist instead of succeeding to a swamp forest. Water can pool for prolonged periods of time due to an

impermeable clay layer in the soil profile; this limits tree establishment and growth. Prolonged periods of drought or hydrologic changes that lower the water table allow for tree development and the conversion of the inundated shrub swamp to swamp forest.

Vegetation is dominated by buttonbush. Additional species commonly present include willows, red-osier dogwood, silky dogwood, winterberry, black chokeberry, swamp dewberry, and swamp rose. Tree cover may include maples, yellow birch, musclewood, ashes, black walnut, oaks, black willow, and American elm.

Left undisturbed this community would likely transition into a swamp forest. Seasonal hydrologic cycling and prolonged flooding are typical disturbances in an inundated shrub swamp community. These disturbances arrest succession to a swamp forest. A minimum of 20 inches (0.5 meters) or water is required for buttonbush populations. The ecological integrity of inundated shrub swamp is threatened by anthropogenic hydrologic alterations and therefore maintaining a buffer, in addition to maintaining water levels, is important to protecting the community.

Flooding creates oxygen deprived sediments and leads to the accumulation of peat. When emergent marshes border fire dependent uplands, wildfires likely burned across emergent marshes as well, reducing litter and having similar effects on the ecosystems as when water levels are low.

The anaerobic soil conditions and accumulation of peat that characterize emergent marsh ecosystems are caused by flooding, thus it is important to buffer and protect and natural hydrology to sustain the community. Historically, wildfires may have burned these communities, shaping the seed bank and seedling establishment.

e) Agricultural land

Agricultural fields occupy over half of the acreage of the Johnson Preserve. Agricultural fields consist of active cropland, fallow fields, and agricultural wetlands (Figure 6).