Grace Woods Final Report

NRES 497

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Introduction

We are working with Grace Methodist Church to improve the urban woodland on their property. They would like for the woodland to be used by the public, but they are struggling with vandalism and destruction. The project partner is also concerned with the management of the property, including the presence of invasive species. The partner needs include an understory planting, invasive maps, and options for monitoring the property and preventing damage.

Background/Literature Review

INVASIVE SPECIES IMPACT AND MANAGEMENT ON URBAN WOODLANDS

While urban woodlands are critical components of an urban ecosystem, they can often prove difficult to manage. Invasive species, soil quality, and antisocial human-environment interactions can all inhibit the diversity and sustainability of an urban woodland. In this literature review, we will examine recent research on management of urban woodlands in an effort to protect and conserve the woodland while increasing its ecological integrity.

Impacts of Invasive Species

Urban woodlands, under the appropriate management, can serve as important biodiversity hotspots in urban dominant environments (Croci et al. 2008), an ecological function opposed by the presence of invasive species which dominate the landscape. A prominent invasive species in North America in environments such as urban woodlands and riparian zones is the asian bush honeysuckle, which has been shown to decrease the structural complexity of forest canopies (Fotis et al. 2022). Moreover, removal of asian bush honeysuckle has shown to improve canopy complexity as well as increase understory openness (Fotis et al. 2022). However, there have also been demonstrably improved nesting outlooks for native birds in environments with high densities of asian bush honeysuckle, cautioning some from referring to areas with high densities of asian bush honeysuckle as “ecological traps” (Gleditsch et al. 2014). Additionally, the introduction of invasive species has also shown a degradation of soil hydraulic properties in Neotropical dry ecosystems (Vasquez-Valderrama et al. 2020). Overall there is evidence to suggest invasive species cause a degradation of some native ecological conditions, such as composition and function.

Managing Invasive Species

Guiser provided insights into selecting trees, shrubs, and groundcovers that are specifically tolerant of wet soils with low drainage (2023). These types of soils are prone to the invasion of non-native species such as asian bush honeysuckle, wintercreeper, periwinkle, and privet. By choosing a native species that is already adapted to wet conditions, land owners and managers are thus able to reduce the spread of invasive plant species, while simultaneously enhancing the strength and resiliency of the urban woodland (Guiser 2023).

The probability of successful eradication of an invasive alien plant species decreases rapidly with increasing infestation size (Eppinga, M.B. 2020). In cases of infestation larger than 10,000 ha, it may be more feasible to explore other management options that have more of a focus on containment and control rather than total removal. In recent years there have been investigations on the effectiveness of spatially explicit removal strategies. The removal of large patches was relatively ineffective, however, methods involving patch geometrical properties were much more effective. Overall, the specific strategy for removal was highly dependent on the invasive species' reproductive type as well as the resulting patch geometries within the IAS population (Eppinga, M.B. 2020).

Native Species

Non-native species cause changes in the ecosystems to which they are introduced. These changes, or some of them, are usually termed impacts; they can be manifold and potentially damaging to ecosystems and biodiversity (Jeschke et al. 2014). Interestingly enough however, the presence and abundance of other plant species, topographic variables, and light availability explained only a small portion of the variation (5–19%) in the distribution and abundance of individual species (Davis et al. 2015). However, there was a positive correlation between most of the species and species richness, which raises the possibility of strong facilitation of some sort taking place among species (Davis et al. 2015). Native species are important when it comes to woodlands, however, over the past century, factors such as long-term fire suppression, mesophication, overabundant deer populations and invasion by non-native shrubs have increased woody encroachment, altered species composition, and reduced native diversity in the herb layer (Kaul et al. 2023).

Smaller isolated, urban woodlands, it is important to recognize smaller woodlands might be less able to support high species richness. The largest woodlot harbored species missing in the smaller ones (Godefroid et Koedam. 2003). Biodiversity recovery efforts in such landscapes can be hamstrung by a paucity of information on factors affecting species' distributions, particularly for threatened and/or declining species (Montague-Drake. 2009). However, these small zones of biodiversity are important. Extensive evidence from the fossil record, recently observed trends, and predictive studies all suggest that climate change is likely to have a large impact on biodiversity, from organisms to biomes (Bellard. 2014). Small areas of high (even if it is just in comparison to the surrounding area) biodiversity, are critical for native species to survive.

Monitoring and Social Engineering to Prevent Vandalism

A challenge associated with managing urban woodlands and other areas of interest such as wildlife populations, is managing and monitoring human-environment interaction. Monitoring of trails and other areas of interest is often accomplished by the use of trail cameras, however, these cameras are subject to human vandalism (Meek, et al. 2019) in addition to the trails and environments themselves. There are a variety of methods employed to prevent human vandalism of trail cameras including, but not limited to: camouflage, chains, protective boxes, and decoy cameras, and depending on the context and desired use of the trail cameras, these methods show varying viability and use (Meek, et al. 2019). The effectiveness of these methods of prevention

have been determined to be questionable (Meek, et al. 2019), but in the context of other urban environments, such as railway environments, prohibitive signage and surveillance have shown to be effective at reducing vandalism (Havârneanu 2017). Additionally, security cameras have also shown to increase prosocial behavior in some individuals (van Rompay, et al. 2009). There is ultimately disagreement on the effectiveness of surveillance in the form of trail cameras on decreasing vandalism and the effectiveness of preventative measures on protecting the trail cameras themselves from vandalism.

While the effectiveness of trail camera surveillance is questionable, the strategic planting of various trees and shrubs can be a valuable resource to discourage vandalism. Although planting trees and shrubs in a formal row may seem to be an effective solution, it may be quite challenging to achieve both functionality and aesthetic appeal in this manner. Instead, it may be much more constructive to consider some alternatives, such as cluster planting (Selmer 2023), which is when trees and shrubs are grouped together rather than planted individually. This approach can create a dense, natural looking privacy screen, which may also deter vandals from entering the urban woodland.

Conclusion

In conclusion, managing an urban woodland involves many challenges, from invasive and native species, to ecological issues and the human dimension of the landscape. It is clear that there has to be multiple factors considered when deciding how to manage an urban woodland. Getting an urban landscape to be sustainable requires a multifaceted approach, and there will always be tradeoffs when deciding on management strategies.

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Goals and Objectives

The overarching goal of this project is to improve the long-term diversity and sustainability of the urban woodland. To reach this goal, we had multiple objectives. The first was to look into the soil conditions such as soil type and drainage, as well as the light conditions. This was the most important factor for picking the understory species to include. From this, we developed a master list of forbs, graminoids, and shrubs that will be suitable for the location and help with the diversity as well as enhance wildlife habitat. Another objective was to take an inventory of the invasive species and map them. This will help the property managers identify and remove the species we found on the site, which will help with the establishment of native species. One other objective has to do with monitoring the property and protecting it from vandalism. Research was done to evaluate different trail cams and lock box options. We also made some signage that explains that the public is welcome to use the property, but also letting them know it is monitored and should be treated respectfully. We decided not to create educational signage since the vandalism has been targeted at other signs, and we are leaving the species selection up to the property manager.

Deliverable Descriptions

A design for sustainable vegetation management:

- The first step for developing this deliverable was using Web Soil Survey to evaluate the soil types and the water conditions of the site. This helped us figure out what species to select for the site.
- Invasive species distribution maps were created for the following species: periwinkle, bush honeysuckle, privet, wintercreeper, invasive wild garlic, garlic mustard, and japanese honeysuckle. The species with smaller and less overlapping distributions were included on the same maps, whereas the bush honeysuckle and wintercreeper have their own maps because of the extent of their spreading.
- We generated a master list of species that work well with the drainage and light conditions in Grace Woods along with information regarding their flowering colors, bloom times, and compatibility with pollinators. This also includes shrub species they can hopefully plant once the bush honeysuckle, privet, and other brushy invasives are removed.
- A site preparation document was also included to help with the establishment of the understory. This gives information about removing the invasive bush honeysuckle and the steps to take after it is under control. Information regarding species selection is also included, advising them to select a few from each bloom time, preferably with a variety of colors.

Plan for site protection:

- A document with information about trail cams and protection options was created to help provide security and deter vandalism.
- Signage was developed for the woodland. This did not end up including educational signage since our project partner didn't want us to select specific species for the understory planting. Instead, we made signage that makes visitors aware that they are welcome in the space, but it is being monitored and needs to be treated properly and with respect.

Metadata/Technical Details

Understory Species List

- We used Web Soil Survey to make the soil and drainage maps, which assisted us in narrowing down suitable species for the site.
- We used our knowledge of native species as well as the knowledge of the Tippecanoe County Soil & Water Conservation District employees Robert Suseland and Jordan Young to create this complete list of suitable native species.
- Excel was used to make the charts provided. A PDF as well as the original excel file are provided in case they need to edit the list or filter for specific bloom time, height, etc.

Invasive Maps

- We went out with the Invasive Species Technician from the Tippecanoe County Soil & Water Conservation District, Jordan Young. She assisted us with the identification of species not as common and noticeable as bush honeysuckle and garlic mustard.
- We brought along printed maps and hand-drew the distributions on-site. We then used ArcGIS Pro to draw the distributions on the map digitally for a cleaner look.

Signage

- We used the free version of canva to create the 3 signs. We based the designs of the signs off of free templates provided by canva and once finished downloaded the images as PNG files. The links to edit these signs are below.
- Grace Woods Sign:
    - https://www.canva.com/design/DAGCi-nTIKA/2NdLwzbyd9Yvstc_ZvShFQ/edit?utm_content=DAGCi-nTIKA&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton
- Surveillance sign 1:

    - https://www.canva.com/design/DAGCg8a-J94/i-HACIFKPh7CODRPKpMllw/edit?utm_content=DAGCg8a-J94&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton
- Surveillance sign 2:
    - https://www.canva.com/design/DAGCg_nYi84/I9v-PuFd7AgAqfW2dDy07Q/edit?utm_content=DAGCg_nYi84&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton

Conclusions/Concerns/Future Work

As a team, we don't have many concerns with this project. The most challenging part of the process will be the invasive removal. We cannot emphasize the importance of controlling these species enough, or there will be nothing to show for all of the work and native seeds purchased. This will be a multi-year process, and it's important to stay on top of invasive species removal, since letting them go to seed will restart the painstaking process.

Appendix

Site Preparation

Bush honeysuckle has allelopathy, which is when the plant produces chemical root exudates that inhibit the growth and germination of plants that are trying to establish themselves in the same area. This makes bush honeysuckles very aggressive. Garlic Mustard also has these traits. There are many methods for invasive removals, but they should all be done before seed production in the early spring and late fall and will likely take numerous years to get under control. Unfortunately, since the site is so close to the church, the middle school, and homes, a prescribed burn won't likely be an option. Usually, a prescribed fire can be done every year or every other year, and this will kill the seedlings and the tops of mature bush honeysuckle plants. They will continue to leaf out, but if you continue to burn, they will not be able to produce fruit and seed, which will control the spread of the bush honeysuckle. Other control methods for these plants include pulling in the spring before they produce seed, foliar applications of herbicides and surfactants (do this before any of the native herbaceous plants emerge, that way they are not impacted), and cutting the stumps and treating them with an herbicide. Selection of the invasive control methods will depend on what time of the year the labor can be done, the capabilities of the people doing the removal, and the target species. Once the invasive species are under control, the site will need to be prepared. If the invasives are removed properly, there will likely be a lot of bare ground, and raking the soil surface will help with the seed-to-soil contact and germination. The seeds can be spread by hand in March/April or September-November. Don't be alarmed if there are no flowers for the first 2-3 years, as most perennials take a couple growing seasons before producing blooms. It is important to keep the invasives and weeds under control during this stage since the native plants will not be producing flowers and seeds initially.

Species Selection

Generally, the more species in a planting, the better. While we are leaving the species selection up to you, we recommend selecting 3 or more forbs from each bloom time (early, middle, and late) and at least 3 graminoids. To make sure the understory is diversified, it is a good idea to select species with different bloom colors, as different colors attract different pollinators and wildlife. You can also wait to see what native species come up from the seed bank once invasive removal is complete, that way you don't buy seed that already exists on site and can instead add to the diversity by selecting other species.

Seed Sources

One recommended source of seed is Spence Restoration Nursery in Muncie, IN. The local Soil and Water Conservation District also has a list of seed vendors.

SUITABLE FORB SPECIES

Common Name	Scientific Name	Max. Height (ft)	Bloom Time			Color	Pollinator	Monarch
			Early	Mid	Late			
Bigleaf Aster	*Eurybia macrophyllus*	1		x	x		High	
Calico Aster	*Symphyotrichum lateriflorum*	2		x	x			High
Devil's Beggartick	*Bidens frondosa*	3		x	x		High	
Wild Garlic	*Allium canadense*	1.5	x	x			High	
Smooth Goldenrod	*Solidago gigantea*	6		x	x		High	
Swamp Goldenrod	*Solidago patula*	3		x	x		High	
Weed	*Eutrochium purpureum*	7		x	x		HIgh	High
Hollow Joe Pye Weed	*Eutrochium fistulosum*	6		x	x		High	High
Wild Leek	*Allium tricoccum*	0.75		x			High	
Early Meadow Rue	*Thalictrum dioicum*	2	x					
Hairy Pagoda-plant	*Blephilia hirsuta*	3	x	x	x		High	High
Blue Phlox	*Phlox divaricata*	1	x	x				High
Tall Bellflower	*Campanulastrum americanum*	0		x	x		High	
Indian Tobacco	*Lobelia inflata*	2	x	x	x			
Virginia Waterleaf	*Hydrophyllum virginianum*	2	x					
Wild Golden Glow	*Rudbeckia laciniata*	7		x	x		High	High
Wingstem	*Verbesina alternifolia*	8		x	x			High
Dwarf Larkspur	*Delphinium tricorne*	1	x				High	High
Harbinger-of-spring	*Erigenia bulbosa*	1	x				High	
Yellow trout lily	*Erythroniun americanum*	1	x				High	
Cardinal Flower	*Lobelia cardinalis*	1-3		x			High	
Great blue lobelia	*Lobelia siphilitica*	1-3		x			High	
Jacob's Ladder	*Polemonium reptans*	1-3	x				High	
Celandine Poppy	*Stylophorum diphyllum*	1-2	x				High	
Great white trillium	*Trillium grandiflorum*	1-2	x					

SUITABLE GRAMINOID SPECIES

Common Name	Scientific Name	Max. Height (ft)	Bloom Time			Color
			Early	Mid	Late	
Frank's Sedge	*Carex frankii*	1-2		x		
Graceful Sedge	*Carex gracillima*	1-3	x			
Hop Sedge	*Carex lupulina*	1-4	x	x		
Awl-fruited Sedge	*Carex stipata*	1-3	x	x		
Virginia Wildrye	*Elymus virginicus*	4-5		x	x	

SUITABLE SHRUBBY SPECIES

Common Name	Scientific Name	Height (ft)	Bloom Time			Color	Pollinator	Monarch	Notes
			Early	Mid	Late				
Spicebush	*Lindera benzoin*	6-12	x				High		
Buttonbush	*Cephalanthes occidentalis*	6-12		x			High	High	Will grow best on the southern border where it receives more sunlight.
Elderberry	*Sambucus canadensis*	6-12		x			High		Will grow best on the southern border where it receives more sunlight.
Serviceberry	*Amelanchier arborea*	10-25	x				High		
Winterberry	*Ilex verticilata*	6-15		x			High		
Pawpaw	*Asimina triloba*	10-40	x						
Maple Leaf Viburnum	*Viburnum acerifolium*	4-6		x			High	High	
Arrowwood Viburnum	*Viburnum dentatum*	3-9		x			High	High	
Silky Dogwood	*Cornus amomum*	6-12		x			High		Will grow best on the southern border where it receives more sunlight.
Grey Dogwood	*Cornus racemosa*	10-15	x				High		Will grow best on the southern border where it receives more sunlight.

Asian Bush Honeysuckle (Lonicera maackii)
Distribution as of March 1st, 2024

N

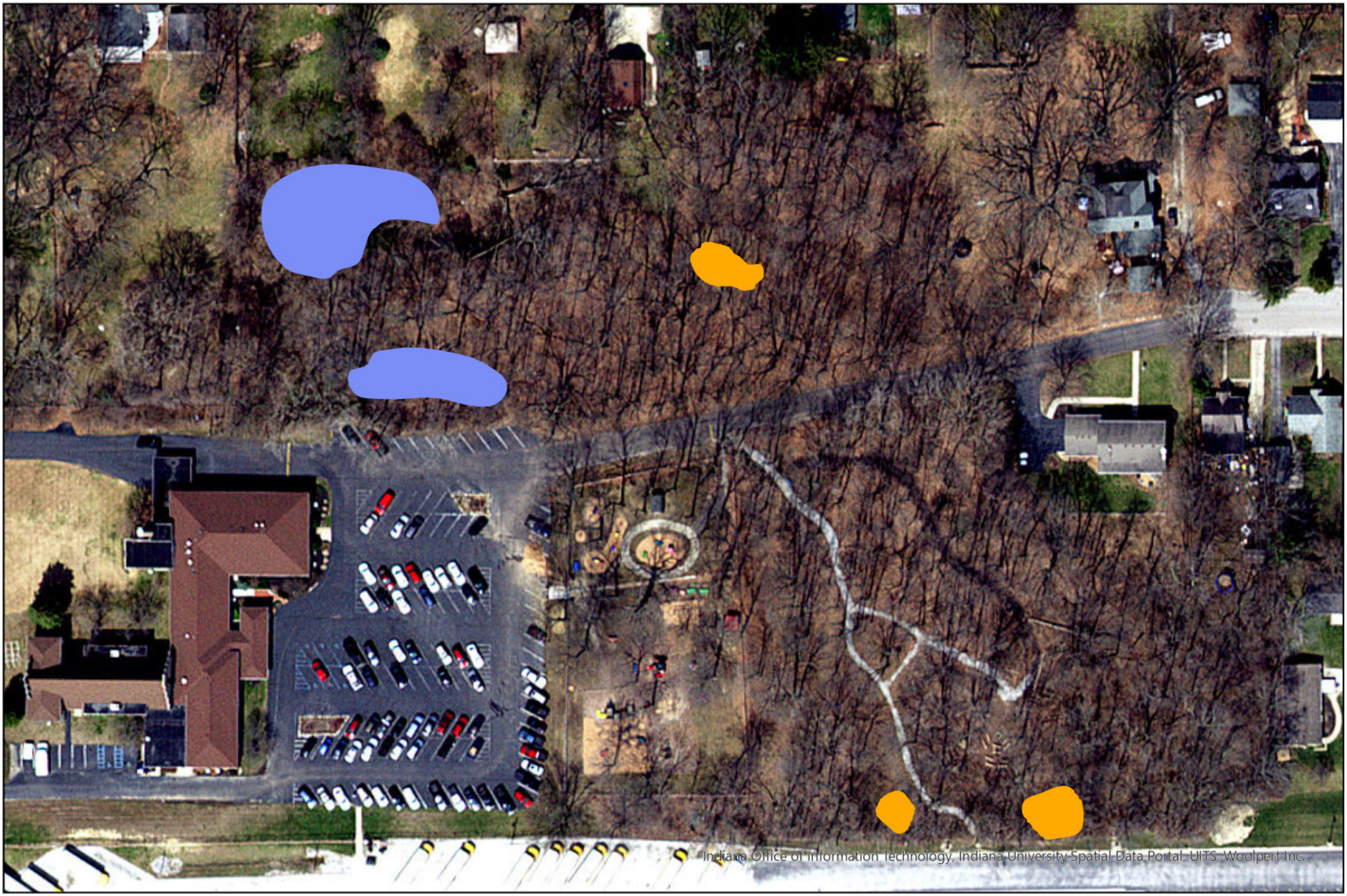
Wintercreeper (Euonymus fortunei)
Distribution as of March 1st, 2024

N

Wild Garlic (Allium vineale) Distribution as of March 1st, 2024

Garlic Mustard (Alliaria petiolata) Distribution as of March 1st,

N



Periwinkle (Vinca minor) Distribution as of March 1st, 2024

Privet (Ligustrum sinense) Distribution as of March 1st, 2024

N

Surveillance Options

Originally, I began my search for a suitable trail camera by looking through customer reviews, but the more I searched, the more they felt inaccurate or filtered through the product seller's website. I wanted reviews from people who were experienced with trail cameras/surveillance and had the same issues of vandalism as was being experienced in Grace Woods.

I found more accurate, honest, and reliable product recommendations after reading on hunter and archer forums. Many property owners had issues of trail camera theft/destruction and were also looking for suggestions from others within their community. This is where I found what I believe to be the strongest combination of products to deter any theft or vandalism within Grace Woods: Python cable locks used in conjunction with a steel lockbox can be very useful for people who have issues with their trail cams being damaged or stolen.

-$39.95 lockbox- 16 gauge steel, fully compatible with the 5/16 master lock, camouflaged
https://www.amazon.com/CAMLOCKbox-Security-Compatible-Wildgame-InnovationsTerra/dp/B01KN8OUHC?source=ps-sl-shoppingads-lpcontext&ref_=fplfs&smid=A86M66Z7Z0Z95&th=1

-$48.99 camera- very good reviews on battery life, infrareds help catch vandals, waterproof
https://www.amazon.com/Terra-Extreme-Wildgame-Innovations-Camera/dp/B07TKMYP5C/ref=sr_1_4?crid=2G3C1ANC9V7E2&dib=eyJ2IjoiMSJ9.a5AKog4IpN9XKZJlkiaDZ7kzFjmH8-chWsQ3g96zX_3s38qqWGgf4uW_qeHgUNWjlgbnuPtGJANcooOaOD1mqJO1ufCcjG1WE5CSNEzJ4Bx1D6F_xa_o5Ng7HpAckOhcBMiEwcF9uRYiKPVoy_H2A1TrkogeleoZ5mZV-iEhV4nO-eL-FHMraq-vm_EW_jKANb0r4C-09hh0I7KuP4ByqY2rJlwJZp_O8NZNY0BAmvcKCQFakH8LBRs9EAguJgQVe1vsEh-ksHh12c07K6IuiA6O5KkyVKWDFnYcDbCdZaM.X_F0GzjYtA0n-KpMrKlvUX02uSN31QRHGUIIXMj7Y7c&dib_tag=se&keywords=wildgame%2Binnovations%2Bterra%2Bextreme%2B14%2Bmegapixel&qid=1711741601&sprefix=wildgame%2Binnovations%2Bterra%2Caps%2C127&sr=8-4&th=1

-$18.98 cable lock- size 5/16, cut resistant
https://www.amazon.com/Master-Lock-Python-Adjustable-8419DPF/dp/B000FBKN24/ref=sr_1_2?crid=1SM10IADN7P0S&dib=eyJ2IjoiMSJ9.G6dgeS0pJu_P6vyaR7Ae-9t60Qtum8ZMXdI5AlsmnW_7zwJgbENg-ySRRqTwOE76W0H-OYvnYCSjgko7Y4wLUOGP-4dZJSiQL1z1XRawq-wTf6iw1kB6LXPjeo3DxrSjPKkEhCq94L6jhawLdDK-mEcbnmAXLTtrgLMTgNJrbf6Gul96pWc7MIW2mxy8Z3YAM2KYAU1_jkf6nueAqxgWp_E6G24Xb_k3hwvhqauopIEmHVHy7e3hqrAi3x4YoddCsHGykwPYBJUh-4g-z5j7Jt4HLCUdpNWgKHg3kgcjNxI.WUpZpfS5WiHKqsU81g9Dc6TLJik7Vkv-xWIVszRttb0&dib_tag=se&keywords=python+cable+5%2F16&qid=1711741714&s=hi&sprefix=python+cable+5%2F16%2Ctools%2C152&sr=1-2

GRACE UNITED
METHODIST CHURCH

Welcome to

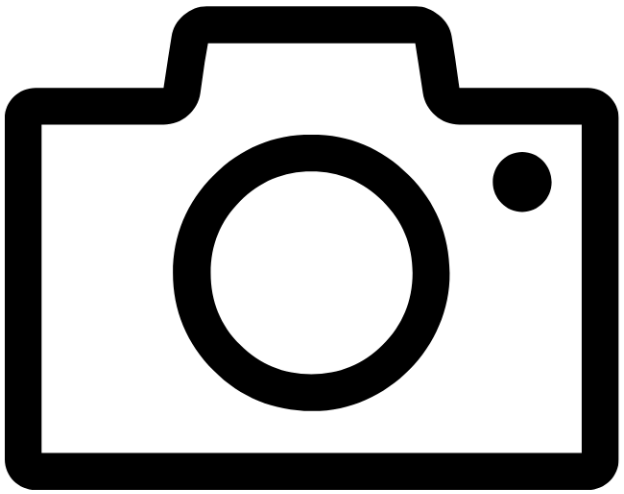
GRACE WOODS

WE WELCOME ALL VISITORS!

BUT PLEASE BE AWARE, THIS PROPERTY IS UNDER SURVEILLANCE TO PROTECT THE INTEGRITY OF OUR WOODS, SO PLEASE BE CONSIDERATE AND LEAVE IT BETTER THAN YOU FOUND IT!

THANK YOU!

NOTICE



THIS PROPERTY IS UNDER SURVEILLANCE

PLEASE BE CONSIDERATE AND LEAVE IT BETTER THAN YOU FOUND IT!

THANK YOU!

NOTICE

THIS PROPERTY IS UNDER SURVEILLANCE. BE RESPECTFUL OF OTHERS AND PLEASE USE RESPONSIBLY!

Map Scale: 1:1,740 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Tippecanoe County, Indiana
Survey Area Data: Version 25, Sep 1, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 16, 2022—Jun 27, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
UmB	Urban land-Miami complex, 2 to 8 percent slopes	1.1	12.2%
UmC	Urban land-Miami complex, 8 to 15 percent slopes	4.9	53.2%
UsA	Urban land-Starks-Fincastle complex, 0 to 2 percent slopes	3.2	34.6%
Totals for Area of Interest		**9.2**	**100.0%**

Tippecanoe County, Indiana

UsA—Urban land-Starks-Fincastle complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: 5j0s
Elevation: 490 to 840 feet
Mean annual precipitation: 35 to 40 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 150 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 45 percent
Starks and similar soils: 25 percent
Fincastle and similar soils: 15 percent
Minor components: 6 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Till plains

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Description of Starks

Setting

Landform: Till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over loamy outwash

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 32 inches: silty clay loam
H3 - 32 to 57 inches: loam
H4 - 57 to 70 inches: stratified loamy sand to silt loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat poorly drained
Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: High (about 11.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F111XD017IN - Outwash Upland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Description of Fincastle

Setting

Landform: Till plains
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over loamy till

Typical profile

H1 - 0 to 11 inches: silt loam
H2 - 11 to 38 inches: silty clay loam
H3 - 38 to 46 inches: clay loam
H4 - 46 to 60 inches: loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 40 to 60 inches to densic material
Drainage class: Somewhat poorly drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 6 to 24 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Available water supply, 0 to 60 inches: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: F111XD009IN - Wet Till Ridge
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Minor Components

Mahalasville

Percent of map unit: 3 percent
Landform: Depressions
Ecological site: R111XD020IN - Wet Outwash Mollisol
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

Treaty

Percent of map unit: 3 percent
Landform: Depressions
Ecological site: F111XD008IN - Till Depression Flatwood
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Tippecanoe County, Indiana
Survey Area Data: Version 25, Sep 1, 2023

Tippecanoe County, Indiana

UmC—Urban land-Miami complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 5j0m
Elevation: 490 to 840 feet
Mean annual precipitation: 35 to 40 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 150 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 55 percent
Miami and similar soils: 45 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Landform: Till plains

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Description of Miami

Setting

Landform: Till plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over loamy till

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 23 inches: clay loam
H3 - 23 to 36 inches: loam
H4 - 36 to 60 inches: loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 24 to 40 inches to densic material
Drainage class: Moderately well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 24 to 42 inches

Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F111XD010IN - Till Ridge
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Tippecanoe County, Indiana
Survey Area Data: Version 25, Sep 1, 2023

Tippecanoe County, Indiana

UmB—Urban land-Miami complex, 2 to 8 percent slopes

Map Unit Setting

National map unit symbol: 5j0l
Elevation: 490 to 840 feet
Mean annual precipitation: 35 to 40 inches
Mean annual air temperature: 50 to 55 degrees F
Frost-free period: 150 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 55 percent
Miami and similar soils: 45 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Miami

Setting

Landform: Till plains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess over loamy till

Typical profile

H1 - 0 to 10 inches: silt loam
H2 - 10 to 23 inches: clay loam
H3 - 23 to 36 inches: loam
H4 - 36 to 60 inches: loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 24 to 40 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 24 to 42 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 40 percent

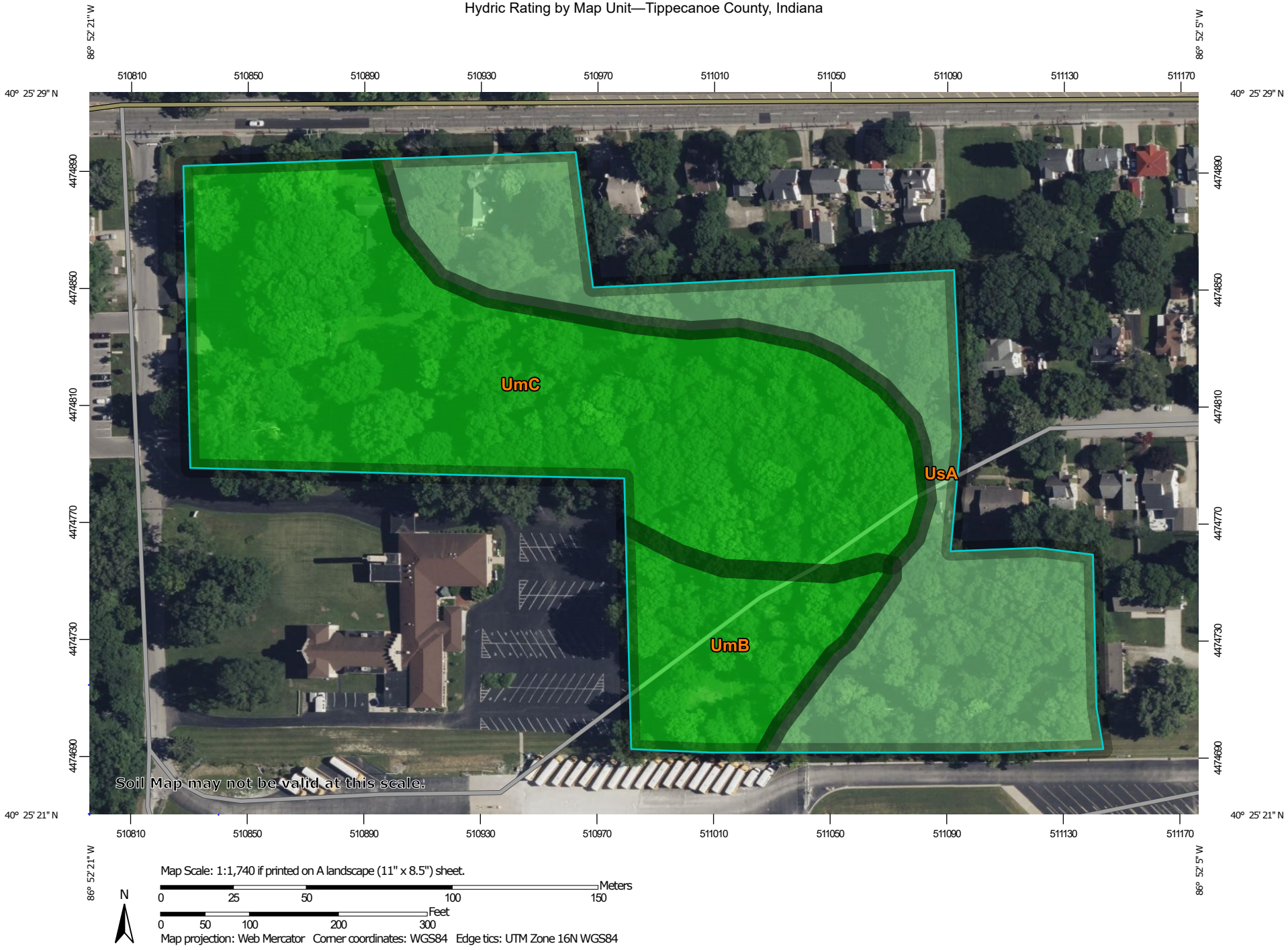
Available water supply, 0 to 60 inches: Low (about 5.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F111XD010IN - Till Ridge
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Tippecanoe County, Indiana
Survey Area Data: Version 25, Sep 1, 2023



Map Scale: 1:1,740 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- Hydric (100%)
- Hydric (66 to 99%)
- Hydric (33 to 65%)
- Hydric (1 to 32%)
- Not Hydric (0%)
- Not rated or not available

Soil Rating Lines

- Hydric (100%)
- Hydric (66 to 99%)
- Hydric (33 to 65%)
- Hydric (1 to 32%)
- Not Hydric (0%)
- Not rated or not available

Soil Rating Points

- Hydric (100%)
- Hydric (66 to 99%)
- Hydric (33 to 65%)
- Hydric (1 to 32%)
- Not Hydric (0%)
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

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Date(s) aerial images were photographed: Jun 16, 2022—Jun 27, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydric Rating by Map Unit

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
UmB	Urban land-Miami complex, 2 to 8 percent slopes	0	1.1	12.2%
UmC	Urban land-Miami complex, 8 to 15 percent slopes	0	4.9	53.2%
UsA	Urban land-Starks-Fincastle complex, 0 to 2 percent slopes	6	3.2	34.6%
Totals for Area of Interest			**9.2**	**100.0%**

Description

This rating indicates the percentage of map units that meets the criteria for hydric soils. Map units are composed of one or more map unit components or soil types, each of which is rated as hydric soil or not hydric. Map units that are made up dominantly of hydric soils may have small areas of minor nonhydric components in the higher positions on the landform, and map units that are made up dominantly of nonhydric soils may have small areas of minor hydric components in the lower positions on the landform. Each map unit is rated based on its respective components and the percentage of each component within the map unit.

The thematic map is color coded based on the composition of hydric components. The five color classes are separated as 100 percent hydric components, 66 to 99 percent hydric components, 33 to 65 percent hydric components, 1 to 32 percent hydric components, and less than one percent hydric components.

In Web Soil Survey, the Summary by Map Unit table that is displayed below the map pane contains a column named 'Rating'. In this column the percentage of each map unit that is classified as hydric is displayed.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). Under natural conditions, these soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

References:

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

Rating Options

Aggregation Method: Percent Present

Component Percent Cutoff: None Specified

Tie-break Rule: Lower

Map Scale: 1:1,740 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- <= 16.32
- > 16.32 and <= 28.35
- Not rated or not available

Soil Rating Lines

- <= 16.32
- > 16.32 and <= 28.35
- Not rated or not available

Soil Rating Points

- <= 16.32
- > 16.32 and <= 28.35
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

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Available Water Storage

Map unit symbol	Map unit name	Rating (centimeters)	Acres in AOI	Percent of AOI
UmB	Urban land-Miami complex, 2 to 8 percent slopes	16.32	1.1	12.2%
UmC	Urban land-Miami complex, 8 to 15 percent slopes	16.32	4.9	53.2%
UsA	Urban land-Starks-Fincastle complex, 0 to 2 percent slopes	28.35	3.2	34.6%
Totals for Area of Interest			**9.2**	**100.0%**

Description

Available water storage (AWS) is the total volume of water (in centimeters) that should be available to plants when the soil, inclusive of rock fragments, is at field capacity. It is commonly estimated as the amount of water held between field capacity and the wilting point, with corrections for salinity, rock fragments, and rooting depth. AWS is reported as a single value (in centimeters) of water for the specified depth of the soil. AWS is calculated as the available water capacity times the thickness of each soil horizon to a specified depth.

For each soil layer, available water capacity, used in the computation of AWS, is recorded as three separate values in the database. A low value and a high value indicate the range of this attribute for the soil component. A "representative" value indicates the expected value of this attribute for the component. For the derivation of AWS, only the representative value for available water capacity is used.

The available water storage for each map unit component is computed as described above and then aggregated to a single value for the map unit by the process described below.

A map unit typically consists of one or more "components." A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated (e.g., available water storage), the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the process is to derive a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for the map units can be generated. Aggregation is needed because map units rather than components are delineated on the soil maps.

The composition of each component in a map unit is recorded as a percentage. A composition of 60 indicates that the component typically makes up approximately 60 percent of the map unit.

For the available water storage, when a weighted average of all component values is computed, percent composition is the weighting factor.

Rating Options

Units of Measure: centimeters

Aggregation Method: Weighted Average

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Interpret Nulls as Zero: No

Layer Options (Horizon Aggregation Method): All Layers (Weighted Sum)