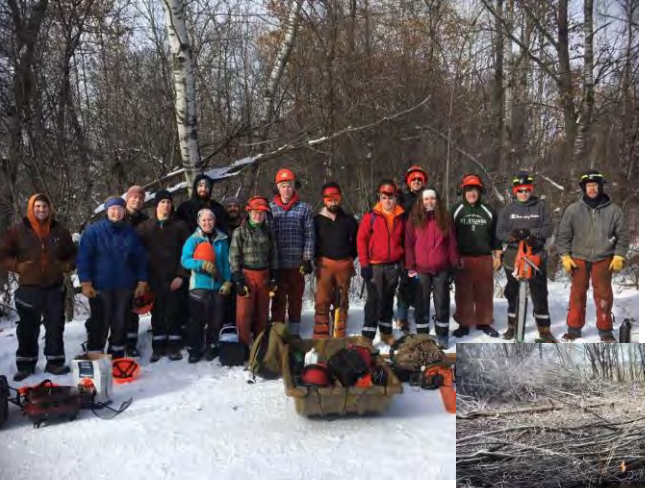

Little Plover Fisheries Area Restoration Monitoring Plan: 2019

Little Plover River Restoration Project Monitoring Protocols

Spring 2019 Ecological Monitoring (NR 457)

Overseeing Professor: Dr. Michael Demchik

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Executive Summary

The Little Plover River Restoration project involves roughly 200 acres of natural area in Portage County, WI, and has been in progress since late 2018. Restoration work was needed to remove invasive species such as Scots Pine and Spotted Knapweed, as well as to preserve and enhance habitat for species such as the Karner Blue Butterfly and Brook Trout. Two main habitat types were recently harvested for timber: a barrens area and a woodland area.

The 25-acre large barrens area, which will provide habitat for Karner Blue Butterfly and other native pollinators, was thinned to 50% canopy cover and then seeded with a mix meant to emulate the seed bank of an oak savannah. All Scots Pine was removed from the area, leaving an overstory of mixed pine and oak. This thinning would release open-grown oaks already present on the site and move the area towards a pine barren/oak savannah type habitat. It will require further management in the form of invasive species control.

The woodland area, roughly 27 acres in size, was harvested in the patch selection harvest system, with a focus on aspen regeneration and coarse woody debris recruitment. Coarse woody debris is utilized heavily by many different species of wildlife, and young aspen pockets are favored by bird species such as grouse. Like the barrens site, the woodland site will also require invasive species control.

The rest of the site's 130 acres will need to be managed for invasive species, and the entire site will require long-term monitoring efforts in order to gauge the success of past management actions and to guide further management actions and maintenance. Those monitoring protocols, and the circumstances which necessitate them, are described in detail in the following report.

Project Background

This project has been made possible by funding graciously provided by the Wisconsin Potato & Vegetable Growers Association, Wisconsin Wetlands Association, Montgomery Associates Resource Solutions, Wisconsin Wildlife Federation, University of Wisconsin Stevens Point, USFWS Partners for Fish and Wildlife, and the Wisconsin Wetland Conservation Trust, as well as the Village of Plover. These donors enable us to do the work described in the following document, and we thank them.

This project, with its focus on the improvement and creation of habitat for species of interest including the American Woodcock, Karner Blue Butterfly and others, seeks to provide the highest quality habitat possible, while ensuring there are plentiful opportunities for public use, whether through hunting, hiking or fishing.

The monitoring protocols describes in the following document are centered around indicator species that will help the restoration practitioners gauge the effectiveness of providing these habitats and services. They will be carried out by future UWSP students, natural resource professionals, and volunteers from interested parties such as Trout Unlimited.

Monitoring Plan Development Teams

Project Coordination Team

1. Heuss, Aja - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for various tasks related to keeping the project on schedule and easing communication between team members
2. Hooyman, Kelcie - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for various tasks related to keeping the project on schedule and easing communication between team members
3. Imp, Richard - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for various tasks related to keeping the project on schedule and easing communication between team members
4. Rusch, Lauren - Wildland Fire Science student at the University of Wisconsin-Stevens Point
    - Responsible for various tasks related to keeping the project on schedule and easing communication between team members

Geospatial Team

1. Denecke, Joseph - Wildland Fire Science student at the University of Wisconsin-Stevens Point

- Responsible for visual overlay and database composition components

2. Mazur, James - Wildland Fire Science student at the University of Wisconsin-Stevens Point
    - Responsible for collecting and uploading data from other teams
3. Sella, Andrew - Forest Recreation and Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for coordinating duties within the Geospatial Team and assisting team members in map development and data processing
4. Volbrecht, Morgan - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for developing a protocol for the use of the Avenza application

Invasive Team

1. Barth, Amanda - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for creating plant ID guide and descriptions for data collecting and volunteers
2. Graves, Abigail - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for the design of data collection sheets and coordination with the Plant Communities Team
3. Pertzborn, Jackson - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for collecting information and delineating thresholds of concern for invasive species relevant to the project
4. Wiedmeyer, Henry - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for coordinating duties within the Invasive Team and assisting team members when needed

Plant Communities Team

1. Janusz, Dana - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for developing a monitoring protocol to determine the increased structure and food sources provided by the various plant communities
2. Kurtz, Mitchell - Wildland Fire Science student at the University of Wisconsin-Stevens Point
    - Responsible for developing a monitoring protocol to determine the increased structure and food sources provided by the various plant communities
3. Scherr, Mitchell - Wildland Fire Science student at the University of Wisconsin-Stevens Point
    - Responsible for developing a monitoring protocol to determine the increased structure and food sources provided by the various plant communities
4. Shooter, Rainer - Wildland Fire Science student at the University of Wisconsin-Stevens Point
    - Responsible for developing a monitoring protocol to determine the increased structure and food sources provided by the various plant communities

Riparian Team

1. Drangeid, Sam - Resource Management and Wildland Fire Science student at the University of Wisconsin-Stevens Point
    - Responsible for developing a monitoring protocol for reserve trees within the project
2. Janssen, Adam - Wildland Fire Science student at the University of Wisconsin-Stevens Point
    - Responsible for developing a monitoring protocol in the riparian area of the Little Plover River
3. Ritter, Nicholas - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for assisting in the development of a pebble count survey in the Little Plover River area

Wildlife Team

1. Haegerl, Nicholas - Resource Management and Wildland Fire Science student at the University of Wisconsin-Stevens Point
    - Responsible for developing a monitoring protocol for Wood Duck and assisted in developing a monitoring protocol for Karner Blue Butterfly
2. Komada, Vanessa - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for developing a monitoring protocol for Woodcock and assisted in developing a monitoring protocol for Karner Blue Butterfly
3. Maurer, Sheila - Forest Ecosystem Restoration and Management student at the University of Wisconsin-Stevens Point
    - Responsible for developing a monitoring protocol for native bees and assisted in developing a monitoring protocol for Karner Blue Butterfly

Project Goals

- Barrens site: an average of 50% closed canopy; reduce invasive species; increase habitat suitability for KBB and woodcock
- Oak Woodland site: enhance oak woodland characteristics; reduce invasive species; augment course woody debris
- Riparian site: restore wetland habitats along channel; improve cold water (trout) habitat; reduce invasive species; promote wood duck habitat
- To enhance habitat for protected wildlife species
- To restore and encourage success of rare ecosystems
- To work in partnership with USWP faculty and students, the Town of Plover and Stockton, and community conservation organizations

Monitoring Objectives

1. Monitor population of game species, and the habitat needed for them, on the site
    - Brook Trout, Wood Duck, Woodcock, deer
2. Monitor invasive species
    - Knapweed, buckthorn, honeysuckle, Scot's pine, etc.
3. Monitor species and habitats of special concern
    - Karner Blue Butterfly, native pollinators, and Savanna habitat
    - American woodcock and old-growth forests
    - Wood duck and cavity-tree habitats

Documented Billable Hours

Project Coordination Team	**Hours**
Aja Heuss	41.5
Kelcie Hooyman	44.5
Richard Imp	2.25
Lauren Rusch	15
Geospatial Team	
Joseph Denecke	13.25
James Mazur	13.5
Andrew Sella	12.5
Morgan Volbrecht	
Invasive Team	
Amanda Barth	
Abigail Graves	17.75
Jackson Pertzborn	7
Henry Wiedmeyer	10
Plant Communities Team	
Dana Janusz	23
Mitchell Kurtz	20
Mitchell Scherr	
Rainer Shooter	18
Riparian Team	
Sam Drangeid	19.5
Adam Janssen	20.5
Nicholas Ritter	18
Wildlife Team	
Nicholas Haegerl	19
Vanessa Komada	10.5
Sheila Maurer	16.25

Geospatial Monitoring Protocol

Data will be collected in the field using Avenza Maps. Avenza Maps can be used for free with up to three maps and is compatible with Android and iOS phones and tablets. A map of the Little Plover Fishery Area Restoration Unit will need to be downloaded to Avenza in the form of a geo-referenced PDF. This geo-referenced PDF will need to be downloaded to the user's device either directly from the Oasis drive or from an email sent by someone with access to the Oasis drive.

1. The geo-referenced PDF can be added to Avenza from the "My Maps" tab by clicking the "Add" (Figure 1) button and selecting "Download or import a map" (Figure 2).
    - By selecting "From Device Storage", the user will be able to select the geo-referenced PDF from an alphabetized list of Avenza compatible files on the device. The user can also choose to select "From Storage Locations" and locate the geo-referenced PDF from their "Downloads" folder.

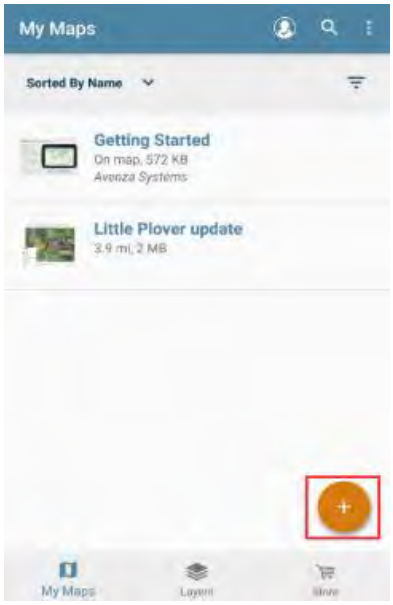


Figure 1

Figure 2

Figure 3

2. Geo-referenced pins are added to Avenza maps using the crosshairs at the center of the screen. The location of the user's device is represented on the map as a blue dot.

- When dropping a pin, the pin will be dropped on the location of the crosshairs at the center of the screen. If the user wishes to drop a pin on their location, the user will need to line the crosshairs up with their location or the user can select the blue "crosshairs icon", located at the bottom left corner of the screen in the white toolbar, to automatically center their location in the crosshairs at the center of the screen (Figure 3).

3. The button to drop a pin is located on the white toolbar at the bottom of the screen, left of the reading of the crosshair's latitude and longitude (Figure 4). The information collected in Avenza will be used by many people over a very large time period so each pin will need to be self-explanatory. Therefore, it is required for each pin to have an appropriate title, a detailed description and a photo to be used as a reference point for the location and/or documentation of the item being pinned.
    - The placement of that pin is finalized after the user selects the "checkmark" at the top right of the screen (Figure 5).

Figure 4

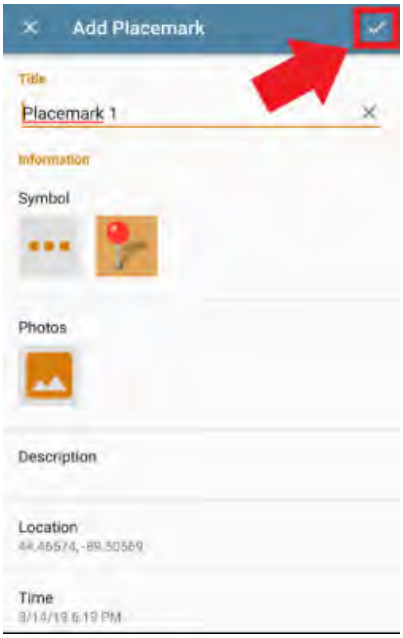


Figure 5

Figure 6

After all the data has been collected, the information entered in Avenza will need to be exported from the user's device. Exported files from Avenza are small because it is only the geo-referenced pins and information contained in those pins, that will be exported.

4. To Export the collection data, the user will need to select the "Layers" button on the white toolbar at the bottom of the map. The "Layers" button looks like a blue pin with three horizontal and parallel lines (Figure 6).
    - Once the "Layers" button has been selected, the user will be brought to the "Map Layers" screen.
    - At the bottom right hand corner of the screen there is an orange button with three horizontal and parallel lines which, after selecting, will give the user the option to "Export Layers".
5. From the "Export Layers Screen", the user will be able to send the data with an appropriate title and in the correct format.
    - The filename should be changed to reflect the type of data that was collected and the date it was collected.
    - The user will need to ensure the export format is "KML" (Figure 7). The export format can be changed by selecting "Export Format" and selecting "KML" from a list of three format options.
6. To finish exporting the data, the user will select "Export" and select the desired export method (Figure 8). It will be left up to the person leading the data collection to select the export method they prefer but it should be noted that email is an option available to users across all devices.

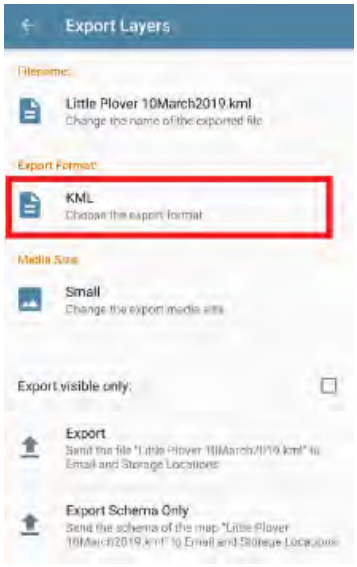


Figure 7

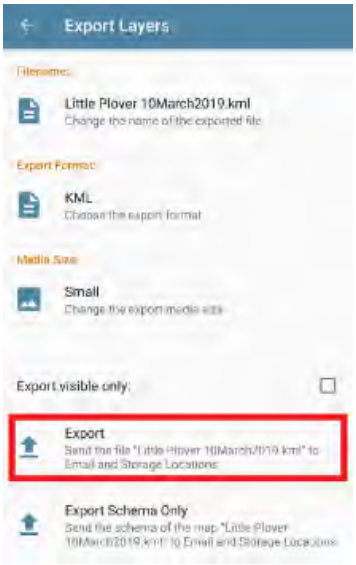


Figure 8

7. Volunteers are expected to submit the data they collected to the geospatial contact leader by the end of business (5:00pm) one week from the day of collection.
    - All data collected by groups and volunteers will be processed and displayed using Google Earth Pro.
    - All files will be stored in .kmz format due to the ease of storage and usability of the format towards other future programs.

Our overall plan includes multiple steps. Ideally, people would input the data that they collect from the field into the mobile data collection app. From there, we would then make the maps and tools necessary from the information provided. Once we make these maps, we will store each map according to whichever section it belongs to. Once everything is completed, we will have organized all our data to each section respectively and upload it to the oasis drive.

Barrens

Introduction

A barrens ecosystem is composed of a matrix of herbaceous vegetation interspersed with shrubs and tree species usually on dry, nutrient poor soils. These are fragile ecosystems that hold global importance in their rarity and their fostering of critical habitats. Oak-pine barrens hold unique ecological features that host a variety of rare and threated plant and animal species. Prairie grasslands and barrens environments provide crucial habitats for rare plant species such as wild lupine, which are specifically tied to the life cycle of the globally protected Karner blue butterfly. These sites are also favored by other protected wildlife species such as native bees and the American woodcock. In the past, barrens were heavily fire-dependent to keep pristine host sites for grassland savannas. With mitigated wildfires and expanding agricultural land, barrens ecosystems are quickly being eliminated from central Wisconsin.

Three barrens sites are being restored and observed at the Little Plover restoration site: pine barrens, oak-pine barrens, and oak barrens. Currently, the pine and oaks barrens system of the Little Plover restoration site are being thinned of invasive and competing overstory species that have been rescinding the necessary canopy gaps to allow desired species to thrive. All Scot's pines will be removed from these sites and further emerging invasive vegetation will be monitored.

Per the Wisconsin Habitat Partnership Fund Project Proposal, projected conditions on site will bestow a 50% closed canopy in the 25.6 acres of pine barrens to allow for mixed savanna grasses and forbs to thrive among pockets of jack, white, and red pine and present standing oaks. Each pocket of pines and oaks will be allowed to span a 50 to 200-foot diameter area. A 10-20% closed canopy will be permitted in the 15.4 acres of oak-pine barrens where open savanna mixes will be seeded among currently standing oak and native pine. A release of oaks within the 25.6 acres of designated oak barrens will be accommodated with an estimated 40-60% closed canopy. All competing trees and shrubs will be removed.

Vegetation Monitoring Protocol

Introduction Native

Unique ecosystems such as the Little Plover River restoration area create microhabitats that host a range of mammal, bird, and insect species. Native vegetation within the habitat are necessary for establishing viable structure and providing an ongoing food source for wildlife that call the area home. These native plants need to be monitored and maintained properly without disturbance. In order to help future managers of the site detect habitat degradation, the vegetation will be monitored for abundance of desired vegetation species along with percent canopy closure. Woody vegetation that will be monitored includes White, Red, and Northern Pin Oak, and American Hazelnut. Herbaceous species of interest include June Grass, Little Blue Stem, Wild Lupine, and Bush-Clover.

Oaks will be a large portion of the monitoring for both oak woodlands and barrens habitats. White oak is wind pollinated and start producing acorns sometime between 50-100 years old with good crop years every 4-10 years (Arbor Day Foundation, 2019).White Oak is rather important for this site because it will provide most of the canopy structure in the barrens and oak woodlands ecotype, as well as provide hard mass food for many wildlife species. It should be monitored due to the fact it will be making up a large portion of the canopy, and one of the objectives is to have 50% crown cover. Red oak is a member of a broad group of trees, characterized by having bristles or points on the leaf lobes and acorns, which mature in two growing seasons and sprout in the spring after maturity. Red and pin oak often associate with other trees like hard maples and basswood. The two oaks are sometimes very similar; generally pin oak has deeper and narrower lobes but sometimes the two hybridize with one another. Pin oak will be monitored even though it will be the least desired of the oak species due to its higher susceptibility to oak wilt.

American hazelnut is a shrub/small tree that will be monitored in the barrens area. Hazelnut can grow in a wide range of soil types. Soil conditions are typically moist to dry-mesic. It prefers full sun light but can persist in slightly shaded areas. The open barrens environment will be suitable for hazelnut to thrive. This shrub will provide a good food source for small game birds, small mammals, and insects. Hard mast, catkins, and buds will all be consumed by

wildlife. Hazelnut can form a main stem, but it usually forms multiple stems which will contribute good structure to the barrens environment (Trees, Shrubs, and Woody Vines of Illinois, 2019).

In the barrens area, four native herbaceous plants will be monitored, of which two will be grasses. The grasses being monitored are June grass and little bluestem. June grass is a cool season grass, meaning that it prefers to grow at temperatures cooler than 80 degrees Fahrenheit. It does best with full sun and well-drained soils, and it is well drought adapted. Little bluestem has been used extensively in prairie restoration projects primarily because of its adaptation to a diversity of sites, drought tolerance, growth habit, and wildlife appeal. Both little bluestem and June grass are known to produce clumps in the ground providing structure to the landscape.

Two other plants of monitoring interest are wild lupine and bush-clover. Wild lupine is a perennial forb that flowers in May or June. The plant is native to Wisconsin and needs a lot of sunlight, as well as recently disturbed areas. Lupine is a necessity to the Karner blue butterfly life cycle. The butterfly will only sustain populations in areas with lupine (Flora of WI, 2019). Bush-clover is a perennial forb flowering in July to September and its habitats consist of dry forested sandy soil sites. The plant is currently threatened in the state of Wisconsin but serves as a good food source for wildlife (Flora of WI, 2019).

Native Vegetation

- **Woody Vegetation**
    - White Oak – *Quercus alba*
    - Red Oak – *Quercus rubra*
    - Northern Pin Oak – *Quercus ellipsoidalis*
    - Hazelnut – *Corylus spp.*
    - Aspen – *Populus spp.*
- **Herbaceous Vegetation**
    - June Grass – *Koeleria macrantha*
    - Little Bluestem – *Schizachyrium scoparium*
    - Wild Lupine – *Lupinus perennis*
    - Bush-Clover – *Lespedeza spp.*

Introduction Invasive

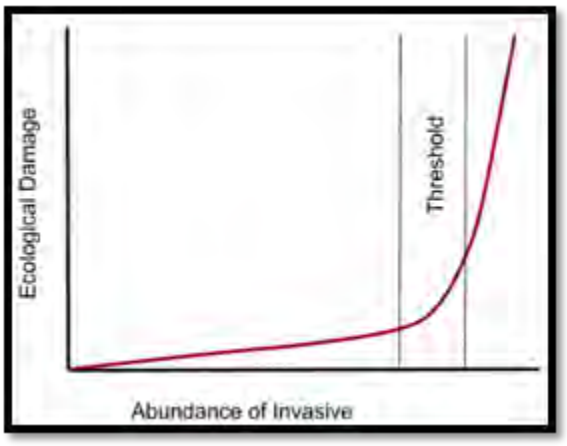
Monitoring invasive species is important because their potential to disrupt ecological site attributes increase as populations rise. The invasive plant species that have been identified for monitoring can cause disruptions in the natural composition, structure, and function of ecosystems—specifically the barrens, riparian, and oak woodland ecosystems present within the LPR restoration site. They can alter the natural food web, degrade habitat, introduce new pests/diseases, and displace native species resulting in decreased plant diversity and richness (WiDNR). According to the Wisconsin Department of Natural Resources (DNR), around 42% of endangered and threatened species have arrived at endangered or threatened statuses primarily as a result of the spread of invasive species (WiDNR).

Non-native plant species boasting aggressive rates of growth and reproduction can alter the intended structure of a site and outcompete desirable native plants (for example: woody brush encroaching on a prairie or invading a forest's understory to the effect of shading out native regeneration). The introduction of exotic and invasive species often arises as the result of anthropogenic (human), environment-manipulating activities such as planting exotic species, tracking in seeds from clothing and footwear, suppressing a historical fire regime, and any variety of mechanical disturbance—mowing, clearcutting, etc. Invasive plants are commonly weeds from agricultural areas capable of spreading along roadway corridors (WiDNR). Once surrounding areas have successful reproduction of invasive species, it is very difficult to stop the natural spread. Since exotic species did not evolve within the ecosystems they invade, they are sometimes without many natural competitors and are therefore likely to outcompete natives (WiDNR).

Invasive species are a large concern in most restoration and land management efforts. "A majority of managers (68%) devote at least 25% of their total restoration effort on this issue." (Rowe, 2010). Invasive encroachment into restoration projects can be explained by the propensity for soil disturbance—a boon to invasive establishment—inherent to restoration activities (Hess, 2019). Also, many restoration projects are located on land previously dedicated to agriculture. This tends to mean unnaturally high levels of nitrogen in soil, favoring invasive species over natives adapted to a nutrient-limited environment.

By monitoring for undesirable species, invasives can be caught before they begin to cause significant ecological alterations. This can present the opportunity to reduce their current

abundance in order to reach the determined goals for species composition. By establishing a threshold for response to an invasive species, one must accept that it is unrealistic to eliminate the species from the site, and that there exists a non-linear damage function relating the ecological damage to abundance of an invasive (Panetta 2017; Knowing, 2013). Adhering to a set threshold, intervention will occur before the number of individuals present conflict with the goals for the site.



Unlike the other species for which a threshold has been assigned, if any garlic mustard is recorded at any of the sites, management/removal will take place immediately. Garlic mustard requires immediate response due to its short maturation period, high reproductive capacity, and aggressive growth.

Management of woody species will involve cut-stump or basal bark herbicide treatments. Management of herbaceous species will likely be limited to foliar spray by herbicide. The biology of each species should be taken into consideration when selecting an herbicide for treatment.

Invasive Vegetation

- **Woody Vegetation**
  - Buckthorn - *Rhamnus*
  - Honeysuckle - *Lonicera spp*.
  - Japanese Barberry - *Berberis thunbergii*
  - Burning Bush - *Euonymus alatus*
- **Herbaceous Vegetation**
  - Spotted knapweed – *Centaurea maculosa*
  - Smooth brome – *Bromus inermis*

Canopy Density

Measuring canopy density will be recorded using a spherical densiometer. A spherical densiometer is a tool comprised of a curved reflective surface (usually glass, however, a cellphone app can be used for this measurement), which is used to reflect the above-head canopy light and shadows to the user of the device. The surface of the densiometer is segmented into a grid system 24 quarter inch squares. To assess canopy closure, hold the densiometer level to the ground and look in to it. However, many squares you see that are completely covered by overhead foliage is our variable. The amount of canopy covered square is divided by the total number of squares to obtain Canopy Density.

Timeline

1. Monitoring will begin Spring 2019
2. Monitoring should start at the beginning of the growing season (or at least two months after any prescribed burn takes place) every year for the first five years
3. After the first five years, monitor will take place in the spring once every three years for the next nine years
4. Training for volunteers is required
    - For use of spherical densiometer
    - Refer to Barrens Identification Guide for plant identification assistance
5. UW-Stevens Point professor or teacher assistant will conduct on-site briefings to volunteers for any species-specific indicators and any known potential hazards

Monitoring Equipment / Tools Required

1. Cellphone with GPS enabled
    - Used for site hotspots and data collection
    - Apps associated with restoration data collection should be downloaded prior to field work
2. Spherical Densiometer
    - Measures canopy closure

- Small concave mirror underneath a grid pattern, allows user to quantify canopy closure as a percent

3. Tape measure
    - Used for counting species at plot centers
4. Data collection sheets (Appendix 1 and 2)
5. Barrens Identification Guide

Monitoring Protocol

1. Site maps should be downloaded prior to inventory
2. Fill out top portion of data collection sheet before beginning the inventory
    - Circle which site is being inventoried
    - Fill in date inventory was carried out
    - Record all names of surveyors involved
3. Run a transect long enough for ten points (transects do not need to be a straight line, try to cover a sizable portion of each site), refer to downloaded maps for site size and boundaries
    - Walk one chain (or 13 paces) between each point
4. Refer to Barrens Identification Guide for assistance identifying species of interest
5. At each point:
    a. Hold the spherical densiometer over plot center, calculate the canopy closure as a percent, record percentage on data collection sheet

        (# of squares canopy covers / 24 total squares) x 100 = % Canopy Cover

    b. Measure five feet out from plot center using the tape measure
        i. Walk in a circle, recording the rank of any <u>non woody/herbaceous</u> invasive species present (ranks are explained on the data collection sheet)
            - If there are more than one species in this category, separate the names and ranks by commas (see example sheet)
        ii. Repeat sub steps for Step b to record data for <u>herbaceous</u> native plants
    c. Measure 15 feet out from plot center using the tape measure

i. Walk in a circle, recording the rank of any woody invasive species present (ranks are explained on the data collection sheet)
    - If there are more than one species in this category, separate the names and ranks by commas (see example sheet)

6. Proceed to the next point and repeat Steps 5a through 5c for all ten points
7. On the data collection sheet, sum the ranks for each species at the bottom of the sheets (separate species and ranks by commas, refer to example sheet for assistance)

Sample Data Collection Table

Point	Invasive Species	Ranks
1	Woody: Buckthorn	2
	Non: Spotted Knapweed	1
2	Woody: Honeysuckle	1
	Non: Spotted Knapweed, Reed Canary	2, 5
3	Woody: Buckthorn	1
	Non:	-
4	Woody: Honeysuckle, Barberry	1,1
	Non: Spotted Knapweed	1
5	Woody:	-
	Non: Spotted Knapweed, Reed Canary	3, 5
6	Woody: Buckthorn, Barberry	3, 2
	Non: Smooth Brome	2
7	Woody: Buckthorn, Honeysuckle, Burning Bush	3, 1, 1
	Non:	-
8	Woody: Spotted Knapweed, Smooth Brome	2,3
	Non:	-
9	Woody:	-
	Non: Garlic Mustard	1
10	Woody:	-
	Non: Smooth Brome	4
Total (Sum)	Woody: Buckthorn, Honeysuckle, Barberry, Burning Bush	9, 3, 3, 1
	Non: Spotted Knapweed, Smooth Brome, Reed Canary, Garlic Must	9, 6, 10, 1

Wildlife Monitoring Protocol

Woodcock Introduction

American Woodcock (*Scolopax minor*) is an important game species within North America. Despite high Wisconsin Woodcock populations, a ten-year study done by the US Fish and Wildlife Service (USFWS) found that Woodcock populations significantly decreased by 0.44% between 2008-2018. (USFWS, 2018). Thus, it is important to annually survey populations to ensure population stability and continue sustainable hunting within Wisconsin. Furthermore, Woodcock serve as a good indicator for forest diversity and matrix complexity. Woodcock can often be difficult to monitor due to their coloration, smaller size, migration patterns, and preference for dense vegetation.

Figure 1. Woodcock Flyway/USFWS survey coverage. Photo by: USFWS

Woodcock have two migration patterns: the Eastern and Central Flyway (see Figure 1.), with Wisconsin located in the Central Flyway. Migration begins between the months of October-November, with wintering locations found by mid-December (Myatt and Krementz, 2007). While monitoring techniques for this species include wing-collection surveys, harvest-collection surveys, and sing-ground surveys, the latter is the most affordable and appropriate option for long-term, volunteer-structured monitoring. Singing-ground surveys (or Peenting surveys) are a suggested monitoring protocol to gauge annual changes in Woodcock populations (Duke, 1966). This technique involves counting the number of males visually spotted or heard during male courtship rituals.

Woodcock survey points along the Barrens site, courtesy of Vanessa Komada

Timeline

1. Wildlife Team site visit in February to analyze and establish potential courting habitat for future surveys
    - Using GIS software, Wildlife Team will create survey points in the Little Plover Fishery Area
2. Surveys conducted from early April to early May and prior, on-site training will be provided by WI DNR staff
3. Daily surveys will be conducted for the next nine years (for a total of ten years)
    - Woodcock population will then be considered for re-evaluation and statistical analysis

Monitoring Equipment/Tools Required

1. Cellphone with GPS enabled
    - Used for site hotspots and data collection
    - Apps associated with restoration data collection should be downloaded
2. Data collection sheets (Appendix 3)
    - To record species heard and surrounding climate
3. Map of courting/survey locations
    - Reference guide

Monitoring Protocol

Surveyors will conduct crepuscular (during dawn and dusk) surveys in early spring between the months of April and May (April 25- May 15 as recommended by the USFWS) Surveys should be conducted once a week in this timeframe. Instruction manuals and appropriate data collection sheets will be provided to allow for consecutive, concise, and comparable data to be collected. Surveys will be conducted for the next ten years before species re-evaluation to allow for appropriate statistical analysis of annual population fluctuations.

There will be a total of four survey points based off previously identified suitable courting habitat. Routes will begin 15 minutes before sunset and end approximately 30 minutes later. At each survey point, surveyors will spend approximately eight minutes observing for male woodcock and fill out the attached data collection sheet. During courtship, males begin by making a "peenting" sound on the ground. Aerial displays follow and a whistling sound is made by the bird's wings, all of which is done in open areas. If volunteers are not experienced, it is recommended that they conduct the survey with a more experienced individual.

Factors to Consider:

- Surveyors must be able to hear sounds between 4,700 and 6,000hz. To test this, please follow this link: https://www.youtube.com/watch?v=H-iCZElJ8m0.
- Temperatures between 40-60F with relative humidity at 51-75% humidity is ideal. Do not survey during rain or adverse weather conditions
- Use both peenting and flight sounds when counting the number of birds at listening point. Only record the individuals heard, NOT the number of peents heard

1. An initial in-person training session with trained personnel with take place before surveys are conducted at the Little Plover River restoration site
    - Volunteers will be provided with GPS capabilities for a map and locating sampling points whether that is on a smart phone or other device
    - Instruction on how to fill out data sheet will be presented, and data sheet will be given

2. It is recommended to review a video of Woodcock courtship peenting and flight activities before conducting surveys: https://www.youtube.com/watch?v=xxb95xTZTeA.
3. Pre-dusk and post-dusk survey
    a. Navigate to designated survey location
    b. Observe Woodcock for eight minutes for peents and/or flight activity
    c. Record observations as follows:
        i. Number of peents and/or flights per bird
        ii. Daily survey totals
        iii. Surrounding vegetation/habitat qualities
4. Repeat Steps a through c for all four designated survey locations
5. Refresh trainings or check-in meetings as needed

Native Bees Introduction

There are approximately 4,000 native bee species that can be found in North America where flowers bloom (Ward, 2014). Bees play an important role in natural and agricultural landscapes by providing valuable services to many flowering plants that range from wild flowers to important crops that include a variety of fruits, vegetables and even almonds (Wilson, 2016). Since the 1990s, there has been a decline in native bee populations, but it was not until 2005 when a drastic decline was noticed by environmentalists that raised concerns (Iowa 2003-2019).

Why is insect pollination so important? Bees can efficiently transfer pollen between different plant individuals of the same species. This cross pollination makes for healthier and more genetically diverse plant populations. It also helps crops such as watermelon, which have separate pollen providing (male) and fruit producing (female) flowers, or apples, for which many varieties require cross-pollination from a different variety (called "self-incompatibility") (Williams, 2009). It is estimated that one third of the food we consume each day relies on pollination mainly by bees, so the decline in bees is detrimental to our ecosystem and our food source (Sustain, 2019).

Taken from: Streamlined Bee Monitoring Protocol for Assessing Pollinator Habitat

Timeline

1. Wildlife Team site visit in February to analyze and establish potential site
2. Surveys conducted from July to late August and prior, on-site training will be provided by WI DNR staff
3. Weekly surveys will be conducted for the next nine years (for a total of ten years)
    - Native Bee populations will then be considered for re-evaluation and statistical analysis

Monitoring Equipment/Tools Required

1. Map of transect/survey locations
2. Data collection sheets (Appendix 4)
3. Clipboard
4. Barrens Identification Guide

Monitoring Protocol

The goal of this monitoring protocol is to document native bee diversity and their abundance on pollinator habitat in order to measure their success in supporting pollinators and to document changes in the bee community over the years after seeding (Ward, 2014). Surveyors will monitor native bee abundance and diversity by conducting two afternoon surveys once a week during the growing season between the months of July to late August in the Great Lakes region as recommended in the Streamlined Bee Monitoring Protocol for Assessing Pollinator Habitat (Ward, 2014). Monitoring protocol and data collection sheets will be provided for data collection. Conducting surveys during optimal weather conditions will allow for best results as bees are most active during warm, sunny, calm days. Best results for data collection will be in the afternoon between 12 pm noon and 4 pm. There will be four parallel 50-foot-long transects spaced 3 feet apart for a total of 200 feet of transect located in full sunlight. Estimated time for collecting data is approximately 30 minutes; walk between transects and count bees visiting flowers. (Ward, 2014).

Taken from: Streamlined Bee Monitoring Protocol for Assessing Pollinator Habitat

Factors to Consider:

- Observers should be able to identify bee species (reference Barrens Identification Guide)
- Temperatures should be greater than 60°F
- Do not survey during rain or cloudy conditions; transects should be in full sunlight. Skies should mostly clear - partly cloudy or overcast skies are okay if shadow can still be seen
- Ideal wind speed should be less than 8 mph

1. Education and/or training session to take place before surveys are conducted at the Little Plover location
    - Will include bee, wasp, and fly identification
2. Afternoon survey
    a. Walk between four parallel 50-foot-long transects
    b. Count bees visiting a flower between 12 pm noon and 4pm
    c. Record data as follows:
        i. Site name and date
        ii. Surveyor name and the number of visits to the site
        iii. Current weather condition for that day
        iv. Surrounding habitat type
3. Repeat Step 2
4. Record each bee found on flower
    - Tally native bees and honey bees separately on data collection sheet
    - Refer to Barrens Identification Guide for assistance identifying bees
    - Other floral visitors can be noted in the notes section of data sheet
5. Refresh trainings or check-in meetings as needed

Karner Blue Butterfly Introduction

The Karner Blue Butterfly (*Lycaeides melissa samuelis*) has been a federally endangered species since 1992. It is known to reside within the central and northern parts of Wisconsin, as well as throughout Portage County. However, their current distribution is sad in comparison to the past where populations spanned across 12 states from Minnesota to Maine, as well as into Canada. Within Wisconsin, ideal habitat consists of barrens, savannas, and prairies that contain Wild Lupine (*Lupinus perennis*). Unfortunately, due to agriculture, urban development, and other natural factors, the prevalence of these ecosystems has been decreasing since early European settlement (WDNR, 2018) (Curtis, 1959). Furthermore, barrens habitat is highly susceptible to climatic changes, are dependent on periodic low-intensity disturbance events, and have a low nutrient-holding capacity due to the sandy soil composition in the region (Hess and Hess, 2015). Karner Blue Butterflies (KBB) are indicative of this fleeting habitat because of their specific needs for Wild Lupine. In fact, as newly developed caterpillars, they rely solely on this species as a food source. By the early 2000s, both the Wisconsin DNR and the US Fish and Wildlife Service (USFWS) had created a recovery plans for this valuable species. This included barrens management using fire, grazing, scarification, and chemicals (Swengel and Swengel, 1996, 2007). Within KBB ranges, Wisconsin holds the greatest amount of remaining barrens habitat, thus making it vitally important to keep these ecosystems thriving and to continuously manage for this important population. Since it is well-established and insightful, it will be most beneficial to base surveys off the WDNR KBB protocols currently in place. This includes presence/absence surveys for Wild Lupine as well as for KBB. Both surveys will allow for accurate determination of habitat suitability as well as future restoration potential. Surveys will be conducted by citizen scientists that are properly trained and supervised by

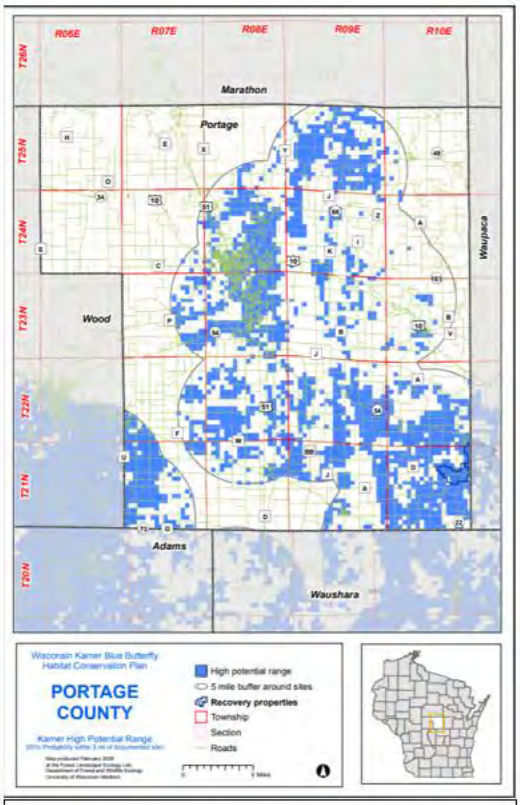


Figure 1. Portage County Kbb Distribution. Photo by: WDNR

authorized personnel at the Little Plover River Restoration area between late May and early June (migration period).

Timeline

1. Wildlife Team site visit in February to analyze and establish potential courting habitat for future surveys
    - Using GIS software, Wildlife Team will create survey points in the Little Plover Barrens Area
2. Surveys conducted from late May to June and prior, on-site training will be provided by WI DNR staff
3. Daily surveys will be conducted for the next nine years (for a total of ten years)
    - Karner Blue Butterfly populations will then be considered for re-evaluation and statistical analysis

Monitoring Equipment / Tools Required

1. Cellphone with GPS enabled
    - Used for site hotspots and data collection
    - Apps associated with restoration data collection should be downloaded prior to field work
2. Data collection sheets (WI DNR website)
3. Clipboard
4. Barrens Identification Guide

Monitoring Protocol

Karner Blue Butterflies (KBB) are closely tied to the Wild Lupine plant during its life cycle. Consequently, areas where surveying for KBB is to take place should have a presence of lupine in the plant community. Since KBB require lupine for their life cycle, part of a sound monitoring plan for the butterflies includes monitoring the lupine presence on a site.

In addition to monitoring lupine presence, visual observations for the actual butterfly adults will be carried out. Both the adult butterflies and the lupine will be surveyed by using designated sampling transects to collect data. Volunteers will walk the transects and record their

observations. The timing of these surveys will match the occurrence of first and second flight for the Karners. Respectively these surveys will be conducted in late May and early June.

Please refer to the Wisconsin Department of Natural Resources monitoring protocols for Karner Blue Butterfly Monitoring at the Little Plover River Fishery Area.

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American Woodcock management regions. Priority Information Needs of Amerian Woodcock. Photo: UWFWS

American Woodcock. This photo was taken in May 2019 at Bryant Park, NY. Photo: Rhododendron, Wikicommons

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Karner Blue Butterfly Portage County Distribution Map. produced by Forest Landscape Ecology Lab in 2009. Photo by: Wisconsin DNR

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Oak Woodland

Introduction

The Oak Woodland portion of the restoration seeks to achieve two main goals: to provide effective matrix habitat for Woodcock and pollinator species, and to restore the woodland to a healthy state with decreased susceptibility to Oak Wilt and invasive species. Pre-restoration, the Oak Woodland was dominated by Northern Pin Oak, with a smattering of Scots Pine, Jack Pine, White Pine, and Red Pine throughout the overstory. The understory was largely *Rubus* spp. and Buckthorn. With the goal of bringing this area in line with similar open Oak Woodland restorations in Illinois, the restoration practitioners sought to release the Oak species present. The target crown cover was 40-60%. A more open woodland setting of this nature will allow for easier control of Oak Wilt should it appear on this portion of the site. Additionally, the open canopy structure will enable the use of barrens species in the understory, thereby increasing the habitat available to pollinator species.

For future management, a barrens seed mix will be applied to this portion of the site, with the goal of providing high-quality habitat for pollinator species and the Karner Blue Butterfly. The Northern Pin Oak will eventually be replaced by White Oak, with the intent of decreasing the site's susceptibility to Oak Wilt even further. In terms of general management, the invasive species (particularly the Buckthorn) must be watched closely. Future monitoring will be done to determine the exact kind of management necessary to control the unwanted species, but it must be assumed that some form of additional management must be necessary.

Any discussion of what this restoration prescription will do to help the indicator species must begin with a discussion of habitat proximity. Throughout an organism's life history, it will likely use different habitat types for breeding grounds, feeding grounds, nesting grounds, et cetera. Habitat proximity simply looks at the distances between these necessary habitat types. This becomes especially important to consider when dealing with offspring. If the offspring must move a great distance between the nesting ground and the feeding or foraging habitat, predation tends to increase.

For American Woodcock, like many other species, this concept is incredibly important to consider when managing for them. Male American Woodcock perform courtship displays in

open areas, which this woodland restoration will qualify as. Female American Woodcock tend to nest near these display areas. When the chicks hatch, the female leads them to foraging grounds, which tend to be moist, riverside areas such as the Riparian area being restored on this same site. What this means is that this more open restoration enables the male woodcock to have a useful performance area near good quality feeding grounds. This increases habitat proximity and will likely decrease the predation of Woodcock offspring as they move from the nest to the forage areas.

The prescriptions for this restoration aim to maximize the quality of habitat for multiple target species while increasing the likelihood of the site withstanding outside pressure from pathogens and invasive species.

Vegetation Monitoring Protocol

Introduction Native

Unique ecosystems such as the Little Plover River restoration area create microhabitats that host a range of mammal, bird, and insect species. Native vegetation within the habitat are necessary for establishing viable structure and providing an ongoing food source for wildlife that call the area home. These native plants need to be monitored and maintained properly without disturbance. In order to help future managers of the site detect habitat degradation, the vegetation will be monitored for abundance of desired vegetation species along with percent canopy closure. White Oak and Pin Oak will be monitored along with herbaceous species such as Bush-Clover and Upland Boneset.

Oaks will be a large portion of the monitoring for both oak woodlands and barrens habitats. For the oak woodland we will be monitoring white and pin oak. White oak is wind pollinated and start producing acorns sometime between 50-100 years old with good crop years every 4-10 years (Arbor Day Foundation, 2019). White Oak is rather important for this site because it will provide most of the canopy structure in the barrens and oak woodlands ecotype, as well as provide hard mass food for many wildlife species. Pin oak are members of the red oak group which are characterized by having bristles or points on the leaf lobes and acorns which mature in two growing seasons and sprout in the spring after maturity. Pin oak will be monitored even though it will be the least desired of the oak species due to its higher susceptibility to oak wilt.

The native herbaceous vegetation that we will be monitoring in the oak woodlands is bush-clover and upland boneset. Bush-clover is a perennial forb flowering in July to September and its habitat consists of dry forested sandy soil sites. The plant is currently threatened in the state of Wisconsin but serves as a good food source for wildlife (Flora of WI, 2019). Upland boneset is an uncommon terrestrial plant found in rocky forests, oak savannas, and oak woodlands. A large range of pollinators are often attracted to the bonesets flower. These pollinators are many kinds of bees, butterflies, moths, and flies. The plant itself is not a common food source for any herbivores as it has a bitter taste (Prairie Wildflowers of Illinois, 2019).

Native Vegetation

- **Woody Vegetation**
    - White Oak – *Quercus alba*
    - Pin Oak – *Quercus ellipsoidalis*
- **Herbaceous Vegetation**
    - Bush-clover - *Lespedeza spp.*
    - Upland Boneset **-** *Eupatorium sessilifolium*

Introduction Invasive

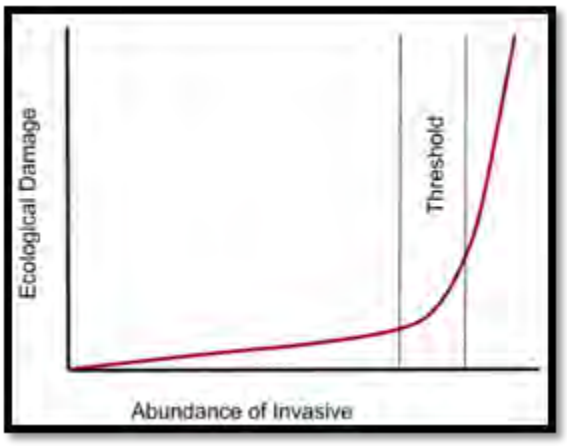
Monitoring invasive species is important because their potential to disrupt ecological site attributes increase as populations rise. The invasive plant species that have been identified for monitoring can cause disruptions in the natural composition, structure, and function of ecosystems—specifically the barrens, riparian, and oak woodland ecosystems present within the LPR restoration site. They can alter the natural food web, degrade habitat, introduce new pests/diseases, and displace native species resulting in decreased plant diversity and richness (WiDNR). According to the Wisconsin Department of Natural Resources (DNR), around 42% of endangered and threatened species have arrived at endangered or threatened statuses primarily as a result of the spread of invasive species (WiDNR).

Non-native plant species boasting aggressive rates of growth and reproduction can alter the intended structure of a site and outcompete desirable native plants (for example: woody brush encroaching on a prairie or invading a forest's understory to the effect of shading out native regeneration). The introduction of exotic and invasive species often arises as the result of anthropogenic (human), environment-manipulating activities such as planting exotic species, tracking in seeds from clothing and footwear, suppressing a historical fire regime, and any variety of mechanical disturbance—mowing, clearcutting, etc.. Invasive plants are commonly weeds from agricultural areas capable of spreading along roadway corridors (WiDNR). Once surrounding areas have successful reproduction of invasive species, it is very difficult to stop the natural spread. Since exotic species did not evolve within the ecosystems they invade, they are sometimes without many natural competitors and are therefore likely to outcompete natives (WiDNR).

Invasive species are a large concern in most restoration and land management efforts. "A majority of managers (68%) devote at least 25% of their total restoration effort on this issue." (Rowe, 2010). Invasive encroachment into restoration projects can be explained by the propensity for soil disturbance—a boon to invasive establishment—inherent to restoration activities (Hess, 2019). Also, many restoration projects are located on land previously dedicated to agriculture. This tends to mean unnaturally high levels of nitrogen in soil, favoring invasive species over natives adapted to a nutrient-limited environment.

By monitoring for undesirable species, invasives can be caught before they begin to cause significant ecological alterations. This can present the opportunity to reduce their current

abundance in order to reach the determined goals for species composition. By establishing a threshold for response to an invasive species, one must accept that it is unrealistic to eliminate the species from the site, and that there exists a non-linear damage function relating the ecological damage to abundance of an invasive (Panetta 2017; Knowing, 2013). Adhering to a set threshold, intervention will occur before the number of individuals present conflict with the goals for the site.



Unlike the other species for which a threshold has been assigned, if any garlic mustard is recorded at any of the sites, management/removal will take place immediately. Garlic mustard requires immediate response due to its short maturation period, high reproductive capacity, and aggressive growth.

Management of woody species will involve cut-stump or basal bark herbicide treatments. Management of herbaceous species will likely be limited to foliar spray by herbicide. The biology of each species should be taken into consideration when selecting an herbicide for treatment.

Invasive Vegetation

- **Woody Vegetation**
  - Common Buckthorn – *Rhamnus cathartica*
  - Honeysuckle – *Lonicera spp*.
  - Japanese Barberry – *Berberis thunbergii*
  - Burning Bush – *Euonymus alatus*
- **Herbaceous Vegetation**
  - Garlic Mustard – *Alliaria petiolata*
  - Smooth Brome – *Bromus inermis*

Canopy Density

Measuring canopy density will be recorded using a spherical densiometer. A spherical densiometer is a tool comprised of a curved reflective surface (usually glass, however, a cellphone app can be used for this measurement), which is used to reflect the above-head canopy light and shadows to the user of the device. The surface of the densiometer is segmented into a grid system 24 quarter inch squares. To assess canopy closure, hold the densiometer level to the ground and look in to it. However, many squares you see that are completely covered by overhead foliage is our variable. The amount of canopy covered square is divided by the total number of squares to obtain Canopy Density.

Timeline

1. Monitoring will begin Spring 2019
2. Should be monitored at the beginning of the growing season (or at least two months after any prescribed burn takes place) every year for the first five years
3. After the first five years, monitor in the spring once every three years for the next nine years
4. Training for volunteers is required
    - For use of spherical densiometer
    - Refer to Oak Woodland Identification Guide for plant identification assistance
5. UW-Stevens Point professor or teacher assistant will conduct on-site briefings to volunteers for any species-specific indicators and any known potential hazards

Monitoring Equipment / Tools Required

1. Cellphone with GPS enabled
    - Used for site hotspots and data collection
    - Apps associated with restoration data collection should be downloaded prior to field work
2. Spherical Densiometer
    - Measures canopy closure

- Small concave mirror underneath a grid pattern, allows user to quantify canopy closure as a percent

3. Tape measure
    - Used for counting species at plot centers
4. Data collection sheets (Appendix 1 and 2)
5. Oak Woodland Identification Guide

Monitoring Protocol

1. Site maps should be downloaded prior to inventory
2. Fill out top portion of data collection sheet before beginning the inventory
    - Circle which site is being inventoried
    - Fill in date inventory was carried out
    - Record all names of surveyors involved
3. Run a transect long enough for ten points (transects do not need to be a straight line, try to cover a sizable portion of each site), refer to downloaded maps for site size and boundaries
    - Walk one chain (or 13 paces) between each point
4. Refer to Oak Woodland Identification Guide for assistance identifying species of interest
5. At each point:
    a. Hold the spherical densiometer over plot center, calculate the canopy closure as a percent, record percentage on data collection sheet

        (# of squares canopy covers / 24 total squares) x 100 = % Canopy Cover

    b. Measure five feet out from plot center using the tape measure
        i. Walk in a circle, recording the rank of any <u>non woody/herbaceous</u> invasive species present (ranks are explained on the data collection sheet)
            - If there are more than one species in this category, separate the names and ranks by commas (see example sheet)
        ii. Repeat sub steps for Step b to record data for <u>herbaceous</u> native plants
    c. Measure 15 feet out from plot center using the tape measure

i. Walk in a circle, recording the rank of any woody invasive species present (ranks are explained on the data collection sheet)
    - If there are more than one species in this category, separate the names and ranks by commas (see example sheet)

6. Proceed to the next point and repeat Steps 5a through 5c for all ten points
7. On the data collection sheet, sum the ranks for each species at the bottom of the sheets (separate species and ranks by commas, refer to example sheet for assistance)

Sample Data Collection Table

Point	Invasive Species	Ranks
1	Woody: Buckthorn	2
	Non: Spotted Knapweed	1
2	Woody: Honeysuckle	1
	Non: Spotted Knapweed, Reed Canary	2, 5
3	Woody: Buckthorn	1
	Non:	-
4	Woody: Honeysuckle, Barberry	1,1
	Non: Spotted Knapweed	1
5	Woody:	-
	Non: Spotted Knapweed, Reed Canary	3, 5
6	Woody: Buckthorn, Barberry	3, 2
	Non: Smooth Brome	2
7	Woody: Buckthorn, Honeysuckle, Burning Bush	3, 1, 1
	Non:	-
8	Woody: Spotted Knapweed, Smooth Brome	2,3
	Non:	-
9	Woody:	-
	Non: Garlic Mustard	1
10	Woody:	-
	Non: Smooth Brome	4
Total (Sum)	Woody: Buckthorn, Honeysuckle, Barberry, Burning Bush	9, 3, 3, 1
	Non: Spotted Knapweed, Smooth Brome, Reed Canary, Garlic Must	9, 6, 10, 1

Wildlife Monitoring Protocol

Woodcock Introduction

American Woodcock (*Scolopax minor*) is an important game species within North America. Despite high Wisconsin Woodcock populations, a ten-year study done by the US Fish and Wildlife Service (USFWS) found that Woodcock populations significantly decreased by 0.44% between 2008-2018. (USFWS, 2018). Thus, it is important to annually survey populations to ensure population stability and continue sustainable hunting within Wisconsin. Furthermore, Woodcock serve as a good indicator for forest diversity and matrix complexity. Woodcock can often be difficult to monitor due to their coloration, smaller size, migration patterns, and preference for dense vegetation.

Figure 1. Woodcock Flyway/USFWS survey coverage. Photo by: USFWS

Woodcock have two migration patterns: the Eastern and Central Flyways (see Figure 1.), with Wisconsin located in the Central Flyway. Migration begins between the months of October-November, with wintering locations found by mid-December (Myatt and Krementz, 2007). While monitoring techniques for this species include wing-collection surveys, harvest-collection surveys, and sing-ground surveys, the latter is the most affordable and appropriate option for long-term, volunteer-structured monitoring. Singing-ground surveys (or Peenting surveys) are a suggested monitoring protocol to gauge annual changes in Woodcock populations (Duke, 1966). This technique involves counting the number of males visually spotted or heard during male courtship rituals.

Timeline

1. Wildlife Team site visit in February to analyze and establish potential courting habitat for future surveys
    - Using GIS software, Wildlife Team will create survey points in the Little Plover Fishery Area
2. Surveys conducted from early April to early May and prior, on-site training will be provided by WI DNR staff
3. Daily surveys will be conducted for the next nine years (for a total of ten years)
    - Woodcock population will then be considered for re-evaluation and statistical analysis

Monitoring Equipment/Tools Required

1. Cellphone with GPS enabled
    - Used for site hotspots and data collection
    - Apps associated with restoration data collection should be downloaded
2. Data collection sheets (Appendix 3)
    - To record species heard and surrounding climate
3. Map of courting/survey locations
    - Reference guide

Monitoring Protocol

Surveyors will conduct crepuscular (during dawn and dusk) surveys in early spring between the months of April and May (April 25- May 15 as recommended by the USFWS) Surveys should be conducted once a week in this timeframe. Instruction manuals and appropriate data collection sheets will be provided to allow for consecutive, concise, and comparable data to be collected. Surveys will be conducted for the next ten years before species re-evaluation to allow for appropriate statistical analysis of annual population fluctuations.

There will be a total of four survey points based off previously identified suitable courting habitat. Routes will begin 15 minutes before sunset and end approximately 30 minutes later. At each survey point, surveyors will spend approximately eight minutes observing for male

woodcock and fill out the attached data collection sheet. During courtship, males begin by making a "peenting" sound on the ground. Aerial displays follow and a whistling sound is made by the bird's wings, all of which is done in open areas. If volunteers are not experienced, it is recommended that they conduct the survey with a more experienced individual.

Factors to Consider:

- Surveyors must be able to hear sounds between 4,700 and 6,000hz. To test this, please follow this link: https://www.youtube.com/watch?v=H-iCZElJ8m0.
- Temperatures between 40-60F with relative humidity at 51-75% humidity is ideal. Do not survey during rain or adverse weather conditions
- Use both peenting and flight sounds when counting the number of birds at listening point. Only record the individuals heard, NOT the number of peents heard

1. An initial in-person training session with trained personnel with take place before surveys are conducted at the Little Plover River restoration site
    - Volunteers will be provided with GPS capabilities for a map and locating sampling points whether that is on a smart phone or other device
    - Instruction on how to fill out data sheet will be presented, and data sheet will be given
2. It is recommended to review a video of Woodcock courtship peenting and flight activities before conducting surveys: https://www.youtube.com/watch?v=xxb95xTZTeA.
3. Pre-dusk and post-dusk survey
    a. Navigate to designated survey location
    b. Observe Woodcock for eight minutes for peents and/or flight activity
    c. Record observations as follows:
        i. Number of peents and/or flights per bird
        ii. Daily survey totals
        iii. Surrounding vegetation/habitat qualities
4. Repeat Steps a through c for all four designated survey locations
5. Refresh trainings or check-in meetings as needed

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American Woodcock. This photo was taken in May 2019 at Bryant Park, NY. Photo: Rhododendron, Wikicommons

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Riparian Floodplain

Introduction

Riparian areas, while generally limited in size, possess unique properties that warrant special attention and additional monitoring effort. The Natural Resources Conservation Service (NRCS) identifies multiple ecosystem services provided by nearly all riparian areas: "energy flow, nutrient cycling, water cycling, hydrologic function, and plant and animal population" (NRCS). Riparian areas and their composition are strong determinants of stream health in general. Overstory composition and the associated shading from trees reduces solar heating on channels (Li et al. 2012). This function alone (manipulating channel water temperature) can have significant implications for aquatic life in the Little Plover River (LPR). Regulation of water temperature in the LPR is especially relevant, given the habitat needs of the Brook Trout populating the river. The current condition of the LPR does not represent suitable habitat for a successful Brook Trout population.

The Little Plover Fishery Area is widely utilized for trout fishing. The LPR, which is considered a Class 1 trout stream, is home to a population of Brook Trout. Because Brook Trout are highly sensitive to temperature fluctuations, they are important indicators of habitat quality. The riparian area associated with the LPR is important when it comes to preserving and improving the ecological and social values associated with a Brook Trout population. Any sort of management in the riparian area that affects solar shading and stream depth (and subsequently stream temperature) will be distinctly reflected in the Brook Trout population. Currently, Brook Trout growth has been stunted due to a lack of available space and wide, shallow fluvial (river) dimensions.

One of the main issues associated with the LPR is reduced groundwater discharge. Being a low-order stream with limited slope and high sinuosity, the risk of shallow water depth (and subsequent increase of temperatures) poses a significant stress on Brook Trout (Hakala and Hartman, 2004). Increased groundwater pumping for irrigation of adjacent agricultural fields is also a contributing risk to the health of the LPR. Pumping from high capacity wells within the Little Plover watershed have been estimated to reduce groundwater recharge to the river system by 50% (Weeks et al., 1965).

Previously, the Riparian Floodplain of the LPR was heavily dominated by Buckthorn, a destructive invasive species. Since December 2018, volunteers have carried out extensive removal efforts to clear as much of the species as possible. Manual removal as well as herbicide application has been utilized, however, continued efforts will be necessary for years to come to keep the trajectory of the site in the direction of a healthy native plant community. The overstory canopy was thinned to achieve a 10-50% canopy closure. This will allow more sunlight to reach the ground allowing the native plant community to thrive. In April 2019, volunteers rotary seeded the LPR Restoration site with warm and cool season herbaceous seed mixes. This will also allow the native plant community to thrive and prevent invasive species such as Buckthorn from taking over the site again. More recent efforts have focused on the LPR itself. Brush bundles composed of the removed invasive species were placed along the stream sides to decrease stream width, which in turn will increase the speed at which the stream flows and increase the depth of the stream. These results will increase the habitat quality of the stream for Brook Trout. With a faster stream flow, smaller substrate will be carried downstream while larger substrate remains in place. Brook Trout require larger substrate for successful reproduction.

The primary objectives of the Riparian Floodplain are to remove invasive species, promote a native plant community, increase Wood Duck and Brook Trout habitat, and enhance the relationship between the LPR and its floodplain.

Vegetation Monitoring Protocol

Introduction to Native Vegetation

Unique ecosystems such as the Little Plover River restoration area create microhabitats that host a range of mammal, bird, and insect species. Native vegetation within the habitat are necessary for establishing viable structure and providing an ongoing food source for wildlife that call the area home. These native plants need to be monitored and maintained properly without disturbance. In order to help future managers of the site detect habitat degradation, the vegetation will be monitored for abundance of desired vegetation species along with percent canopy closure. The four herbaceous native plants that will be monitored are Cardinal Flower, Joe-pye Weed, Wool Grass, and Blue Vervain.

Cardinal flower is a pollinator used by hummingbirds. Deer browse the plant as well, often killing it. This perennial species will take two years to bloom, but will have a large rosette, 5 to 15 cm tall, the first year when mature. (USDA, 2019) Joe-pye weed's nectar attracts honey bees, bumblebees, long-horned bees, leaf-cutting bees, butterflies, skippers, and moths. Habitats include wet black soil prairies, wet sand prairies, sedge meadows, marshes, fens, and swampy thickets with small trees or shrubs. (Wetland Wildflowers of Illinois, 2019) Wool grass is a tall grass like perennial that is found in soils with higher moisture content in partial to full sun. Wool grass is an important food source for insects, waterfowl, and small mammals. The plant also provides nesting structure for duck and other wetland birds. (Grasses, Sedges, Rushes, & Non-flowering Plants in Illinois, 2019) Blue vervain also attracts a wide variety of native bees, honey bees, beneficial wasps, pollinating flies, small butterflies, skippers and moths. Caterpillars of the verbena moth and common buckeye butterfly feed on the leaves (MN Wildflowers, 2019). Cottontail rabbits nibble young foliage and cardinals, sparrows and juncos forage for the seed

Native Vegetation

- **Herbaceous**
    - Cardinal Flower - *Lobelia cardinalis*
    - Joe-Pye Weed - *Eutrochium spp*
    - Wool Grass - *Scirpus cyperinus L.*

- Blue Vervain- *Verbena hastata*
- Switchgrass
- Cattail
- Skunk Cabbage

Introduction to Invasive Vegetation

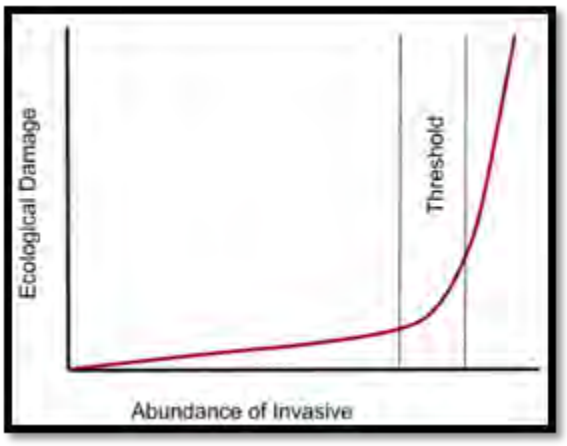
Monitoring invasive species is important because their potential to disrupt ecological site attributes increase as populations rise. The invasive plant species that have been identified for monitoring can cause disruptions in the natural composition, structure, and function of ecosystems—specifically the barrens, riparian, and oak woodland ecosystems present within the LPR restoration site. They can alter the natural food web, degrade habitat, introduce new pests/diseases, and displace native species resulting in decreased plant diversity and richness (WiDNR). According to the Wisconsin Department of Natural Resources (DNR), around 42% of endangered and threatened species have arrived at endangered or threatened statuses primarily as a result of the spread of invasive species (WiDNR).

Non-native plant species boasting aggressive rates of growth and reproduction can alter the intended structure of a site and outcompete desirable native plants (for example: woody brush encroaching on a prairie or invading a forest's understory to the effect of shading out native regeneration). The introduction of exotic and invasive species often arises as the result of anthropogenic (human), environment-manipulating activities such as planting exotic species, tracking in seeds from clothing and footwear, suppressing a historical fire regime, and any variety of mechanical disturbance—mowing, clearcutting, etc.. Invasive plants are commonly weeds from agricultural areas capable of spreading along roadway corridors (WiDNR). Once surrounding areas have successful reproduction of invasive species, it is very difficult to stop the natural spread. Since exotic species did not evolve within the ecosystems they invade, they are sometimes without many natural competitors and are therefore likely to outcompete natives (WiDNR).

Invasive species are a large concern in most restoration and land management efforts. "A majority of managers (68%) devote at least 25% of their total restoration effort on this issue." (Rowe, 2010). Invasive encroachment into restoration projects can be explained by the propensity for soil disturbance—a boon to invasive establishment—inherent to restoration activities (Hess, 2019). Also, many restoration projects are located on land previously dedicated to agriculture. This tends to mean unnaturally high levels of nitrogen in soil, favoring invasive species over natives adapted to a nutrient-limited environment.

By monitoring for undesirable species, invasives can be caught before they begin to cause significant ecological alterations. This can present the opportunity to reduce their current

abundance in order to reach the determined goals for species composition. By establishing a threshold for response to an invasive species, one must accept that it is unrealistic to eliminate the species from the site, and that there exists a non-linear damage function relating the ecological damage to abundance of an invasive (Panetta 2017; Knowing, 2013). Adhering to a set threshold, intervention will occur before the number of individuals present conflict with the goals for the site.



Unlike the other species for which a threshold has been assigned, if any garlic mustard is recorded at any of the sites, management/removal will take place immediately. Garlic mustard requires immediate response due to its short maturation period, high reproductive capacity, and aggressive growth.

Management of woody species will involve cut-stump or basal bark herbicide treatments. Management of herbaceous species will likely be limited to foliar spray by herbicide. The biology of each species should be taken into consideration when selecting an herbicide for treatment.

Invasive Vegetation

- **Woody**
  - Common Buckthorn – *Rhamnus cathartica*
  - Honeysuckle – *Lonicera spp*.
  - Reed Canary Grass – *Phalaris arundinacea*
  - Japanese Barberry – *Berberis thunbergii*
  - Burning Bush – *Euonymus alatus*
- **Herbaceous**
  - Garlic Mustard – *Alliaria petiolata*

Canopy Density

Measuring canopy density will be recorded using a spherical densiometer. A spherical densiometer is a tool comprised of a curved reflective surface (usually glass, however, a cellphone app can be used for this measurement), which is used to reflect the above-head canopy light and shadows to the user of the device. The surface of the densiometer is segmented into a grid system 24 quarter inch squares. To assess canopy closure, hold the densiometer level to the ground and look into it. However, many squares you see that are completely covered by overhead foliage is our variable. The amount of canopy covered square is divided by the total number of squares to obtain Canopy Density.

Timeline

1. Monitoring will begin Spring 2019
2. Should be monitored at the beginning of the growing season (or at least two months after any prescribed burn takes place) every year for the first five years
3. After the first five years, monitor in the spring once every three years for the next nine years
4. Training for volunteers is required
    - For use of spherical densiometer
    - Refer to Riparian Floodplain Identification Guide for plant identification assistance
5. UW-Stevens Point professor or teacher assistant will conduct on-site briefings to volunteers for any species-specific indicators and any known potential hazards

Monitoring Equipment / Tools Required

1. Cellphone with GPS enabled
    - Used for site hotspots and data collection
    - Apps associated with restoration data collection should be downloaded prior to field work
2. Spherical Densiometer
    - Measures canopy closure

- Small concave mirror underneath a grid pattern, allows user to quantify canopy closure as a percent

3. Tape measure
    - Used for counting species at plot centers
4. Data collection sheets (Appendix 1 and 2)
5. Riparian Floodplain Identification Guide

Monitoring Protocol

1. Site maps should be downloaded prior to inventory
2. Fill out top portion of data collection sheet before beginning the inventory
    - Circle which site is being inventoried
    - Fill in date inventory was carried out
    - Record all names of surveyors involved
3. Run a transect long enough for ten points (transects do not need to be a straight line, try to cover a sizable portion of each site), refer to downloaded maps for site size and boundaries
    - Walk one chain (or 13 paces) between each point
4. Refer to Riparian Floodplain Identification Guide for assistance identifying species of interest
5. At each point:
    a. Hold the spherical densiometer over plot center, calculate the canopy closure as a percent, record percentage on data collection sheet

        (# of squares canopy covers / 24 total squares) x 100 = % Canopy Cover

    b. Measure five feet out from plot center using the tape measure
        i. Walk in a circle, recording the rank of any <u>non woody/herbaceous</u> invasive species present (ranks are explained on the data collection sheet)
            - If there are more than one species in this category, separate the names and ranks by commas (see example sheet)
        ii. Repeat sub steps for Step b to record data for <u>herbaceous</u> native plants
    c. Measure 15 feet out from plot center using the tape measure

i. Walk in a circle, recording the rank of any woody invasive species present (ranks are explained on the data collection sheet)
    - If there are more than one species in this category, separate the names and ranks by commas (see example sheet)

6. Proceed to the next point and repeat Steps 5a through 5c for all ten points
7. On the data collection sheet, sum the ranks for each species at the bottom of the sheets (separate species and ranks by commas, refer to example sheet for assistance)

Sample Data Collection Table

Point	Invasive Species	Ranks
1	Woody: Buckthorn	2
	Non: Spotted Knapweed	1
2	Woody: Honeysuckle	1
	Non: Spotted Knapweed, Reed Canary	2, 5
3	Woody: Buckthorn	1
	Non:	-
4	Woody: Honeysuckle, Barberry	1,1
	Non: Spotted Knapweed	1
5	Woody:	-
	Non: Spotted Knapweed, Reed Canary	3, 5
6	Woody: Buckthorn, Barberry	3, 2
	Non: Smooth Brome	2
7	Woody: Buckthorn, Honeysuckle, Burning Bush	3, 1, 1
	Non:	-
8	Woody: Spotted Knapweed, Smooth Brome	2,3
	Non:	-
9	Woody:	-
	Non: Garlic Mustard	1
10	Woody:	-
	Non: Smooth Brome	4
Total (Sum)	Woody: Buckthorn, Honeysuckle, Barberry, Burning Bush	9, 3, 3, 1
	Non: Spotted Knapweed, Smooth Brome, Reed Canary, Garlic Must	9, 6, 10, 1

Fluvial Geomorphology Monitoring Protocol

Introduction

The Brook Trout in the LPR are sensitive to the fluvial changes that have happened to the river in the recent years. These changes have stunted the Brook Trout population in this body of water. Historically, post settlement records of the LPR have never experienced a dry up event until 2005. Since then, LPR has struggled to maintain a healthy population of Brook Trout. Therefore, an effort in monitoring should be focused on these changes and to see if there is any way to restore the LPR to its prime Brook Trout habitat that it has been known for in the past. These changes to the fluvial geomorphology suggest that groundwater discharge has declined rapidly. This is having subsequent impacts on water output, which has severely changed the dynamic of the resource itself. Some factors that have seen change are an increase of sandy sediment build up, increased water temperature, and degradation of the thalweg. Three potential stressors of these changes could be climate change, land use practices, and/or hydraulic restraints.

In order to determine if the LPR is returning to a stable state, monitoring for Brook Trout is an effective strategy. Brook Trout will be indirectly monitored for due to ease of monitoring and the cost effectiveness when monitoring the following factors Due to the specific life parameters that Brook Trout hold, one can overlook water chemistry as a factor to consider when monitoring.

The protocols for the LPR itself will be indirectly monitoring for this species. Looking at the LPR's physical variables should correspond to Brook Trout growth. An increase in the desired trajectory should also increase the Brook Trout's. (See the Brook Trout section of the Monitoring Protocol). In other words, factors that have affected the river have also affected the Brook Trout and that pattern should be depicted when monitoring.

Our variables to monitor in LPR are as follows: The width to depth ratio of the LPR, pebble counts, and water temperature.

Monitoring Equipment / Tools Required

1. Cellphone with GPS enabled

- Used for site hotspots and data collection
- Apps associated with restoration data collection should be downloaded

2. Tape measure
    - Used for measuring various distances
3. Measuring stick
    - Used to measure depth of stream bottom
4. Steel concrete forming stake
5. Calipers
    - Used to measure dimensions of substrate materials
6. Thermometer
    - Used to determine temperature of stream water
7. Data collection sheets (Appendix 5)

Width/Depth Ratio Monitoring Protocol

The width/depth (W/D) ratio, defined by the EPA, is the ratio of the bank-full surface width to the mean depth of the bank-full channel. W/D can be variable along a stream, therefore, to get a useful metric, multiple points along the LPR will be established as cross-sections to measure W/D. A steel concrete forming stake (spray-painted for quick identification) will be embedded along one side of the stream to mark where measurements will be taken.

The width to depth ratio is a key aspect of quality trout habitat. The LPR is relatively wide and shallow, which slows the speed of water, allowing for a buildup of sandy sediments over the gravelly substrate, reducing available trout spawning habitat. One of the main goals for the LPR area is to reduce the width and increase the depth of the stream.

1. Navigate to GPS data point (steel concrete forming stake in ground)
2. Use the tape measure to measure stream width
    - Make sure the tape measure is perpendicular to the flow of the river
    - Record width on data collection sheet
3. Find the deepest part of the river using the measuring stick following the tape measure transect

4. Break the stream up into 18 equal proportions.

   (stream width in inches)/18 = length of measuring points

   - At each point, record the depth on data collection sheet

Pebble Count Survey Protocol

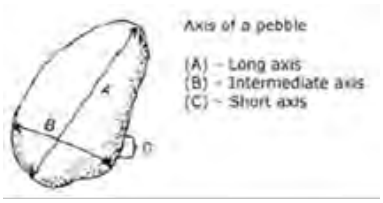
Note: Current conditions of the substrate in the LPR are to sandy to allow for much reproduction of Brook Trout in our site. The beds of Brook Trout must be on a coarser gravily substrate in order for the eggs to be anchored down against the current of the LPR. Throughout this monitoring protocol we hope to see that change to said substrate type. This is practical due to restoration efforts on the site. Brush bundles have been placed along the riverbanks in order to increase the depth of the LPR as it gets deeper a response of faster water movement over the sandy substrate should wash away lighter substrates and leave behind the desired spawning material.

Randomly select transect along stream edge

1.
2. Navigate to GPS data point
3. Go to bank of the stream
4. Take a step diagonally across the stream bed (should have around five stream crosses or 20 steps until you reach the next bank)
5. Reach down and grab a handful of substrate material
6. Run substrate through fingers
   - Does the substrate feel sandy (no distinction from individuals)?
     - Record Sandy (Possibly 0 for an integer data set) in the Data Sheet. If not, Go to 7

https://dep.wv.gov/wwe/getinvolved/sos/documents/sops/pebblecount_methods.pdf

7. If the substrate is not completely sandy measure the largest section of the pebble to the closest whole number in mm.
    - Record on data sheet
8. Continue zig zag pattern until 100 samples/measurements have been taken



https://dep.wv.gov/wwe/getinvolved/sos/documents/sops/pebblecount_methods.pdf

Water Temperature Monitoring Protocol

Stream temperature data will be used in making predictions to benefit Brook Trout spawning. Having a higher water flow speed resulting from channel narrowing and depth increase should result in a lower water temperature that will add to these benefits. However, restoration work on this site such as buckthorn removal and thinning of oversto**.**

ry trees has allowed for a higher amount of sunlight reaching the LPR reducing the desired effects of the thermal variables. Monitoring should be done to assess the true results of the restoration efforts on LPR.

1. Navigate to GPS data point
2. Submerge bulb of thermometer into the water
3. Hold thermometer submerged until stable temperature is reached
4. Record temperature (in degrees Fahrenheit) on data collection sheet

Wildlife Monitoring Protocol

Wood Duck Introduction

The Wood Duck (*Aix sponsa*) is a heavily pursued migratory game spe

cies in the United States. The United States Fish and Wildlife Service estimated that in 2017, duck hunters harvested 601,123 Wood Ducks in the Mississippi Flyway (Finger, 2018). This intense hunting pressure mandates annual evaluation of the population to properly set bag limits for the next season.

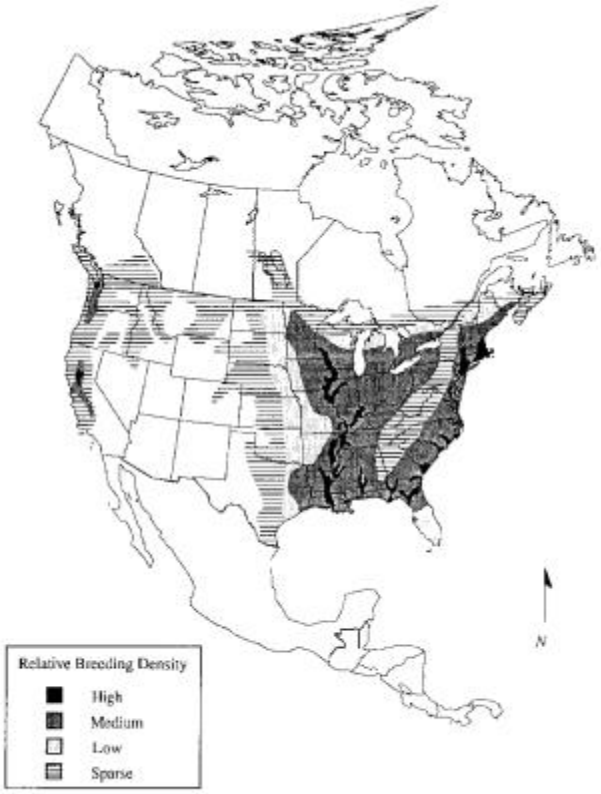


Figure 1. Relative Breeding Density of Wood Duck in North America (Dugger, 1992)

The Little Plover Fishery Area is currently not utilized heavily by Wood Ducks. The Wood Duck's habitat requirements diverge the from typical puddle duck habitats due to the Wood Duck being a cavity nester. This means it requires cavities in trees large enough to nest in (Bellrose, 1953). Most cavity trees utilized by nesting Wood Ducks are within half a kilometer of a water (Soulliere, 1988). Once the eggs have been laid, a 30-day incubation follows. When the ducklings hatch, they climb out of the cavity and leap to the ground. Cavities 10-25 feet above water or ground have been known to be utilized (Bellrose, 1953). Wood Ducks typically nest from early-May to late-June depending on if their first clutch was successful (Bellrose, 1953). After the ducklings leave the cavity tree, they move to brooding cover where they will spend much of their time fledging. Preferred brooding cover is characterized by shallowly flooded wetland or riparian habitat with a vigorous understory of woody brush and emergent vegetation. Fledging occurs between six and eight weeks after hatching (Dugger, 1992).

In order to monitor the Wood Duck population at the Little Plover Fishery Area we intend on using this unique phenology to narrow our survey areas and time frames. Our monitoring for Wood Ducks will target the nesting stage and brooding stage of reproduction to increase the effectiveness of time spent surveying.

Cavity trees and potential cavity trees will be surveyed and evaluated annually to determine quality of nesting habitat on the site. Additionally, only cavity trees within the Little Plover riparian corridor will be considered. This monitoring will occur between early May and the end of June because this is when Wood Ducks are most likely to be using them (Bellrose, 1953). Visual surveys of adult Wood Ducks and ducklings will be conducted from mid-June to mid-July. These surveys will be targeting the riparian corridor because this is the area ducks will most likely be utilizing; this will be especially true of female Wood Ducks with ducklings.

Timeline

1. Wildlife Team site visit in February of 2019 to analyze and establish potential courting habitat for future surveys
    - Using GIS software, Wildlife Team will create survey points in the Little Plover Fishery Area
2. Surveys for both cavity trees and individual Wood Ducks will be carried out annually for the next ten years to capture any trends in Wood Duck utilization of the site

Monitoring Equipment / Tools Required

1. Cellphone with GPS enabled
    - Used for site hotspots and data collection
    - Apps associated with restoration data collection (Avenza) should be downloaded
2. Binoculars

Monitoring Protocol

Volunteers will be conducting a survey on both cavity trees within the riparian corridor and individual Wood Ducks from designated observation points. Given the resources for this

project, these two methods of monitoring for Wood Ducks will yield enough information to achieve site goals. It is prudent to survey the cavity trees because they are the most important element to Wood Ducks from a habitat standpoint. When a Wood Duck first migrates back to its summer breeding range, the first thing it looks for when choosing a site is availability of nesting cavities (Bellrose, 1953). Thus, monitoring these potential nesting sites over time will yield valuable information about the suitability of the site and possible use by Wood Ducks. The individual trees will be marked with GPS coordinates to assist volunteers in locating them. Once a cavity tree is located, a cavity suitability rating will be assessed. This will allow for monitoring cavity suitability through time as well as Wood Duck utilization. These surveys should be carried out in mid-May and in mid-June to maximize the probability that Wood Duck cavity utilization is detected (Dugger, 1992).

Visual observation surveys will also be conducted at designated points along the LPR. For this survey, volunteers will spend ten minutes at each location quietly watching for Wood Ducks in the stream and in the floodplain before moving to the next point. This will be carried out in mid-June and mid-July to maximize the probability that Wood Duck utilization is best captured in the data collected. This seasonal time frame would allow surveying to occur during the brooding period of Wood Duck reproduction. When brooding females take their offspring from the nest, they lead them to the best and nearest "brooding cover". In the Little Plover Fishery Area, the habitat matrix that provides the best brooding cover is in the riparian corridor. During the brooding phase of their lives, Wood Ducks are flightless, and their mother remains with them. Therefore, surveying in mid-June and mid-July gives the greatest opportunity to observe individual Wood Ducks utilizing the site. Wood Duck mothers are known to travel a distance of <4 kilometers from cavity tree to brooding cover (Ryan, 1998). Thus, if ducklings are observed at a sampling point, one can be confident that the adults used the nearby area to nest.

Visual Survey Protocol

Factors to consider:

- When making observations on the riparian corridor, odds of detecting a Wood Duck increase as observer movement and sound is minimized and appearance is muted
    - Surveyors should avoid bright colored clothing
    - Surveyors should walk slowly and quietly when going to observation points
    - Insect repellant can be used to reduce movement caused by biting insects

1. Initial in-person training to take place before surveys are done
    - Volunteers will be provided with GPS capabilities for a map and locating sampling points whether that is on a smart phone or other device
    - Instruction on how to fill out data sheet will be presented, and data sheet will be given
2. Morning survey in mid-June and mid-July
    a. Navigate to GPS designated sampling point
    b. Observe sampling point for ten minutes
    c. Record observations on data collection sheet, to include:
        i. Number of adult Wood Duck males observed
        ii. Number of adult Wood Duck females observed
        iii. Number of Wood Duck ducklings observed (if ducklings are seen with a female Wood Duck)
    d. Repeat Steps a through c for all designated sampling points

Cavity Tree Survey Protocol

Factors to Consider:

- Volunteers should approach cavity tree quietly
- Some trees may be in saturated soils; water proof boots are recommended
- Insect repellant may be desired

- Watching the crown of a cavity tree while approaching the base of the tree increases the probability of observing a duck leaving due to observer presence

1. Initial in-person training to take place before surveys are done.
    - Volunteers will be provided with GPS capabilities for a map and locating sampling points whether that is on a smart phone or other device
    - Instruction on how to fill out data sheet will be provided, and data collection sheet will be distributed
2. Cavity tree observations in mid-May and Mid-July
    a. Navigate to GPS designated individual trees
    b. Walk around the tree using binoculars to observe the individual tree's cavity structure
    c. Record each sampled tree's cavity tree suitability rating on data collection sheet as follows:
        i. Rating of 0: tree is no longer upright.
        ii. Rating of 1: no cavity/cavities present.
        iii. Rating of 2: 6-inch wide cavity/cavities present.
        iv. Rating of 3: cavity/cavities present and utilized by wildlife

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Photo By: Benutzerin: BS Thurner Hof https://en.wikipedia.org/wiki/Wood_duck#/media/File:Brautentenpaar_2008-03-21_072.jpg

Appendix

Appendix 1: Native Species Data Collection Table

Point	Native Species	Ranks
1	Woody:	
	Non:	
2	Woody:	
	Non:	
3	Woody:	
	Non:	
4	Woody:	
	Non:	
5	Woody:	
	Non:	
6	Woody:	
	Non:	
7	Woody:	
	Non:	
8	Woody:	
	Non:	
9	Woody:	
	Non:	
10	Woody:	
	Non:	
Total (Sum)	Woody:	
	Non:	

Ranks for estimated cover:

1 = a few sparse individuals

2 = small groupings/ several individuals within the plot

3 = species covers a significant portion, but less than half the plot

4 = species covers above 50 percent of the plot

5 = species dominates the plot, 75 percent or more

Consult identification sheets to know if not familiar with native species of concern

Appendix 2: Invasive Species Data Collection Table

Point	Invasive Species	Ranks
1	Woody:	
	Non:	
2	Woody:	
	Non:	
3	Woody:	
	Non:	
4	Woody:	
	Non:	
5	Woody:	
	Non:	
6	Woody:	
	Non:	
7	Woody:	
	Non:	
8	Woody:	
	Non:	
9	Woody:	
	Non:	
10	Woody:	
	Non:	
Total (Sum)	Woody:	
	Non:	

Ranks for estimated cover:

1 = a few sparse individuals

2 = small groupings/ several individuals within the plot

3 = species covers a significant portion, but less than half the plot

4 = species covers above 50 percent of the plot

5 = species dominates the plot, 75 percent or more

Consult identification sheets to know if not familiar with invasive species of concern

Appendix 3: Woodcock Survey Data Collection Table

Date:	
Observer:	

Sky: *mark at the start		Temperature: F°		Precipitation:		Wind:	
clear		<30		none		calm	
1/4 overcast		30-40		fog		light	
1/2 overcast		40-50		snow		moderate	
2/3 overcast		50-60		light rain		strong	
overcast		>60		heavy rain			

Stop	Time	# heard peenting	Habitat *see codes below
1			
2			
3			
4			
Total:			

Habitat Code:	
1	open/mostly grasses
2	open/mostly shrubs
3	50% canopy cover
4	70% canopy cover
5	90% canopy cover
6	other

Appendix 4: Native Bees Data Collection Sheet

Bee Monitoring Data Sheet

Site Name:_____ Date:_____ Observer:_____

Visit#: _____of 2 Skies (circle): Clear / Partly Cloudy Bright Overcast Temp:_____°F

Type of Vegetation Habitat_____

Conduct observations in the afternoon (noon-4pm), when temperatures are over 60°F, skies are clear (partly cloudy or bright overcast is OK as long as you can see your shadow) and wind speed is low (a gentle breeze or less). Conduct observations on 200 ft of transects, evenly spaced through the field. Observe flowers in all combined transects. For each transect, record the number of native bees and honey bees visiting flowers. You can note flies, wasps, or other floral visitors in the notes.

Transect	Start Time	End Time	# Native Bees	# Honey Bees	Notes
Transect 1					
Transect 2					
Transect 3					
Transect 4					

Site notes: (e.g. details surrounding habitat)_____

Courtesy of: Streamlined Bee Monitoring Protocol for Assessing Pollinator Habitat

Appendix 5: Fluvial Geomorphology Data Collection Sheet

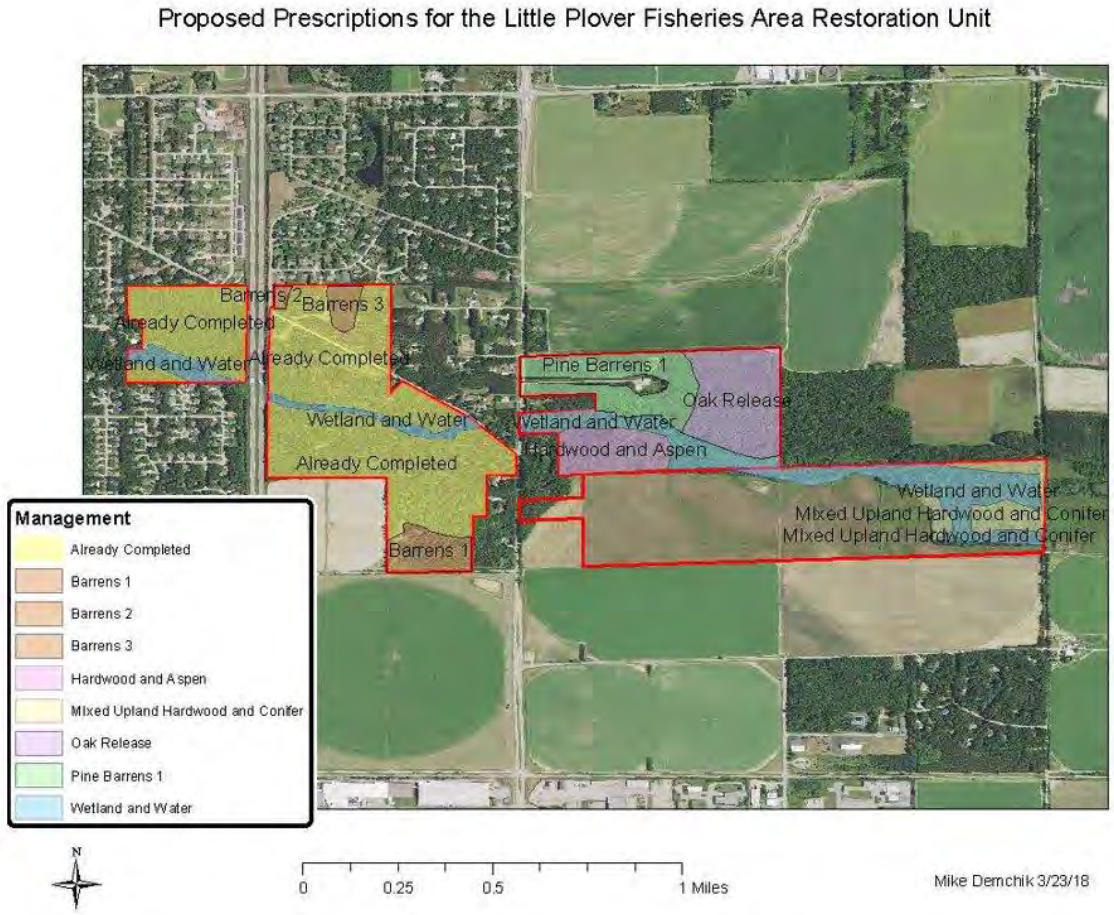
Data Collector Name
Date
Point #

Pebble Count			
Size Class	Size Comparison	Size (mm)	Count (Tally)
Silt/Clay	indistinguishable particles	n/a	
Sand	Too small to measure yet particles are distinguishable	<2	
Fine Gravel	Pea sized first size that is measureable	2-8	
Medium Gravel		9-16	
Coarse Gravel	Quarter Coin-Tennis Ball sized	17-64	
Small Cobble		65-90	
Medium Cobble		91-128	
Large Cobble		129-256	
Small Boulder	Basketball Sized	257-512	
Medium Boulder	Grocery Cart Sized	513-1024	
Large Boulder	Car Sized	>1024	
Bedrock	Unmeasureable	n/a	
Woody Debris	sticks, leaves, etc...	n/a	
		Tally Total:	

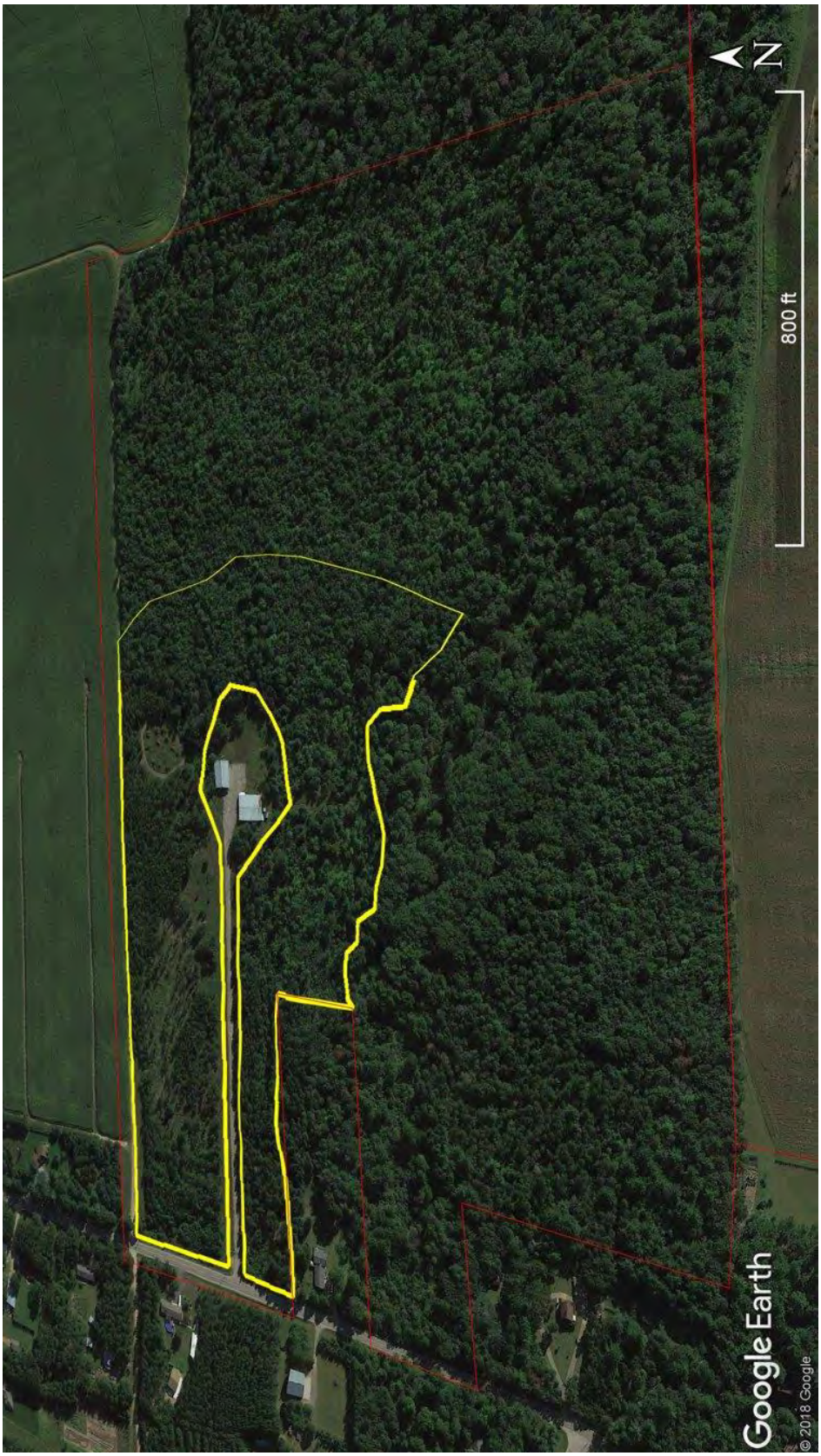
Confirm that tally count sums to 100.

Width/Depth Ratio	
Width (ft)	
Depth (ft)	
Ratio	
Temp (F)	

Appendix 6: Little Plover River Restoration Site Map

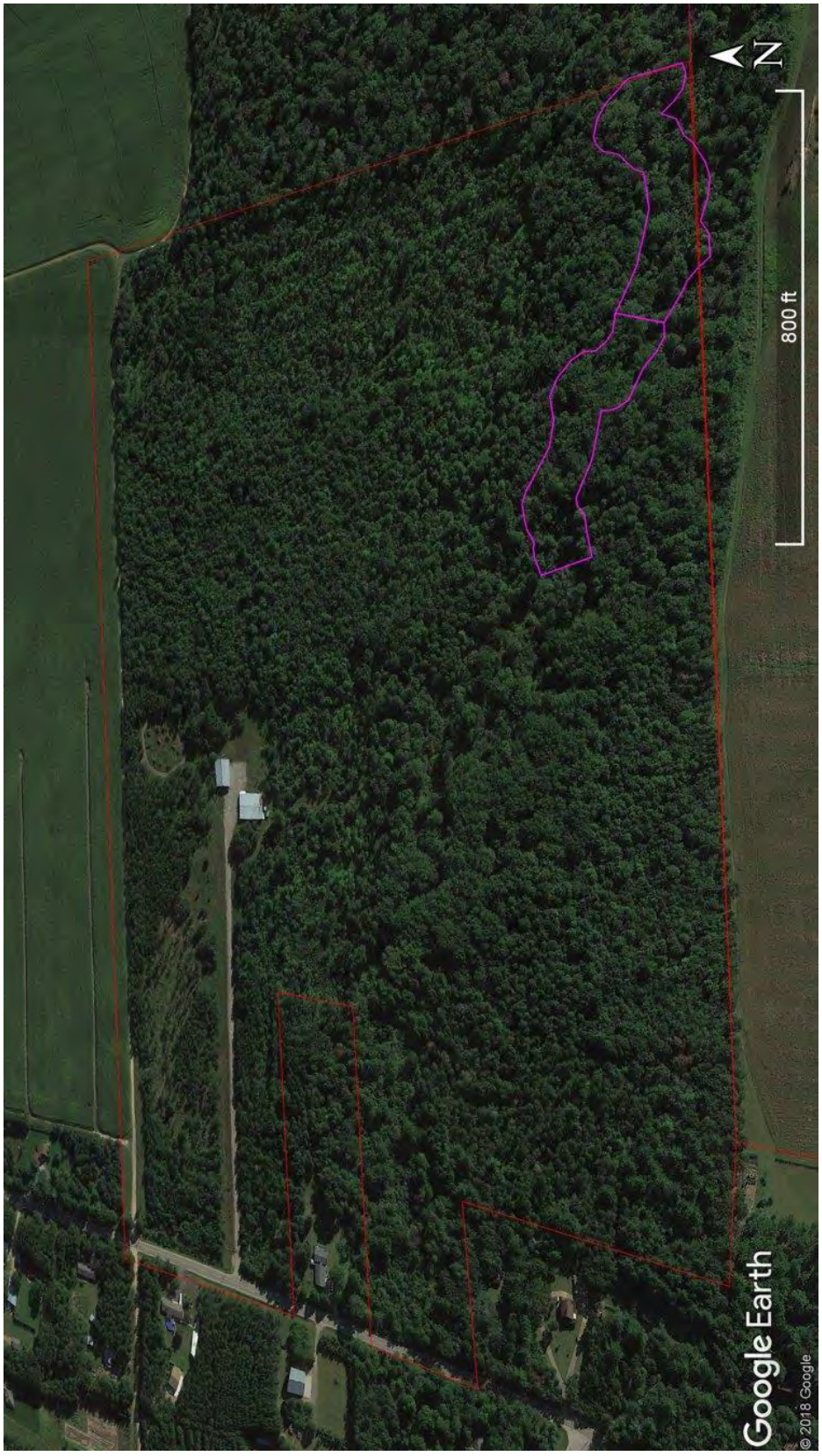


Appendix 7: Barrens Ecotype Site Map



Appendix 8: Oak Woodland Ecotype Site Map

Appendix 9: Riparian Floodplain Ecotype Site Map



Appendix 10: Little Plover River Restoration Public Review

Project Coordination (Aja, Richard, Kelcie, and Lauren)

- Please refer to the Report Template in the NRes_457-657_Spring2019 OneDrive folder for formatting specifics
- Citation format is APA with in-text citations
    - Don't forget to cite and add captions to photos used underneath the photo
    - Utilize the UWSP writing resources/tutors for additional help. TLC Writing Consultants typically do not address grammar issues. However, these issues need to be fixed. Ask politely when working with writing tutors. Aja is willing to help edit protocols, but this must be done cooperatively- you must be present, papers cannot just be dropped off with her to be fixed.
- For all data collected, use English units (feet, inches, Fahrenheit, acres, etc.)
- Please remove any and all notations to our class (NRES 457-657), as in any data collecting methods that will be done by NRES 457-657 students.
- The Coordination Team will work on which teams need to consult with each other to determine protocols base on the ecosystem approach discussed on page 3 of this document
    - Utilize Group Information document in NRes_457-657_Spring2019 OneDrive folder for further contact information of team members

Geospatial (Morgan, Joe, Andrew, and James)

- Team Thoughts:
    - Need to add screenshots/pictures of how to use Avenza application
    - Meet with each group to discuss how they can use Avenza to accommodate group specifics/goals
    - Use Google Earth Pro to transfer Avenza data
    - Dr. Demchik suggested using KML/KMZ files for ease of use in the future
        - KMZ is the "zipped" version
- Question? How does the team want data to be exported?
    - Answer: KMZ to Avenza (this needs to be added to the protocol)
- Question? Is the Oasis drive available to UWSP students only or is it available to the community?
    - Answer: The drive is available unless the folder is restricted, which is the case for the Karner Blue Butterfly (KBB) data
- Question? How is data going to be collected? Is there a uniform format for data sheets?
    - Answer: Store these as pictures?
    - Question? Will this allow others to analyze trends in the future? Should there be group Excel sheets?
        - Answer: KML/KMZ can be exported into Excel
- Class consensus was that tablets are not going to be necessary as most people now have smartphones that can access the same applications we are using
- Question? Regarding data collection for the KBB since it is not publicly available, how should this be addressed?
    - Answer: Don't keep this data on the Oasis drive, it should be kept within the WI DNR, point-of-contact is Chelsea Gunther (608) 397-0631

Invasives (Amanda, Abigail, Henry, and Jackson)

- Team Thoughts:
  - There will be additional plants to be monitored, need to be added yet
  - The class will follow the format of the Invasive Plant ID Guide
    - Identification clues, habitat, descriptions, commonly confused plants, photos
  - Put data collection sheets near each specific plant in the protocol
  - Asked about feedback for potentially separate protocols for herbaceous and woody plants
    - Herbaceous protocol would have smaller plots, woody protocol would be based on percent cover
- Question? Two separate protocols?
  - Answer: There should be two separate protocols, one for herbaceous, one for woody, however, make sure to focus on one at a time
  - Question? What are the volunteer requirements (will it be done all at once or separately, amount of time required)?
    - Answer: Protocols should try to be done on the same day and roughly same time of day, depending on plant emergence
    - Utilize Trout Unlimited, Boy Scouts, Isaac Walton League
    - Must remember base knowledge of volunteers being utilized ("reasonable man")
      - With KBB, volunteers must have incidental take permits through the WI DNR
    - Protocols should typically take a half day to carry out
      - Dr. Demchik and Dr. Herman will coordinate in the future
- For the Plant ID Guide:
  - Need to cite photos being used (underneath photo) and make sure the photos are legal to use. Add captions to photos for identification purposes.
  - If the information on the plant is being taken from another place (book, website, journal, etc.), this needs to be cited as such: "…adapted from blank source…"
- Question? Is there potential to combine certain protocols to reduce redundancy? Will this help with being consistent?
  - Answer: The teams don't need to be "distinct"
    - This ultimately led to the class deciding protocols would be better written according to ecosystems being accessed, rather than the teams we currently have.
    - Ecosystems = chapters, teams = sub-sections within these chapters
      - Riparian floodplain, oak woodland, and barrens
- Question? How do we overcome the lack of base knowledge that might be present with volunteers?
  - Answer: consider simpler steps in the protocol

Plant Communities (Dana, Mitchell, Rainer, and Mitchell)

- Team Thoughts:
  - Looking at significant changes based on coordination with Invasives team

- Dr. Demchik suggested changing photos used in the Plant ID Guide to photos taken by Mrs. Demchik since they are not legally obligated

- Question? Why are the photos in a table format?
  - Answer: Table allowed for organization of the photos
  - Led class to decide on utilizing a plant ID pamphlet for each ecosystem protocol
    - Must decide on which groups will begin working with each other first (because of shift in approach to protocols) before creating pamphlets
    - Question? Should the plant ID pamphlet be offered as a hard copy or a PDF? Both?
      - Answer: Dr. Demchik said he could probably float the cost of distribution with grant funding
      - However, in the future where will supplies be available?
- Question? What time of year is the protocol being carried out?
  - Answer: It was stated in the protocol, but the team will make sure it is clearly stated.
- Question? Could there be some sort of visitor center where volunteers could utilize Wi-Fi to download the necessary applications?
  - Answer: A portal could be set up for this information, just need to ask the person in charge of the portal?
- There were many comments brought up about the use of Microsoft Word online vs. the regular Word format
  - Users must utilize the "Read Only" view for Word online for the regular Word format to remain the same
  - Export protocols/plant ID guides as PDFs
- Invasive and Plant Communities protocols will be combined and will also absorb the riparian plant protocol as well
  - Question? How should data be quantified? Low, medium, high levels? Percent ranges? Should it be quantitative?
    - Answer: Utilize low, medium, high levels and percent ranges because quantitative data will be very time consuming.
    - Thought of requiring pictures for validity but class decided that would be micromanaging the project, plus who would go through all that data?

Riparian (Adam, Sam, and Nicholas)

- Team Thoughts:
  - Felt very comfortable with what they have so far
  - Changes might need to be made based on coordination with other teams (based on shift in protocol approach)
- Question? Are the instructions for the pebble count survey appropriate?
  - Answer: Add photos to assist in what is being measured and where/how to make these measurements
- Question? Team wasn't sure if they would use a graduate student's data as a baseline
  - Answer: If the graduate student is okay with their data being used, go for it
- Question? Many concerns were brought up with the "maintaining markings" section.
  - Answer: Coordinate with the Wildlife team to see if this survey could be combined with one of their protocols.

- Question? Was the "three-dot" system explained? If so, might think about relocating explanation for clarity
    - Answer: Suggestion of moving it within the steps or reference in the steps to its location
- Dr. Demchik is meeting with Trout Unlimited on 14March2019 and will discuss potential sponsorship with them on the project

Wildlife (Nicholas, Sheila, and Vanessa)

- Team Thoughts:
    - Asked if they should use actual GPS waypoints
        - Answer: Yes!
    - Should they develop their own KBB protocol?
        - Answer: No, use the one through the WI DNR
    - Need to add data sheets
- Question? Are the species being monitored associated with specific sites within the project?
    - Answer: Bees are associated with the barrens ecosystem, should coordinate with other teams to develop similar protocols/timelines
        - Match the species' phenology with the protocols
        - Further emphasized the need for ecosystem protocols rather than a protocol for each team

Woodcock Protocol

- Consider adding links for sounds/trainings
- Rephrase "Factors to consider #1"
    - Link to website for easy hearing test
- Woodcock timeline = weekly weekend surveys
    - Dawn vs dusk survey? Remove dawn surveys, redundant since males can be hear near dusk during breeding season
    - Contact Roughed Grouse Society for sponsorship
    - Add specific sitting locations into protocol
        - GPS reference on map
        - Less disruptive and allows for less error in data collected
- Question? Can we use Excel or an online format to track population trends?
    - Answer: Geospatial and Coordination Teams will discuss options

Wood Duck Protocol

- Coordinate with Riparian Team to combine protocols
- Question? Will volunteers be provided with GPS capabilities? Should this even be provided?
    - Answer: include this in your equipment list
        - Avenza app, GPS device, paper map
            - Each tree is an individual, if they're using a paper map they must make sure they're collecting data for the correct tree and not the one next to it
- Question? Equipment list
    - Answer: specify why the items listed are needed

- Question? He couldn't find an example protocol so the protocol he proposed may need further examination
    - Answer: use a habitat survey with a visual survey within the habitat
- Need to add data collection sheets

Native Bees Protocol

- Question? Use soapy water bowls vs. visual survey on flowers for data collection?
    - Answer: Visual surveys on flowers, more public support than using soapy water bowls
- Question? How specific should she get with the types of native bees to look for?
    - Answer: refer to the websites and ask Mrs. Demchik to use her photos
        - Pick the most likely to be seen subgroup of native bees

Karner Blue Butterfly Protocol

- Refer to the WI DNR website for monitoring protocol and NHI for incidental take training
- Question? Who should be considered for monitoring?
    - Answer: it would be a group of volunteer monitors that are not reimbursed for their training
        - Would give them the WI DNR protocol and they should be able to carry it out with their base knowledge on the subject
- Question? Is a separate equipment list necessary?
    - Answer: Just streamline the one of the WI DNR website/protocol

Barrens

Identification Guide

Native Vegetation:

J.S. Peterson
USDA NRCS NPDC
@ PLANTS

White Oak (*Quercus alba)*

Identification: White Oak is a large, stately tree that grows up to over 100 feet tall, and 38 to 50 inches in diameter, with a round to wide spreading irregular crown. White Oak bark is whitish or light gray, varying from scaly to irregularly platy or ridged and furrowed. Leaves are simple and alternately arranged on the stems; they are five to six inches long and have a rounded tip and wedge-shaped base, with evenly notched edges. The leaves are bright green above and whitish underneath. White Oak acorns are oval and about a quarter of the acorn body is covered with a cap which drops off at maturity.

Habitat: Although found on many soil types, White Oak does best on coarse, deep, moist, well-drained, with medium fertility, and slightly acid soils. It is well-adapted to heavy soils and north and east-facing slopes. Natural stands are often found in areas with loam and clay soil. White Oak is moderately resistant to ice breakage, sensitive to flooding, and resistant to salt spray and brief salt-water submergence. It is sensitive to fire injury, coal smoke, and fly ash deposit on soil surface.

Aaron_Carlson

Steve J. Baskauf

Commonly Confused Species: Bur Oak, or other Oak species.

DRAFT

<u>Red Oak & Northern Pin Oak</u> (*Quercus rubra & Quercus ellipsoidalis*)

Identification: Both Red and Pin Oak are members of the Red Oak subgroup, meaning they both have pointed ends of the leaves. Red Oak often reaches 20 to 30 m tall. The inner bark is reddish to pink and generally develops a strong taproot. Leaves are deciduous, alternate, elliptic, 10 to 25 cm long and 8 to 15 cm wide, with shallow wavy lobes with a few irregular bristle-tipped teeth. The sinuses usually extending less than 1/2 the distance to the midrib. Pin Oak is a moderately large tree with normal heights ranging from 70 to 90 feet with diameters between two and three feet. The bark of this tree is smooth, reddish to grayish-brown during the juvenile period, becoming darker and shallowly fissured as the tree growth slows with age. Three- to five-inch leaves have five to seven points or lobes with bristled tips and deep C-shaped sinuses. Pin Oak acorns are roundish, short stalked, 3/8 to 1/2 inches long, and capped with a thin and shallow saucer-like cup. Red Oak acorns are about 15 to 30 cm long, with a broad, usually shallow cup, borne singly or in clusters of two to five.

© Mike Hogan
Trees of Alabama and the Southeast
Auburn University

Robert H. Mohlenbrock
USDA NRCS 1991. Southern Wetland Flora
@USDA NRCS PLANTS

Habitat: Red Oak grows under a wide range of site conditions but is a true bottomland tree. It is seldom found growing above elevations of 800 feet, or on sloped ground. Best growth is in full sun and well drained, slightly acidic, sandy loam. Northern Pin Oak grows in practically pure stands with good growth rates on wet, shallow sites with heavy soils that drain poorly. Pin Oak commonly grows on mesic slopes and well-drained uplands, less commonly on dry slopes or poorly drained uplands

Darrin Kimbler

Matthew L. Wagner

Matthew L. Wagner

Commonly Confused Species: Pin Oak is often confused with scarlet oak (*Q. coccinea*) due to similar appearance. Scarlet Oak is an upland species that prefers soils with good drainage on dry sites.

DRAFT

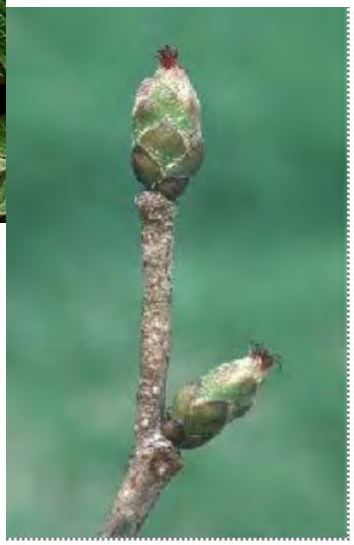
Hazelnut (*Corylus spp.)*

Identification: Hazelnut is a native shrub growing one to three (sometimes four) meters tall, is strongly rhizomatous and forms colonial thickets. Its main stems (or trunk) are straight with spreading, ascending branches. The twigs are slender, zigzag, light brown, and have numerous stiff, red-glandular hairs. Leaves are deciduous, alternate, broadly oval with a heart-shaped or rounded base, 8 to 12 (sometimes 15) cm long and 12 cm wide, acuminate, doubly serrate, hairy beneath with a stiff petiole that has glandular hairs. Fruit is a light brown, acorn-like nut one to two cm long, wider than it is long, enclosed in two, leafy, coarsely-toothed (husk-like) bracts.

© William S. Justice
Dept. of Botany, Smithsonian Institution
@ PLANTS

Habitat: Hazelnut occurs in moist to dry woods and thickets, forest margins, roadsides, and fencerows and other disturbed areas. It grows best on rich, moist, well-drained soils but often may be found close to streamside's and grows on prairies. Open habitats are common, but it can also grow successfully in deep shade and is found at 0 to 750 meters in elevation.

Commonly Confused Species: This species could potentially be confused with Witch Hazel, since they have similar overall forms and leaf shapes.



Kitty Kohout

Christopher Noll

<u>June Grass</u> (*Koeleria macrantha)*

Identification: Prairie June Grass is a highly variable, moderately long-lived, cool season perennial bunchgrass that grows one half to two feet tall. Clusters of narrow, markedly veined, light green to bluish green leaves grow to about seven inches tall. The leaves are flat to in-rolled with slightly rough edges and boat-shaped, pointed tips. Erect seed heads appear as dense, pale green to purplish spikes, are tapered at both ends and are two to five inches long. These are often held well above the foliage. They fluff open during flowering. There are two to four flowers per spikelet.

Merel R. Black

Habitat: This plant grows in a wide variety of climates, soils and native plant communities. It is most commonly found on rocky to sandy loam soils of low fertility but also occurs on clay-bearing soils with adequate drainage. This plant prefers a soil pH of 6.0 to 8.0.

Commonly Confused Species: This plant can look a lot like Reed Canary Grass.

Christopher Noll

Emmet J. Judziewicz

Little Bluestem (*Schizachyrium spp.)*

Identification: Little Bluestem is a tufted (sometimes with short rhizomes), warm-season, perennial grass. Plants vary in height, color, length of leaves, flowering, and clump diameter. It grows from one to three feet tall with culms slightly flattened. The blades are folded, sometimes rolled inward, and are smooth to hairy. They are two to 12 inches long, 1.5 to 6 mm wide, pointed with sheaths keeled and usually are smooth. The ligule is a fringed membrane 0.5 to 2.5 mm long. The culms terminate in a single raceme one to three inches long. The pedicelled spikelets are three to six mm long with flattened pedicels.

Habitat: This mid-grass is a tallgrass prairie increaser and mixed prairie decrease. Little Bluestem typically occurs on dry upland sites, especially on ridges, hilltops, and steep slopes. It also occurs on limey, sub-irrigated sites and in prairie fens. This plant occurs in soils ranging from sandy to clay-loam in texture.

Commonly Confused Species: Anything within the Bellwort family can be confused with Little Bluestem since they all have very bell-shaped flower structures.

Merel R. Black

Emmet J. Judziewicz

Christopher Noll

DRAFT

Wild Lupine (*Lupinus perennis)*

Identification: This herbaceous perennial has erect stems that are two to six cm that are thinly pubescent. The petioles are two to six cm. The leaves are palmately compound. There are seven to eleven leaflets that are oblanceolate and are from two to six cm long. The flowers occur in terminal racemes arising above the leaves. They are numerous and range from blue to pink or white. The fruits are pubescent pods that are oblong, flattened, and with two-several seeds. They are three to five cm. Wild Lupine is an important food source for the Karner Blue Butterfly, a federally endangered species.

Derek Anderson

Habitat: This plant is found in dry, open woods and clearings from southern Maine to Florida, west to Minnesota and Indiana. The plant grows in Pine Barrens and sandy prairies in the east. It is found in full to partial sun, dry to moderate moisture, woods, prairies and in sandy soil

Merel R. Black

Commonly Confused Species: Some Foxglove species or Purple Loosestrife may look like Wild Lupine, however their leaf shapes are very different.

Merel R. Black

DRAFT

<u>Bush Clover</u> (*Lespedeza spp.)*

Identification: This perennial plant has stiff, erect stems that are 0.6 to 1.5 m tall. The compound leaves have three moderately large leaflets (18x45 mm) which are often crowded along the stem. Both leaves and stems are densely covered with appressed hairs, giving the plant a silvery sheen. Flowering occurs in August and September. The typical fruits (legume) are indehiscent, and one seeded. Small pea-like flowers with petals are white with a purple spot on the banner petal. Rhizobia, nitrogen fixing bacteria, live in nodules on the plant's roots. Roundhead is quite tolerant of drought conditions. Tap roots can grow to a depth of two and a half meters, but there are also many branched roots near the soil's surface that extend up to a meter in all directions from the plant.

Habitat: This plant is found in both upland and lowland prairie sites, but it tends to be more common in uplands. It grows well at a soil pH between 6.5 and 8.0. This plant can be found in dry, open woods, sand dunes, and prairies.

Commonly Confused Species: This plant is in the same family as many of the clovers, and their leaves tend to resemble something close to Sweet Clover (invasive).

Invasive Vegetation:

<u>Common Buckthorn</u> (*Rhamnus cathartica)*

Photo by: USDA NRCS Montana - Plants_OB_828, Public Domain

Identification: Buckthorn can grow shrubby to tree-like. Leaves are oriented opposite along the branch, have curving veins toward the tip, are one to two and a half inches long, ovate shaped with very small serrated edges, and come to a small point at the tip. Foliage is usually a deep green and remain well into fall. The flowers are small, green/white in color and grow in clusters on the leaf axils. Fruits are deep blue/black berries and very abundant. The bark is gray/brown in color with obvious lenticels and contain thorns. The cambium layer just under the bark is bright orange and is easily seen by chipping the bark lightly with a sharp edge. They have a distinctive long, thin thorn between twig branching.

Photo by: Leslie J. Mehrhoff, University of Connecticut

Habitat: Found on dry to moist woodlands, fallow pastures and disturbed areas Buckthorn is easily spread by birds.

Commonly Confused Species: Native cherry trees can be easily misidentified as Common Buckthorn due to the similar bark and leaf shape, but cherries do not have the orange cambium layer. Dogwood's leaf venation can look like Common Buckthorn, but 'the dogwood test' will help identify them as well as their lack of serrated edges. Tag alder has a similar growth form, but they have catkins and small false cones, where Common Buckthorn has berries.

Honeysuckle (*Lonicera* spp.)

Identification: Leaves of Honeysuckle are opposite and oblong, untoothed, may be hairless or downy, and green to blue/green. Honeysuckle leafs out in early spring and persists later in the fall than many native woody species. Flowers bloom from May to June, occur in pairs along leaf axils, are long and tubular in shape, and can range from reddish pink to white, then yellowing with time. The fruit are red or orange berries that are also found in pairs at the leaf axils.

Photo by: WI DNR

Honeysuckle is generally bushy and can grow up to 20 feet tall but is more commonly less than ten feet. Bark is light tan and slightly flaky with arching branch structure.

Habitat: Common Buckthorn is commonly found on mesic soils with full sun to a lot of shade.

Commonly Confused Species: Native honeysuckles can look similar but are smaller, have sparser growth forms and contain a white pith in the stem. Dogwood can be another look alike, though most have smooth grey or red bark. Detect Dogwood with 'the dogwood test'.

Photo by: Daniel Fuchs

DRAFT

<u>Japanese Barberry</u> (*Berberis thrungii)*

Photo by: S. Kelly Kearns

Identification: Japanese Barberry is a dense, woody shrub that only reaches two to three feet tall. There are spines along each node with simple, oval leaves bunching above them. The leaf color can range from dark red, to green. Like many invasive species, Barberry is early to leaf out in the spring. They have small, white/yellow flowers that are less than 1.5 inches wide, which bloom in clusters come mid-spring. Berries are a vibrant red and oblong shaped. They are a common food source for birds, which contributes to the spread of the species.

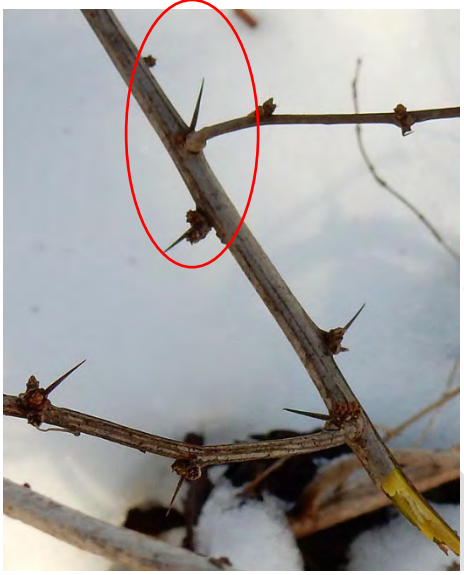


Photo by: R. A. Nonenmacher

Habitat: Japanese Barberry can be found on a large range of soil types and persist with different levels of moisture. It is very shade-tolerant and is commonly seen in transitional habitat (i.e. edges of forested areas), along roadsides, old agricultural fields, and disturbed areas.

Commonly Confused Species: There aren't many species that are easily mistaken for barberry. Although bramble species may cause some confusion without the foliage due to its spiny, woody stems. Barberry can be determined without leaves by the red, oblong berries that persist through winter.

Photo by: Bernie Williams

DRAFT

<u>Burning Bush</u> (*Euonymus alatus)*

Photo by: Nisa Karimi

Identification: This woody shrub is deciduous and is often planted as an ornamental for its bright foliage. It is recognized by its winged ridges on the bark of the stems, being more prominent on mature branches. The leaves are opposite and oblong with pointed tips and have edges with small serrations. Flowers are yellow to green and are very small, each with four petals and bloom min-spring. During the fall, leaves turn bright red and round and red fruits will form.

Habitat: Burning Bush is often found in hardwood understory, along roadsides and forest edges, and pastures. It can endure a large range of soil and light conditions, from full shade to full sun.

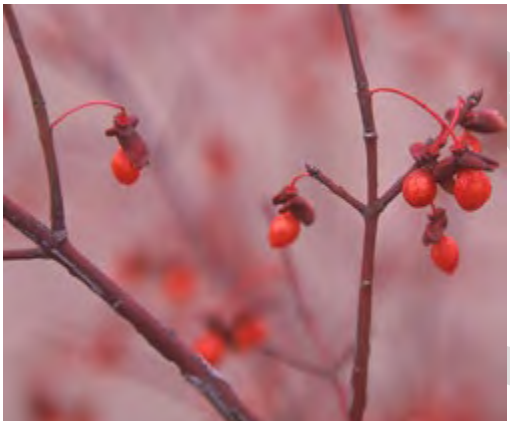


Photo by: Ohio DNR

Commonly Confused Species: A similar native species in the same genus is Wahoo (*E. atropurpureus*) but unlike burning bush, it does not have winged stems and will grow to be larger in size.

Photo by: Ohio DNR

Photo by: Elizabeth J. Czarapata

<u>Spotted Knapweed</u> (*Centaurea biebersteinii)*

CAUTION! - Knapweed can cause skin irritation, wear proper clothing when handling.

Identification: Remains as a rosette for one to four years until bolting between two and four feet tall. Leaves are grayish green, deeply lobed with rough hairs. Rosette leaves can reach six inches long, while the stem leaves only get to one to three inches as you get higher up the plant, leave also become more entire (no teeth on edges), and linear. Flowers bloom from the middle of summer to early fall and are pink-purple in color with black tipped bracts. Seeds are small and easily carried by humans and animals.

Photo by: Elizabeth J. Czarapata

Photo by: Michael Shephard, USDA Forest Service, Bugwood.org University of Georgia

Habitat: Dry or sandy areas such as prairies, barrens, dunes, and ridges, quick to invade disturbed sites.

Commonly Confused Species: Thistles have similar flower structure as well as other *Centaurea* species, but Spotted Knapweed has black tipped bracts on the flower head.

By USDA NRCS Montana - Plants_OB_211, Public Domain

DRAFT

<u>Smooth Brome</u> (*Bromus inermis)*

Photo by: S. Kelly Kearns

Identification: This cool season grass usually grows up to three and a half feet tall and without branching. It will have a hollow, dull, hairless, green stem. Basal and stem leaves can range from four to ten inches in length. An identifying feature on the leaves is a wrinkle that is shaped like a 'W' below the tip. The flower head becomes purple/brown with time. Five-inch branching panicles sore the flat, awn less seeds which are smooth and less than an inch long. (An awn is a hair or bristle-like structure coming off a larger structure.)

Photo by: Peter Chen, College of DuPage

Habitat: Fallow fields, roadsides, mowed areas or degraded meadows.

Commonly Confused Species: Smooth brome can be confused with other types of bromes, but almost all other brome types have seeds with awns.

Photo by: Bruce Ackley, The Ohio State University

Oak Woodland

Identification Guide

Native Vegetation: (*This plant identification guide has been adapted from Wisconsin Department of Natural Resources Plant Fact Sheets)

White Oak (*Quercus alba*)

J.S. Peterson
USDA NRCS NPDC
@ PLANTS

Identification: White Oak is a large, stately tree that grows up to over 100 feet tall, and 38 to 50 inches in diameter, with a round to wide spreading irregular crown. White Oak bark is whitish or light gray, varying from scaly to irregularly platy or ridged and furrowed. Leaves are simple and alternately arranged on the stems; they are five to six inches long and have a rounded tip and wedge-shaped base, with evenly notched edges; leaves are bright green above and whitish underneath. White Oak acorns are oval; about a quarter of the acorn body is covered with a cap which drops off at maturity.

Habitat: Although found on many soil types, White Oak does best on coarse, deep, moist, well-drained, with medium fertility, and slightly acid soils. It is well adapted to heavy soils and north- and east-facing slopes. Natural stands are often found in areas with loam and clay soil. White Oak is moderately resistant to ice breakage, sensitive to flooding, and resistant to salt spray and brief salt-water submergence. It is sensitive to fire injury, coal smoke, and fly ash deposit on soil surface.

Aaron_Carlson

Steve J. Baskauf

Commonly Confused Species: Bur Oak, or other Oak species.

Red/Northern Pin Oak (*Quercus rubra/ellipsoidalis*)

Darrin Kimbler

Matthew L. Wagner

Identification: Both Red and Northern Pin Oak are members of the Red Oak subgroup, meaning they both have pointed ends of the leaves. Red Oak often reaches 20 to 30 m tall, the bark is dark gray or black, and is shallowly furrowed into broad hard scaly ridges. The inner bark is reddish to pink; generally, develops a strong taproot. Leaves are deciduous, alternate, elliptic, 10 to 25 cm long and 8 to 15 cm wide, with shallow wavy lobes with a few irregular bristle-tipped teeth, sinuses usually extending less than 1/2 distance to midrib.

© Mike Hogan
Trees of Alabama and the Southeast
Auburn University

Robert H. Mohlenbrock
USDA NRCS 1991. Southern Wetland Flora
@USDA NRCS PLANTS

Northern Pin Oak is a moderately large tree with normal heights ranging from 70 to 90 feet with diameters between two and three feet. The bark of this tree is smooth, reddish to grayish-brown during the juvenile period, becoming darker and shallowly fissured as the tree growth slows with age. Three- to five-inch alternate leaves have five to seven points or lobes with bristled tips and deep C-shaped sinuses. Northern Pin Oak acorns are roundish, short stalked, 3/8 to 1/2 inches long, and capped with a thin and shallow saucer-like cup. Red Oak acorns are about 15 to 30 cm long, with a broad usually shallow cup, borne singly or in clusters of two to five.

Habitat: Red Oak grows under a wide range of site conditions but is a true bottomland tree. It is seldom found growing above elevations of 800 feet, or on sloped ground. Best growth is in full sun and well drained, slightly acidic, sandy loam soils. Northern Pin Oak grows in practically pure stands with good growth rates on wet, shallow sites with heavy soils that drain poorly. Northern Pin Oak commonly grows on mesic slopes and well-drained uplands, less commonly on dry slopes or poorly drained uplands

Matthew L. Wagner

Commonly Confused Species: Northern Pin Oak is often confused with Scarlet Oak (*Quercus coccinea*) due to similar appearance. Scarlet Oak is an upland species that prefers soils with good drainage on dry sites.

Bush-Clover (*Lespedeza spp.*)

Identification: This perennial plant has stiff, erect stems that are .6-1.5 m tall. The compound leaves have three moderately large leaflets (18 x 45 mm) which are often crowded along the stem. Both leaves and stems are densely covered with appressed hairs, giving the plant a silvery sheen. Flowering occurs in August and September. The typical fruits (legume) are indehiscent, and one seeded. Small pea-like flowers with petals are white with a purple spot on the banner petal. Rhizobia, nitrogen fixing bacteria, live in nodules on the plant's roots. Roundhead is quite tolerant of drought conditions. Tap roots can grow to a depth of two and a half meters, but there are also many branched roots near the soils surface that extend up to one meter in all directions from the plant.

Habitat: This plant is found in both upland and lowland prairie sites, but it tends to be more common in uplands. It grows well at a soil pH between 6.5 and 8. This plant can be found in dry, open woods, sand dunes, and prairies.

Commonly Confused Species: This plant is in the same family as many of the clovers, and their leaves tend to resemble something close to Sweet Clover (invasive).

Upland Boneset – *Eupatorium sessilifolium*

Identification: This flower is a native perennial wildflower that grows from 2 - 4 feet tall. The central stem is covered in long white hairs and is unbranched with the exception of a few flowering side stems near the apex of the plant. The narrow, lanceolate (tapering), opposite leaves grow up to 8 inches long and 2 inches across. The bases of the leaves tend to grow together, making it appear as if the central stem perforates the leaves. Two- to eight-inch clusters of fragrant white flowers (with approximately 15 florets per flower head) appear in late summer or early fall. The florets produce wind-dispersed small dry seed with hair-like bristles. The fibrous root system frequently produces rhizomes (horizontal stem with shoots above and roots below), which create small colonies.

Christopher Noll

Habitat: This plant prefers moist or wet conditions, soil with a significant amount of organic matter, and full to partial sun. It populates a variety of wetland habitats across eastern North America. This uncommon terrestrial plant is found in rocky forests, oak savannas, and oak woodlands. A large range of pollinators are often attracted to the bonesets flowers. These pollinators are many kinds of bees, butterflies, moths, and flies. The plant itself is not a common food source for any herbivores as it has a bitter taste.

Commonly Confused Species: Without any flowers may appear to something close to Wild Bergamot. Flowers roughly resemble Garlic Mustard (invasive) from a distance.

Native Vegetation

Invasive Vegetation

Common Buckthorn (*Rhamnus cathartica*) **-** Before restoration efforts began at the Little Plover Fisheries Area, Buckthorn dominated the site, choking out many native species which reduced biodiversity and productivity. Because it is commonly found in dry to moist woodland sites, fallow pastures, and/or disturbed landscapes, the Little Plover Fisheries Area has become the perfect habitat for Buckthorn to thrive.

Photo by: USDA NRCS Montana – Plants_OB_828, Public Domain

Common Buckthorn can grow as a shrub or into a tree-like plant. Its leaves have small serrations along its edges and are ovately shaped with veins that curve toward the tips. The leaves can be one to two and a half inches long and are oppositely arranged along the branch. Foliage is usually a deep green color and remain on the branch well into the fall. Buckthorn flowers are small, green/white in color and grow in clusters within the leaf axis. Fruits are a deep blue/black berry, are very abundant and readily spread by many bird species. The thorny bark of a Buckthorn plant is a grayish brown with obvious lenticels. The cambium layer, which is just under the bark, is bright orange and can easily be seen by chipping the bark lightly with a sharp edge.

Photo by: Leslie J. Mehrhoff, University of Connecticut

Common Buckthorn can be easily confused with many species. Native cherry trees can be misidentified as Common Buckthorn due to the similar bark and leaf shape. However, cherry trees do not have an orange-colored cambium layer like Buckthorn has. Dogwood leaf venations can look similar to Common Buckthorn, but a simple 'dogwood' test can correctly identify them, as well as Dogwood's lack of serrated leaf margins. Tag Alder and Common Buckthorn have similar growth forms, but Tag Alder have catkins and small false cones, whereas Common Buckthorn has berries.

Honeysuckle (*Lonicera spp.*) – Leaves of Honeysuckle are oppositely arranged, oblong, untoothed, and may be hairless or downy in texture. They are commonly green to blue-green in color. Honeysuckles leaf out in early spring and persist later in the fall than many other native woody species. Flowers bloom from May to June. They occur in pairs along the leaf axis, are long and tubular in shape, and can range from reddish-pink to white, then yellow after time. Honeysuckle fruits are red or orange berries that are also found in pairs at the leaf axils. The species generally grows in a bushy structure and can grow up to 20 feet tall, however, is more commonly less than ten feet tall. The bark is light tan and slightly flaky with arching branch structure.

Honeysuckle is commonly found on mesic soils and can handle full sun to full shade conditions. It can easily be mistaken for Wisconsin's native honeysuckle varieties, but these species' are smaller, have sparser growth patterns and contain a white pith within the stem. Dogwood can also be confused with Honeysuckle, though Dogwood bark is a smooth grey-red color. Utilize the "dogwood" test mentioned in the Common Buckthorn section to differentiate Dogwood from Honeysuckle.

Japanese Barberry
Burning Bush

Garlic Mustard (*Allairia petiolate*) - Garlic Mustard is a biennial plant, meaning it takes two years to complete its lifecycle. Their first-year rosettes grow to only a few inches tall and persist through winter. The leaves are rounded, or heart shaped, and edges are toothed. Second-year vegetation can grow up to 5 feet tall and have alternate, toothed leaves which are slightly more triangular than the first-year leaves and range from two to four inches wide. The white flowers can be seen from April to May, and again occasionally from July to August. They grow at the top of the second-year growth in clusters and have four petals. The fruits are long

and slender capsules, between one and two and a half inches. The garlic-like smell when crushed will also be helpful when identifying.

Garlic Mustard is commonly found in disturbed forested and riparian areas. Soil conditions where Garlic Mustard thrives can be moist to dry and it will grow in full shade to light direct sun. Floodplains are easily susceptible to invasion due to seeds easily transported by water.

Violets and Wild Ginger are commonly confused with Garlic Mustard because they look similar to first-year rosettes. However, Wild Ginger leaves are entire with no toothed edges.

Smooth Brome (*Bromus inermis*)

Photo by: Peter Chen, College of DuPage

Identification: This cool season grass usually grows up to three and a half feet tall and without branching. It will have a hollow, dull, hairless, green stem. Basal and stem leaves can range from four to ten inches in length. An identifying feature on the leaves is a wrinkle that is shaped like a 'W' below the tip. The flower head becomes purple-brown with time. Five-inch-long branching panicles sore the flat, awn-less seeds which are smooth and less than an inch long. (An awn is a hair or bristle-like structure coming off a larger structure.)

Photo by: S. Kelly Kearns

Habitat: Fallow fields, roadsides, mowed areas or degraded meadows.

Commonly Confused Species: Smooth brome can be confused with other types of bromes, but almost all other brome types have seeds with awns.

Photo by: Bruce Ackley, The Ohio State University

Picture?

Wildlife

Woodcock (*Scolopax minor*)

Figure 2. Two male woodcock Photo by: Tom Tetzner, USFWS

American woodcock are a unique member of the sandpiper family. They are easily distinguishable by their long bill, short legs, large eyes, dark eyeline stripe, and dumpy form. Their back feathers are a grey/brown color, with black and chestnut patterning throughout. Upper wings tend to exhibit a reddish hue, while the underside of the wings is a darker brown. Males and females show the same coloration patterns, as well as juveniles. On average, woodcock only reach around 8-10 inches in length (USGS 2018). Outside of morphology, this species resides in upland woods and shrubby fields. Male woodcock prefer dense, mid-story coverage for protection from avian predators, but prefer open fields to conduct courtship rituals.

To allow for their diverse habitat needs, it is best to manage for/create an uneven-aged forest; with shade-tolerant trees managed through single selection, and shade-intolerant trees through group selection. (Straw et al. 1986). Long and Locher (2013) suggest that managing for 3-5-year-old age class rotations can also help to achieve this uneven-aged ideal habitat. Based off this research, it is recommended that relevant managers aim to create a matrix condition for this species, specifically creating open areas where aspen (*Populus spp.*) can grow along with some understory shrubs and brambles (*Rubus spp.*) as they provide a good food source.

For the purposes of this study, it is important to understand male courting behavior. Courting occurs just before dawn and can be identified through visual or vocal cues. There are three sounds heard during their ritual: a buzzing peent call (given on the ground while bobbing its

head), a chirping (accompanied by aerial zigzags and swoops), and wing twittering (Duke 1966).

Riparian Floodplain Identification Guide

Native Vegetation:

Switchgrass (*Panicum virgatum*) - Switchgrass leaves are 12-35 inches long with a prominent midrib. It can grow to be very tall, sometimes over eight feet. The flowers have a well-developed panicle (up to six cm long); the seeds are 3-6mm longs. Leaves can have a pink or purplish tinge when ripe. Switchgrass has extremely hardy and deep root rhizomes and is both a perennial and a self-seeding plant. It is very robust and can live up to ten years. It can spread aggressively after it's planted.

Cattail (*gen. Typha*) - Cattail grows best in still waters, but it can still be found in and near running creeks. The plant is roughly 4-9 feet tall. It is unbranched, having six or more broad, flat leaves and a flowering stalk. Cattails possess a massive root network which is very strong and serves to stabilize the plants and protect them from high-energy flooding.

Red/Pin Oak (*Quercus rubra/palustris*) - Red Oak is a member of a broad group of trees characterized with bristles or points on the leaf lobes and acorns which mature in two growing seasons. Red Oak leaves are simple and arranged alternately on the twig. They have seven to eleven lobes and are five to nine inches long with slender petioles one to two inches long. The sinuses of the lobes are u-shaped, and the tips of the lobes are bristle tipped.

Twigs are stout, hairless, and reddish/greenish in color.

Although the two species are very similar and can hybridize with one another, Pin Oak have deeper and more narrow lobes than Red Oak. Red and Pin Oak can often be found near other trees like hard maples and basswood. Large specimens of these oak species can serve as nesting habitat for Wood Ducks.

*add maple?

Invasive Vegetation:

Common Buckthorn (*Rhamnus cathartica*) **-** Before restoration efforts began at the Little Plover Fisheries Area, Buckthorn dominated the site, choking out many native species which reduced biodiversity and productivity. Because it is commonly found in dry to moist woodland sites, fallow pastures, and/or disturbed landscapes, the Little Plover Fisheries Area has become the perfect habitat for Buckthorn to thrive.

Photo by: USDA NRCS Montana – Plants_OB_828, Public Domain

Common Buckthorn can grow as a shrub or into a tree-like plant. Its leaves have small serrations along its edges and are ovately shaped with veins that curve toward the tips. The leaves can be one to two and a half inches long and are oppositely arranged along the branch. Foliage is usually a deep green color and remain on the branch well into the fall. Buckthorn flowers are small, green/white in color and grow in clusters within the leaf axis. Fruits are a deep blue/black berry, are very abundant and readily spread by many bird species. The thorny bark of a Buckthorn plant is a grayish brown with obvious lenticels. The cambium layer, which is just under the bark, is bright orange and can easily be seen by chipping the bark lightly with a sharp edge.

Photo by: Leslie J. Mehrhoff, University of Connecticut

Common Buckthorn can be easily confused with many species. Native cherry trees can be misidentified as Common Buckthorn due to the similar bark and leaf shape. However, cherry trees do not have an orange-colored cambium layer like Buckthorn has. Dogwood leaf venations can look similar to Common Buckthorn, but a simple ‘dogwood’ test can correctly identify them, as well as Dogwood’s lack of serrated leaf margins. Tag Alder and Common Buckthorn have similar growth

forms, but Tag Alder have catkins and small false cones, whereas Common Buckthorn has berries.

Reed Canary Grass (*Phalaris arundinacea*) **-** Reed Canary Grass was introduced upstream by the WI DNR attempting to reduce the width of the LPR. The spread of this grass species is unlikely, but it should still be monitored due to its invasive tendencies. Reed Canary Grass is commonly found in wetlands, marshes, wet meadows, wet prairies, and/or along stream banks, which is why this species could spread throughout the Little Plover Fisheries Area. It can even grow in pastures, fallow fields, and along roadways.

Reed Canary Grass sprouts early in the spring before many other species. It can grow two to six feet tall. It has a hairless stem and a large, characteristic ligule that can be up to half an inch long. The flowers can range from green to purple and bloom from May to mid-June. The leaves are long, roughly four to eight inches, tapered, and rough textured on each side.

Orchard Grass can easily be mistaken for Reed Canary Grass however, Reed Canary Grass leaves are wider than those of Orchard Grass. Bluejoint Grass looks similar as well, except the ligule of Reed Canary Grass is transparent unlike the white ligule of Bluejoint Grass.

Garlic Mustard (*Allairia petiolate*) - Garlic Mustard is a biennial plant, meaning it takes two years to complete its lifecycle. Their first-year rosettes grow to only a few inches tall and persist through winter. The leaves are rounded, or heart shaped, and edges are toothed. Second-year vegetation can grow up to 5 feet tall and have alternate, toothed leaves which are slightly more triangular than the first-year leaves and range from two to four inches wide. The white flowers can be seen from April to May, and again occasionally from July to August. They grow at the top of the second-year growth in clusters and have four petals. The fruits are long and slender capsules, between one and two and a half inches. The garlic-like smell when crushed will also be helpful when identifying.

Garlic Mustard is commonly found in disturbed forested and riparian areas. Soil conditions where Garlic Mustard thrives can be moist to dry and it will grow in full shade to light direct sun. Floodplains are easily susceptible to invasion due to seeds easily transported by water.

Violets and Wild Ginger are commonly confused with Garlic Mustard because they look similar to first-year rosettes. However, Wild Ginger leaves are entire with no toothed edges.

Honeysuckle (*Lonicera spp.*) – Leaves of Honeysuckle are oppositely arranged, oblong, untoothed, and may be hairless or downy in texture. They are commonly green to blue-green in color. Honeysuckles leaf out in early spring and persist later in the fall than many other native woody species. Flowers bloom from May to June. They occur in pairs along the leaf axis, are long and tubular in shape, and can range from reddish-pink to white, then yellow after time. Honeysuckle fruits are red or orange berries that are also found in pairs at the leaf axils. The species generally grows in a bushy structure and can grow up to 20 feet tall, however, is more commonly less than ten feet tall. The bark is light tan and slightly flaky with arching branch structure.

Honeysuckle is commonly found on mesic soils and can handle full sun to full shade conditions. It can easily be mistaken for Wisconsin's native honeysuckle varieties, but these species' are smaller, have sparser growth patterns and contain a white pith within the stem. Dogwood can also be confused with Honeysuckle, though Dogwood bark is a smooth grey-red color. Utilize the "dogwood" test mentioned in the Common Buckthorn section to differentiate Dogwood from Honeysuckle.

Japanese Barberry (*Berberis thunbergii*)

Burning Bush (*Euonymus alatus*)

Wildlife:

Brook Trout (*Salvelinus fontinalis*) **-** Brook Trout are stenothermal, or highly sensitive to temperature, and can only function within a relatively narrow temperature range. This makes the fish an important indicator species for habitat quality.

Brook Trout follow a six-stage life cycle. Sometime in the fall, female trout deposit eggs into a bed of course gravel, referred to as redds. The eggs require a larger diameter gravel-like substrate in deep pools that act as an anchor and a shelter. At the same time, a male trout will be nearby, preventing any other trout from interrupting the fertilization process. Once the female deposits her eggs, the male trout will proceed to fertilize the eggs with a cloud of seminal fluid, known as milt. The eggs will then hatch after two to three months (Wild Trout Trust).

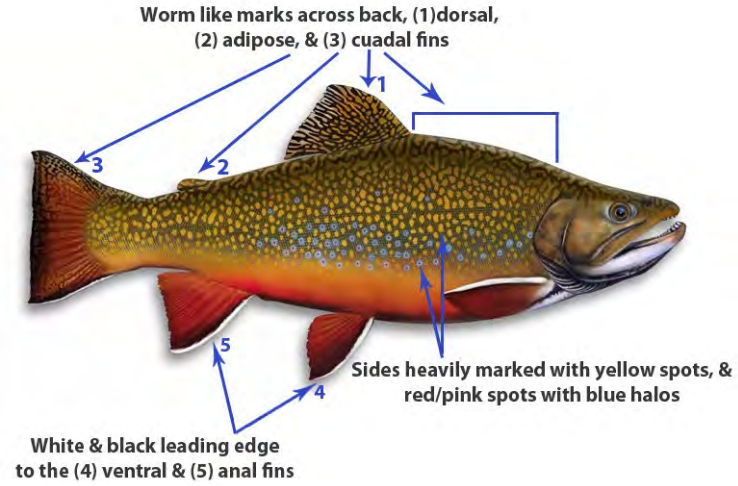


Figure 1(ImageSource:https://cdn10.bigcommerce.com/s-u24ja/product_images/uploaded_images/how-to-identify-brook-trout.jpg?t=1542064450)

Time until hatch is heavily dependent on stream temperature. Once hatched, alevin (the next life stage) are revealed. Alevin retain the yolk from their egg, utilizing it as an energy source for upwards of one month. By the time the yolk is fully consumed, the alevin has grown into a fry. Fry will seek cover in aquatic vegetation. This is the point at which the fish will now be required to procure food on its own. Fry will then develop into immature trout, known as parr. While being recognizable as trout, parr are still sexually immature. Finally, the parr grows into a sexually mature adult.

Besides their value as indicators of habitat quality, the Brook Trout population in the Little Plover River are worth monitoring due to the number of anglers who visit the river. Brook Trout fishing is an important revenue for the WI DNR, the single largest monetary investor in the LPR rehabilitation project (Little Plover River Watershed Enhancement Project Update).

*add physical descriptors of Brook Trout

Wood Duck(*Aix sponsa*) **-** The Little Plover Fishery Area is not currently utilized heavily by Wood Ducks. The Wood Duck's habitat requirements diverge from typical puddle duck habitats because they are cavity nesters. They require cavities in trees large enough to lay their eggs (Bellrose, 1953). Most cavity trees utilized by nesting Wood Ducks are less than half a mile from water (Soulliere, 1988). Cavities 10-25 feet above water or ground are commonly utilized (Bellrose, 1953). Wood Ducks typically nest from early-May to late-June depending on whether their first clutch was successful (Bellrose, 1953). Once the eggs have been laid, a 30-day incubation follows. When the ducklings hatch, they climb out of the cavity and leap to the ground. After the ducklings leave the cavity tree, they move to brooding cover where they will spend much of their time fledging. Preferred brooding cover is characterized by shallowly flooded wetland or riparian habitat with a vigorous understory of woody brush and emergent vegetation. Fledging occurs between six and eight weeks after hatching (Dugger, 1992).

Figure 2 (Image Source:https://www.wcn247.com/wp-content/uploads/2017/05/Screen-Shot-2017-05-08-at-2.16.42-PM.png)

Wood Ducks are considered a mid-sized duck weighing about 1.5 pounds. They are omnivorous, meaning their diets are made up both plant and animal material. A primary food source for Wood Ducks are acorns, along with seeds from other mast trees and herbaceous plants. Additionally, Wood Ducks consume a variety of aquatic invertebrates and insects (Dugger, 1992).

Drake (male) Wood Ducks have strikingly colorful plumage. His head is crested and is colored with iridescent greens and purples. He has red eyes and a white throat with an orange bill. A white streak follows the crest on either side of his head. The neck and chest are a burgundy color with white flecks. On its side there is a black and white bar parallel to one another (Bellrose, 1953). Hen (female) Wood Ducks are duller in color with most of the body appearing brown and gray. Her head is grayer in color with a white throat patch and white ring around the eye. Hen Wood Ducks are more vocal and can often be heard making a shrill "W-e-e-e-e-k W-e-e-e-k" call (Bellrose, 1953).