Environmental Impact and Health Assessment of Berry Pond
Leopold's Preserve, Prince William County, Virginia

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Abstract

This study assesses the environmental conditions and ecological health of Berry Pond at Leopold's Preserve in Prince William County, Virginia, following major hydrologic changes caused by drought, storm damage, and renewed beaver activity. Once part of the Berry family's agricultural landscape, the pond has transitioned from a cattle pond to a developing wetland habitat.

Historical aerial imagery shows that the pond area declined from about 120,000 square feet in 1954 to about 64,000 square feet in 2016, then expanded to roughly 73,000 square feet by 2026 after beavers rebuilt the dam. Field surveys documented surrounding land use, pond depth, vegetation composition, macroinvertebrate communities, fish diversity, and early management needs. Average pond depth was 3.9 feet, with deeper channels near the beaver dam and lodge. Vegetation sampling across three 10-meter-by-10-meter plots recorded high plant cover and species richness, dominated by trees and shrubs, while floating aquatic vegetation remained limited. Native plants outnumbered invasives, although invasive species accounted for 48% of total vegetation cover; Japanese honeysuckle and Marsh Dewflower were identified as management concerns. Macroinvertebrate sampling found 183 individuals, and 73% of pond macroinvertebrates were highly or very highly tolerant of poor water quality, suggesting reduced biological condition and possible effects from runoff, limited water movement, and sparse aquatic vegetation. Fish sampling captured 18 adult fish, including bluegill, green sunfish, and golden shiners, and estimated the adult fish population at roughly 263 individuals. Numerous fish fry indicated active reproduction and natural recolonization through stream channels.

Overall, Berry Pond appears to be a regenerating freshwater ecosystem with improving habitat structure, but ongoing water-quality and invasive-species challenges persist. Recommended actions include continued monitoring, chemical water-quality testing, hand removal of Marsh Dewflower, and targeted planting of native emergent wetland species to stabilize shorelines, improve habitat, and support long-term pond management.

Table of Contents

Overview of Research Site

A short walk along the Berry Meadow Loop leads to Berry Pond, where benches offer a place to observe birds, frogs, dragonflies, and water flowing through the streambed. Berry Pond is one of the biodiversity-rich water bodies within Leopold's Preserve.

Research Objectives and Scope

This project aims to assess the health of Berry Pond following major ecological changes over the past three years and to provide a foundation for future pond management at Leopold's Preserve. Data from this project can serve as a baseline for future monitoring of Berry Pond, which has historically lacked quantitative surveys. This study also examines the influence of beaver activity on a freshwater ecosystem.

To make a reliable assessment, this project used a series of key indicators to evaluate pond health. The most common methods were used to build a data set, including:

1. Vegetation survey: Estimating percent cover and species and density of emergent, floating, and terrestrial vegetation
2. Macroinvertebrate survey: Completing a macroinvertebrate species list and determining the ratio of tolerant and intolerant species
3. Fish diversity survey: Completing a fish species list and tallying visible occurrences

The assessment begins by establishing Berry Pond's historical and physical context and then defines the project objectives and sampling design. The report then presents land-use, vegetation, macroinvertebrate, and fish surveys, including methods, results, interpretation, and limitations for each. It concludes by translating the combined findings into a conservation plan.

Historical Background

Berry Pond has ecological importance, intrinsic value, and a rich history tied to the surrounding agricultural landscape. According to property and census records, the Berry family established their farming community in the late nineteenth century, after the Civil War. Earlier land records link the Berry name to settlement patterns along the Broad Run watershed and the Bull Run Mountains. The family played an important role in the agricultural community of Thoroughfare and Broad Run and was known for maintaining dairy pastures and cornfields. Thomas Berry, a Spanish-American War veteran who served with Theodore Roosevelt's Rough Riders, returned from military service in 1898 to manage the family's dairy homestead.

The exact year Berry Pond was constructed was never documented; however, the land's agricultural origins and aerial imagery provide grounds for speculation. Satellite imagery from 1937 shows an open pasture with a low-lying ravine that forms part of the 61-acre agricultural parcel.

Figure 1a. Aerial imagery of the Berry farm before Berry Pond was established, 1937. Source: Prince William County Mapper.

The pond was likely constructed as a functional farm feature during the post-World War II agricultural boom, whether for livestock management or irrigation purposes—the earliest satellite imagery of the pond dates to 1954.

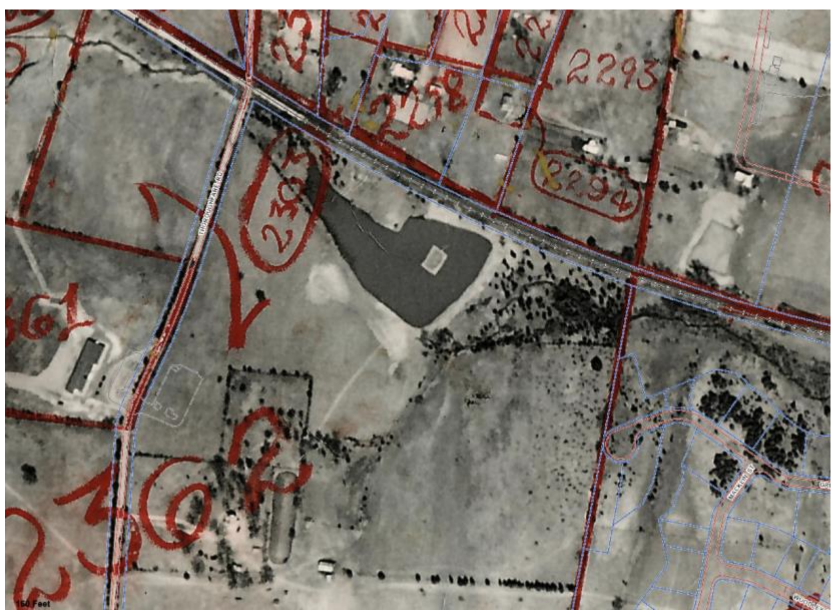

***Figure 1b**. Aerial image from 1954 of Berry farm showing Berry Pond. Source: Prince William County Mapper.*

Oral histories from Prince William County indicate that the Berry family hired local youth as farmhands. A typical day began at 6:00 a.m., when they brought in the cows for milking, then ate breakfast at the Berry family home before working in the fields until noon. After a hard day's work, they spent the rest of the evening swimming in the pond. The Berry family was well known for welcoming neighbors to the pond, which became a popular swimming spot and an important gathering place within the Thoroughfare community.

Since the 1950s, natural systems have reshaped the terrain. The agricultural fields and the human-constructed pond have undergone ecological succession, with gradual forest growth visible along the preserve's trails and around the pond. The historic landmark has become a diverse wetland habitat that supports a wide range of flora and fauna. Visitors can spot a green heron or great blue heron flying overhead, a family of mallards, a Northern water snake swimming near the shore, Northern cricket frogs making distinctive clicks from their hiding places, and many other native terrestrial or aquatic species that take advantage of the wetland habitat.

Changes Over Time

The area of Berry Pond was measured using Google Earth and Prince William County Mapper. The first satellite image of the pond in 1954 (Figure 1b) showed an area of roughly 120,000 square feet, or approximately 2.8 acres. Subsequent aerial images indicate that the area began to decline around 1979 and continued to taper off over the next 46 years until 2025, when the pond's area began to increase due to beaver activity. As of 2026 (Figure 1f), the pond measured roughly 73,000 square feet, or approximately 1.7 acres.

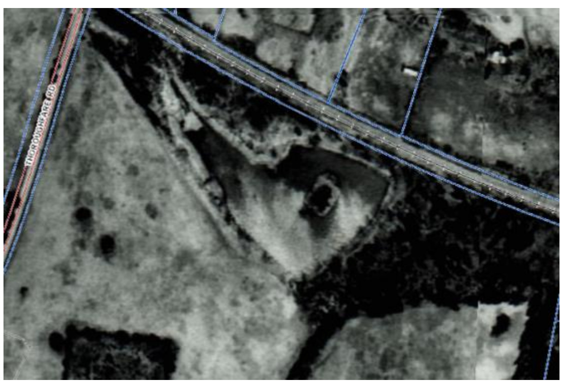

Figure 1c. *Aerial imagery from 1979 of Berry Pond, ~86,000 square feet/~2.0 acres*
Source: Prince William County Mapper

Figure 1d. *Aerial imagery from 2000 of Berry Pond, ~67,000 square feet/~1.5 acres*
Source: Prince William County Mapper

Figure 1e. *Aerial imagery from 2016 of Berry Pond, ~64,000 square feet/~1.5 acres.*
Source: Prince William County Mapper

Figure 1f. *Aerial imagery from 2026 of Berry Pond, ~73,000 square feet/~1.7 acres*
Source: Google Earth.

In 2022, heavy rainfall destroyed a beaver dam, breaching the pond and causing significant drainage. Berry Pond reached its lowest water level during a drought in 2023. Although no depths were recorded at the time, multiple accounts described sections that are now underwater as walkable and dry (Davis, 2026).

Figure 1g. *Aerial imagery from 2023 of Berry Pond dried up. Source: Google Earth.*

Figure 1h. *Image from 2022 of the original beaver dam. Source: Nick Davis.*

Staff and volunteers at Leopold’s Preserve attempted to rebuild the dam, but storms washed away the first two attempts. On the third attempt, the dam was successfully rebuilt. In the winter of 2025, beavers returned and further restored the structure. The effects were visible within months: water levels rose, and the pond expanded substantially.

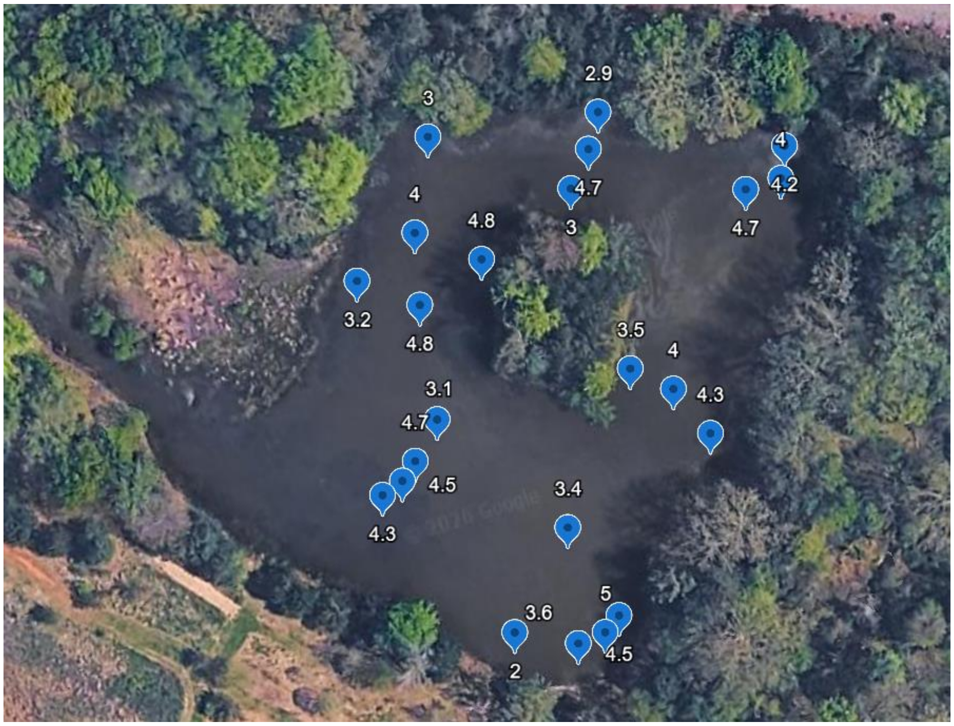

***Figure 1i**. Beacons representing variable water depths (ft.) throughout Berry Pond. Source: Google Earth.*

Using a measuring rod marked in feet, water depths at various points in Berry Pond were recorded for analysis. The average depth was 3.9 feet, with depths appearing to cap around 5 feet. Depths varied across the pond; shallower zones were typically near the shoreline, while depths increased toward the island. Beavers are skilled engineers that transform underwater terrain and create deep channels to swim through. The beaver dam near the southern edge of the map was the deepest, and this pattern continued along the channel leading to their lodge on the island’s southern border.

Methods

Land Assessment

We assessed surrounding land use, adjacent water bodies, and the pond’s physical features to determine how environmental factors may affect pond quality and survey results (Biggs, 1998). A large square plot was drawn, with each corner roughly 300 meters from the pond. Within the plot, the area of each land-use type was quantified to assess its proportional influence on the pond.

Table 1. Nearby Land Use and Area.

Land use	**Area (Sq. feet)**
Roads	26,700
Buildings & Concrete	8,000
Deciduous Trees & Woodland	704,000
Improved grassland	241,000
Unimproved Grassland	242,000
Wet Grassland	11,200
Ponds	63,100
Train Tracks	15,500

The total plot area was 1,834,700 square feet, while the area measured for each land-use category was 1,300,500 square feet. After subtracting the pond's area from the total plot, the percent error is 25%. This indicates that some portions of the plot were not measured; however, the available measurements still provide sufficient data for proportional comparison. Woodland made up the largest percentage of the pond's surrounding area, which is significant because wooded ponds can support healthier wildlife habitat and help buffer water quality. As Matson (2007) notes, "Naturally protected wooded ponds are often superior to exposed sites for creating wildlife and waterfowl refuges." The proximity of woody material may also have contributed to the beaver activity that helped restore the pond in 2025.

As shown in Figure 2a, there are numerous human-made features north of the pond, including buildings, train tracks, and manicured grass fields. These features can carry polluted runoff when it rains, which can easily enter the pond and harmfully alter its chemistry. In Figure 2b, there are numerous nearby waterbodies, some of which are connected by streams. Inflow begins at the left end of the pond relative to Figure 2b and then flows into other waterbodies. Notably, some of the water entering the pond flows over roads, which can increase pollution as it enters the pond (Figure 2b).

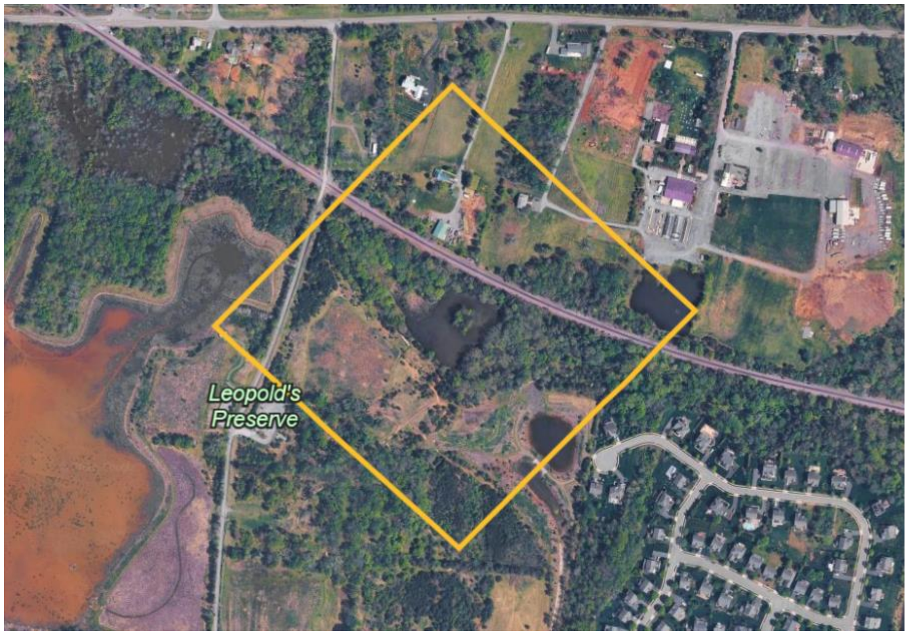

Figure 2a. *Aerial imagery of Berry Pond within the land-use analysis range. Source: Google Earth.*

Figure 2b. *Aerial imagery of Berry Pond and surrounding bodies of water. Source: Prince William County Mapper.*

Plot Layout

Table 2. Tools used for plot layout

Tool/Technology	Purpose
Tape measure	To measure the plot dimensions
Plastic-coated steel stakes	To permanently mark plot corners
Avenza Maps	To save GPS coordinates of plot corners
Waders	To measure plot dimensions and place stakes in a wet environment
Google Earth Pro	To map plot locations after fieldwork

Plot Overview

Three plots (10 meters by 10 meters) were established across the southern end of the pond. Within each plot, field technicians conducted vegetation and benthic macroinvertebrate surveys. Plot 1 (Corner A: 38°49'02.45"N, 77°40'21.96"W) was selected as the first site due to its historical significance. During the 2023 drought, this site was completely dry and grassy (Figure 1g). The willow oaks (Quercus phellos) that grew between corner 1D: 38°49'02.55"N, 77°40'21.57"W and corner 1C: 38°49'02.26"N, 77°40'21.35"W are now semi-submerged, serving as a useful reference for water-level changes. Plot 2 (Corner A: 38°49'00.82"N, 77°40'20.35"W) was selected for its proximity to the beaver dam and the limnetic zone. As shown in Figure 1g, it was part of the original pond that did not dry up in 2023, making it a feasible comparison to Plot 1. Plot 3 (Corner A: 38°49’03.72"N, 77°40’21.52"W) was chosen for its position within the inlet, near the stream catchment as it enters the pond. At this location, the pond bottom appeared rich and flocculent, and the water was muddy brown from suspended sediment.

Figure 2c*. Beacons representing corner A for each of the established plots. Source: Google Earth.*

Vegetation Survey

Data Collection

Table 3. Tools for vegetation survey

Tool/Technology	Purpose
Data sheets and pen	To manually record data in the field
Waders	To reach vegetation located past the shoreline
Excel	To input data into spreadsheets after fieldwork

For each of the three plots, we recorded species names and estimated the percent cover of all occurring plants. Data were then transferred to Excel for charting and analysis. Terrestrial, semi-submerged, and floating vegetation were measured. Future projects may consider including submerged aquatic vegetation, which can be very informative about pond health and productivity.

Data and Results

Figure 3a. Vegetative Species Inventory

Floating-Leaved Plants
Heteranthera dubia
Ludwigia peploides

Emergent Plants
Kosteletzkya pentacarpos
Murdannia keisak

Trees and Shrubs
Acer rubrum
Carpinus betulus
Cephalanthus occidentalis
Combretum erythrophyllum
Cornus amomum
Diospyros virginiana
Fraxinus americana
Juniperus virginiana
Nyssa sylvatica
Platanus occidentalis

Other
Amorpha fruticosa
Apocynum cannabinum
Carex blanda
Carex cephalophora
Carex hirta
Celastrus orbiculatus
Cyperus esculentus
Daucus carota
Dichanthelium clandestinum
Dioscorea villosa
Fragaria vesca
Galium circaezans hypomalacum
Geum canadense
Lactuca canadensis
Lonicera japonica
Microstegium vimineum
Oxalis dillenii
Parthenocissus quinquefolia

Prunus serotina	*Persicaria virginiana*
Quercus palustris	*Rubus spp.*
Quercus phellos	*Sanicula canadensis*
Rosa multiflora	*Sanicula canadensis*
Rubus allegheniensis	*Scutellaria integrifolia*
Salix spp.	*Smilax rotundifolia*
Symphoricarpos orbiculatus	*Teucrium canadense*
	Toxicodendron radicans
	Vitis vinifera

Trees and Shrubs

Throughout the three 10-meter-by-10-meter plots, estimated vegetation cover totaled 341% because overlapping plants occupied the same space. Plot 3 had the highest percent cover among all examined sites, at 173%. Most vegetation cover consisted of trees and shrubs, accounting for 257% of total cover and comprising mostly trees in the sycamore family (Platanaceae) and the conifer family (Cupressaceae) (Figure 3b). Trees and shrubs also had the greatest species richness, comprising 14 families. The most abundant tree species were American sycamore (*Platanus occidentalis*) and Eastern red cedar (*Juniperus virginiana*). Willow trees (*Salix spp.*) were also abundant throughout the pond, especially in Plot 1, where they were congested and semi-submerged. Willow roots can act as natural filters for water bodies; however, while willows can grow in waterlogged soil, long-term submersion may reduce their health because of limited oxygen availability.

An American sycamore trunk was chewed in Plot 1, and multiple other trees outside the sample areas were also chewed. This suggests a strong beaver presence.

Emergent and Wetland Plants

A few wetland species stood out as healthy indicators of pond condition. Virginia saltmarsh mallow (*Kosteletzkya pentacarpos*) is a native plant that benefits pollinators and provides cover for wildlife. Buttonbush is another beneficial native shrub that provides food for waterfowl, thrives in waterlogged soils, and helps control erosion.

Aquatic Vegetation

Floating aquatic vegetation accounted for a small percentage of total vegetation cover (9%; Figure 3c). The plant community primarily consists of terrestrial species, suggesting that aquatic species have yet to be established in the changing ecosystem. Plot 2, representing the old pond, was the only plot with aquatic plants, including floating primrose willow (*Ludwigia peploides*) and water stargrass (*Heteranthera dubia*). Outside the surveyed plots, substantial aquatic vegetation was observed on the western side, near the willow trees, whereas the eastern side of the pond had less vegetation.

Invasive Species

Of the total vegetation cover, 48% consisted of invasive species (Figure 3c). Observed invasive species included Multiflora rose (*Rosa multiflora*), Oriental bittersweet (*Celastrus orbiculatus*), Japanese honeysuckle (*Lonicera japonica*), Japanese stiltgrass (*Microstegium vimineum*), and Marsh Dewflower (*Murdannia keisak*). Plot 3 had the highest proportion of invasive species, with Japanese honeysuckle dominant. Many invasive plants found on the preserve are less adapted to wet environments; however, the terrestrial portion of Plot 3 is drier than the other plots because of its gradual slope toward the pond, which may explain why invasives are growing more freely there. Rising water levels appear to have reduced some terrestrial vegetation, including invasive species and natives such as cardinal flower (*Lobelia cardinalis*), as reported by Land Stewardship Manager Nick Davis. Marsh Dewflower is a common invasive weed in North American wetland habitats; however, because its current cover is low (1% in Plot 2), it should remain manageable with early intervention.

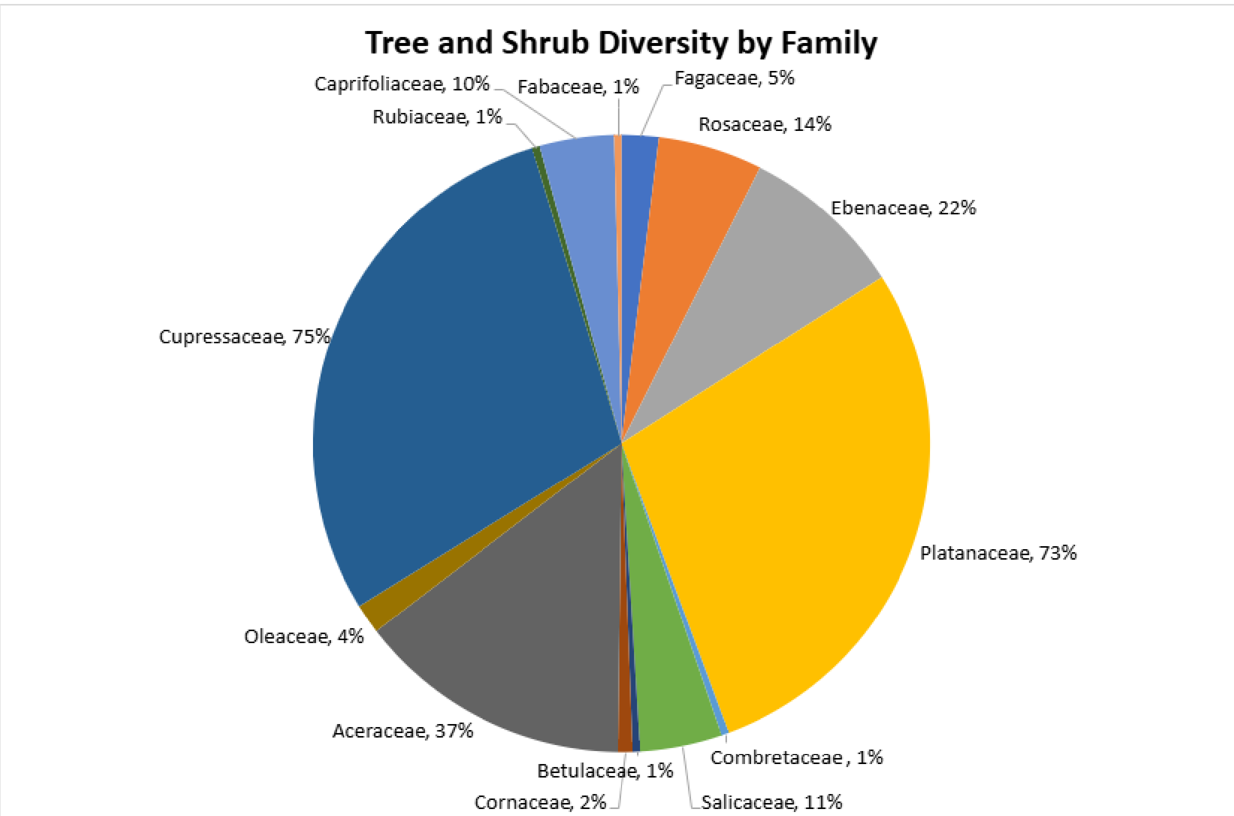

Figure 3a. Total proportion of trees and shrubs by family (Conifer 75%, Sycamore 73%, Maple 37%, Persimmon 22%, Rose 14%, Willow 11%, Honeysuckle 10%, Oak 5%, Ash 4%, Dogwood 2%, Buttonbush 1%, Legumes 1%, Hornbeam 1%, Bushwillow 1%).

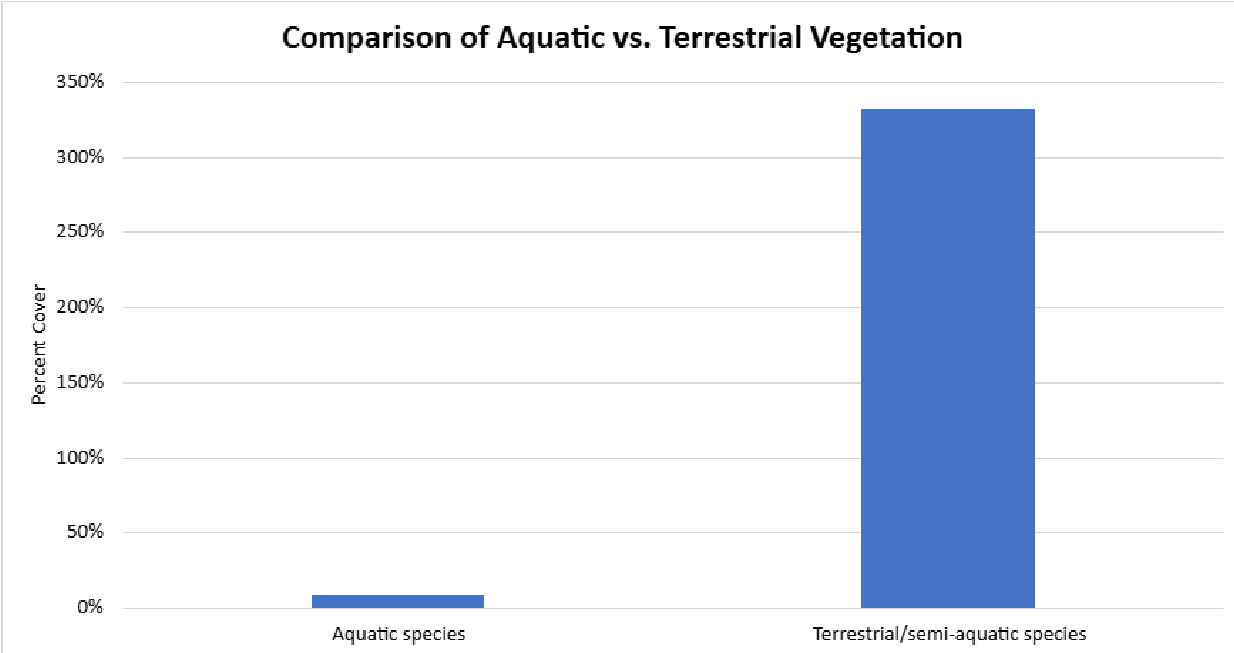

Figure 3b. Comparison between aquatic and terrestrial vegetation cover.

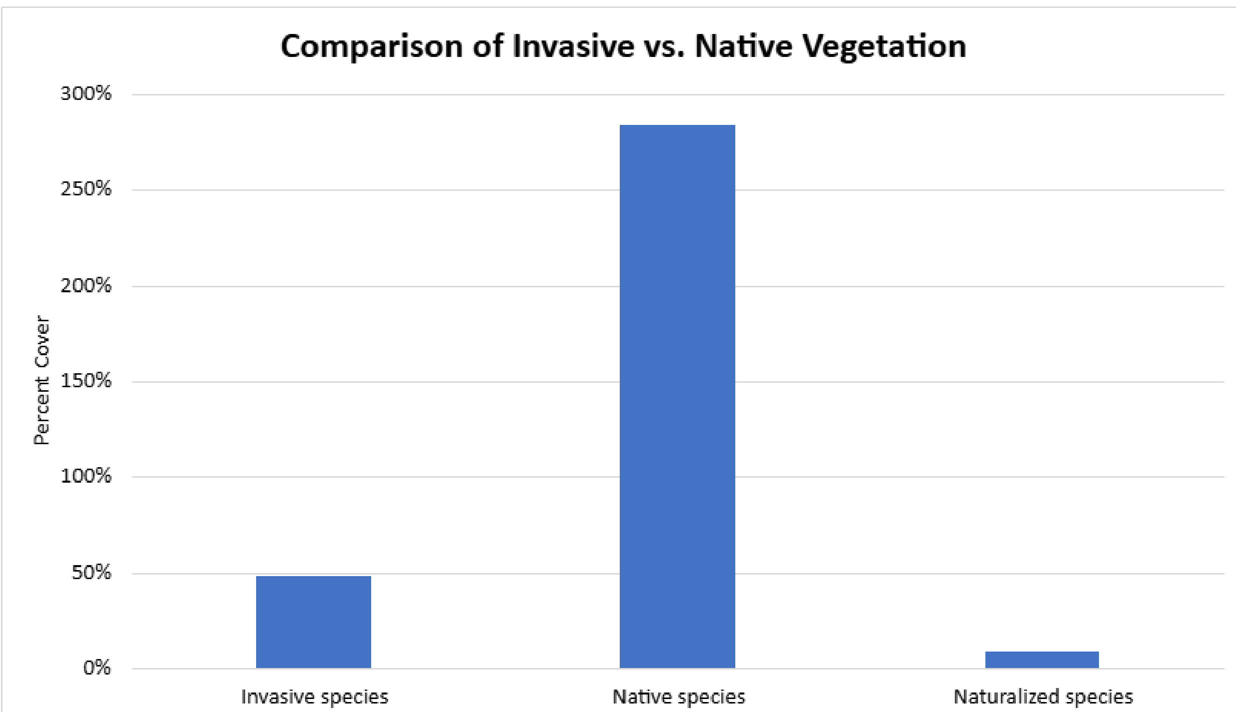

Figure 3c. Comparison between invasive and noninvasive vegetation cover.

Discussion

Although no strict index was used in this survey, the pond appears to support a healthy level of plant species diversity. Invasive species, while present, were largely outnumbered by native species.

Most previously dominant invasive flora, such as Japanese stiltgrass, have been substantially reduced in a short period. Other terrestrial plants may decline as well, depending on each species' tolerance of prolonged waterlogged conditions. By contrast, emergent and aquatic vegetation may benefit from the wetter environment and reduced competition. The vegetative landscape is likely to continue changing in response to recent submergence, and future monitoring will be needed to document that transition. This survey provides a basis for measuring and tracking environmental changes in future studies at Berry Pond.

Macroinvertebrate Survey

Data Collection

Table 4. Tools for macroinvertebrate survey

Tool/Technology	Purpose
Data sheets and pen	To manually record data in the field
Bottle traps	To place within the plot boundary and catch sample macroinvertebrates over a 48-hour period
Dip net	To manually catch sample macroinvertebrates in the field
Sampling tray	To hold retrieved specimens for identification
Wash bottle	To rinse the dip net and/or bottle traps for debris to ensure all macroinvertebrates have been removed
Portion cup and ice cube tray	To separate and accurately count individual specimens from the sampling tray for identification
Magnifying glass	To enlarge specimens for examination
Waders	To place and retrieve bottle traps, or maneuver dip nets, in a wet environment
Avenza Maps	To save GPS coordinates of bottle trap locations
Google Earth Pro	To map bottle trap locations after fieldwork
Excel	To input data into spreadsheets after fieldwork

Pond Macroinvertebrate Survey

Three bottle traps were constructed from 2-liter soda bottles with their tops cut off and inverted. The bottles were attached to plastic-coated steel stakes for anchoring. Traps were set with bottles submerged about 5 inches and spread across various depths. They were placed as close to shade and vegetation as possible within each plot. Traps were left for 48 hours, then carefully removed and brought to shore for specimen identification using a dichotomous key created by Virginia Save Our Streams.

Specimens were documented on a survey card before being carefully released back into the pond. Field technicians then used dip nets in a sweeping motion 2-3 times to catch additional macroinvertebrates for identification, and the previous steps were repeated. The entire process was repeated once for each of the three plots.

Stream Macroinvertebrate Survey

For comparison, the inflow and outflow streams were also tested for macroinvertebrates. Similarly, dip nets were used to collect macroinvertebrates with a sweeping motion, and the nets were then brought to shore for examination.

Three samples were taken for each stream, with field technicians moving approximately 10 feet upstream or downstream between samples. Notably, there were fewer macroinvertebrates the farther the samples were from the pond.

***Figure 4a**. Stonefly collected from the inflow stream in a portion cup for identification. Source: Elisa Dass.*

Macroinvertebrate Tolerance Metrics

Table 5 presents the tolerance to poor water quality and disturbed conditions for each identified macroinvertebrate, referencing the WV Department of Environmental Protection's tolerance scale. The species of aquatic snail could not be determined. Tolerance differs between gilled and lunged snails; therefore, the tolerance rating was left as 'unknown,' and these were excluded from the final counts. Tolerance levels can vary greatly among damselfly and dragonfly nymph species (WVDEP); however, for the purpose of this survey, metrics use ‘moderate' as their general tolerance rating.

***Figure 4b**. Locations of traps in Plot 1. Source: Google Earth.*

***Figure 4c**. Locations of traps in Plot 2. Source: Google Earth.*

***Figure 4d**. Locations of traps in Plot 3. Source: Google Earth.*

Table 5. Macroinvertebrate Tolerance Scale for Poor Water Quality (WVDEP).

Tolerance Rating	Macroinvertebrates
Very Low	Stonefly
Low	Mayfly, Water penny, Watersnipe
Low to Moderate	Dragonfly, Damselfly
Moderate	Alderfly, Crayfish, Netspinning Caddisfly, Waterstick
High	Beetle, Sowbug, Water strider
Very High	Aquatic worm, Leech, Midge, Water boatman
Unknown	Aquatic snail

Data and Results

The most common macroinvertebrates were aquatic worms, most of which were found in the pond, consistent with their very high tolerance for pollution. Mayflies came in close second; however, most were found in the outflow stream, where water quality tends to be higher. Many beetles were documented, primarily from Plot 1.

A total of 183 macroinvertebrates were identified and recorded. Across all sampling locations, 5.49% were classified as very highly tolerant of poor water quality, 20.77% as highly tolerant, 19.78% as moderately tolerant, 23.20% as having low tolerance, and 30.77% as having very low tolerance. Conditions differed substantially among the pond, inflow stream, and outflow stream, as shown in Figures 4e to 4g.

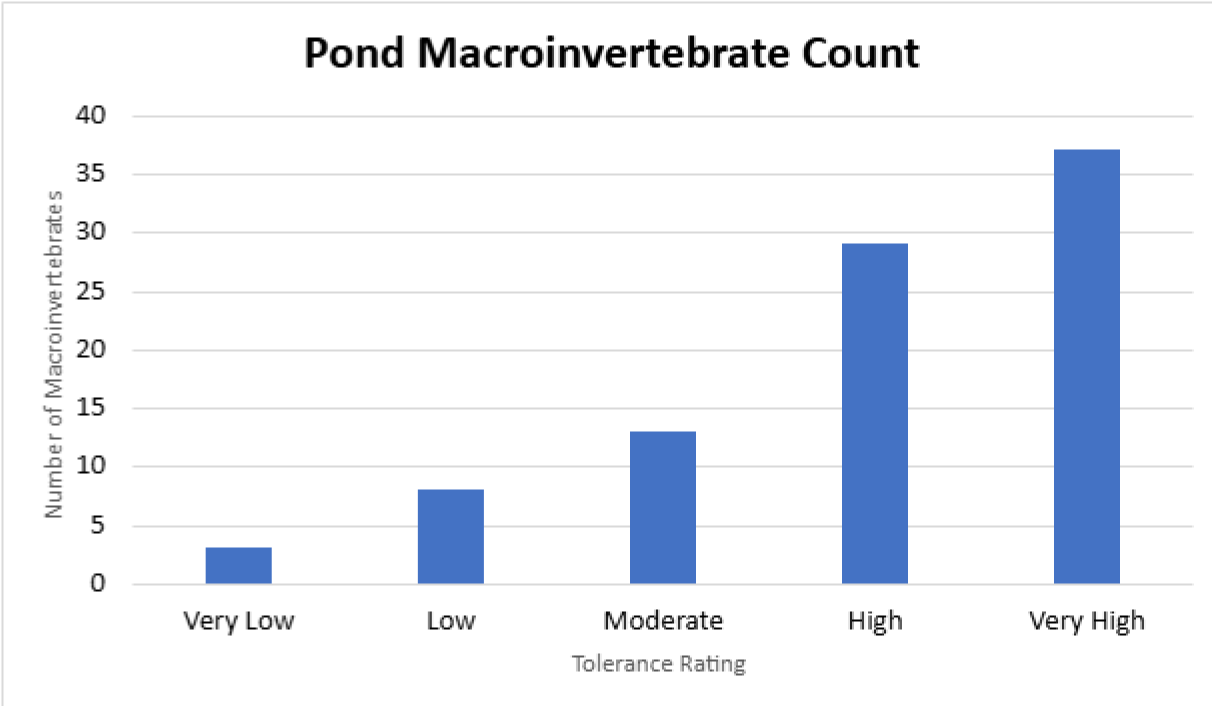

Figure 4e. Pond macroinvertebrates quantified based on tolerance ratings.

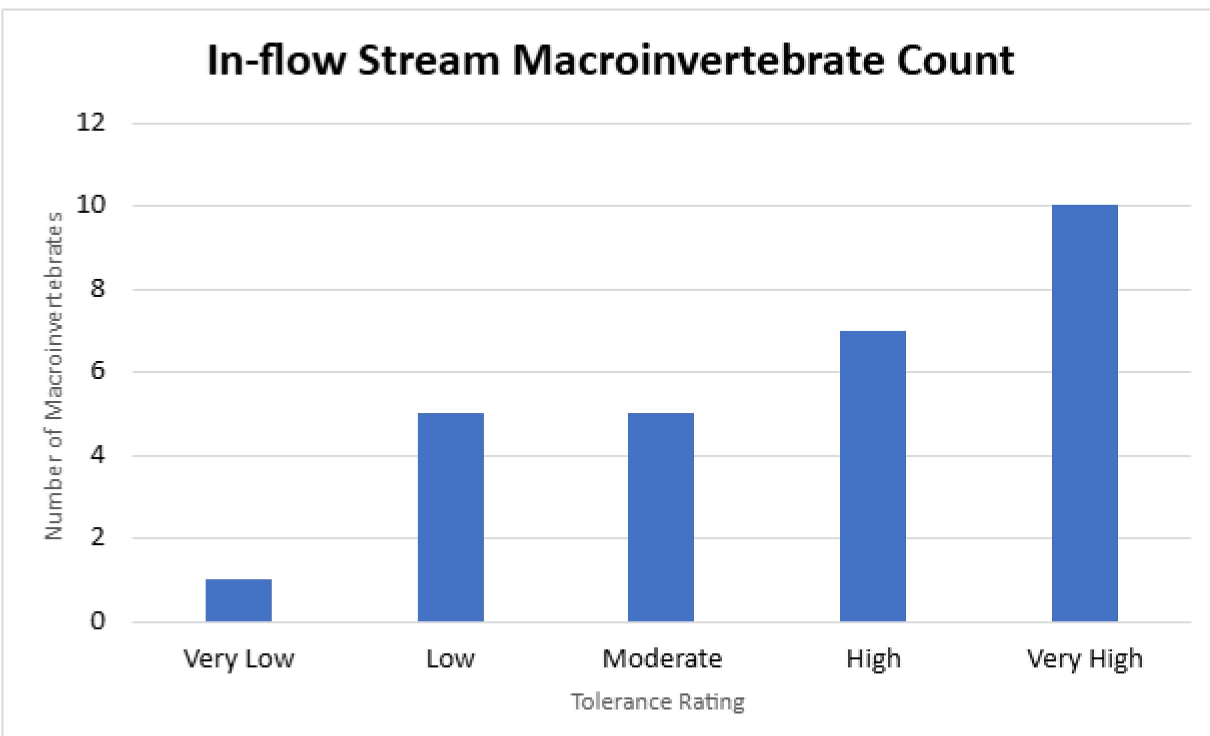

Figure 4f. Inflow stream macroinvertebrates quantified based on tolerance ratings.

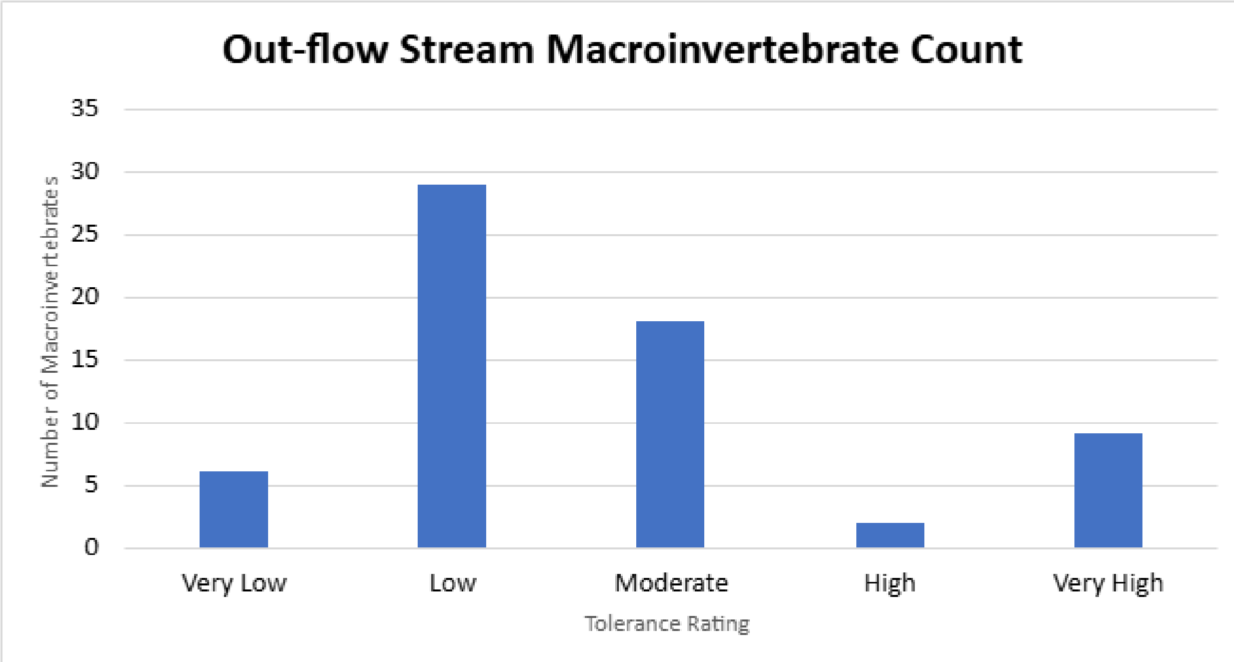

Figure 4g. Outflow stream macroinvertebrates quantified using tolerance ratings.

Discussion

Implications of Pond Health

The data from the three pond plots indicate that, based on observed biological parameters, the pond's biological quality falls toward the poorer end of the index. Of the macroinvertebrates identified in the pond, approximately 73% had high to very high tolerance for poor-quality conditions, while only 12.22% had low to very low tolerance, yielding an approximately 1:6 ratio. Potential contributing factors include nearby land use and runoff, limited aquatic vegetation, and reduced water movement. Further chemical water-quality testing is recommended to better identify pollution sources and inform management strategies.

Interestingly, Plot 3, where water levels are shallower as it bends into the inlet and where there is a thick sediment layer, appeared to have the highest biological productivity among the surveyed plots. Samples from Plot 3 contained the most amphibians and fish, as well as a couple of large predatory diving beetles. This indicates that the muddy layer is balanced and bioactive, supporting life cycles for both invertebrates and larger predators.

Limitations

Macroinvertebrates were counted using common names (such as beetles, leeches, etc.) rather than by species because the technology to identify taxonomic richness beyond families and orders was unavailable. Additionally, surveys were conducted only in the summer rather than in the spring, which could misrepresent diversity and abundance (Biggs, 1998).

Fish Survey

Data Collection

Table 6. Tools for fish survey

Tool/Technology	Purpose
Data sheets and pen	To manually record data in the field
Seine net	To non-lethally surround and catch specimens throughout the pond
Dip nets	To hold and transfer specimens
Buckets	To hold captured specimens for identification
Waders	To allow field technicians to wade in the pond while holding the seine net
Excel	To input data into spreadsheets after fieldwork

The purpose of this survey was to document the general composition of Berry Pond's fish community for future monitoring and comparison and to provide transparent data for future reference.

Fish specimens were collected with a seine net measuring 10 feet in length and 4 feet in height. Sampling locations were established at 50-foot intervals around the pond, resulting in a transect length of approximately 500 feet. For context, Berry Pond covers approximately 1.7 acres (about 73,000 square feet), so a focused assessment was conducted on a representative portion of the waterbody. Using the net dimensions and surveyed area, a rough estimate of fish abundance can be calculated.

At each 50-foot interval, the seine net was deployed in shallow water, with the lead line set firmly on the substrate, and carefully swept with minimal disturbance. The net was then swept inward at the end of each interval to retain the captured aquatic organisms. Specimens were transferred from dip nets to buckets on shore for identification and counting, then released back into the pond.

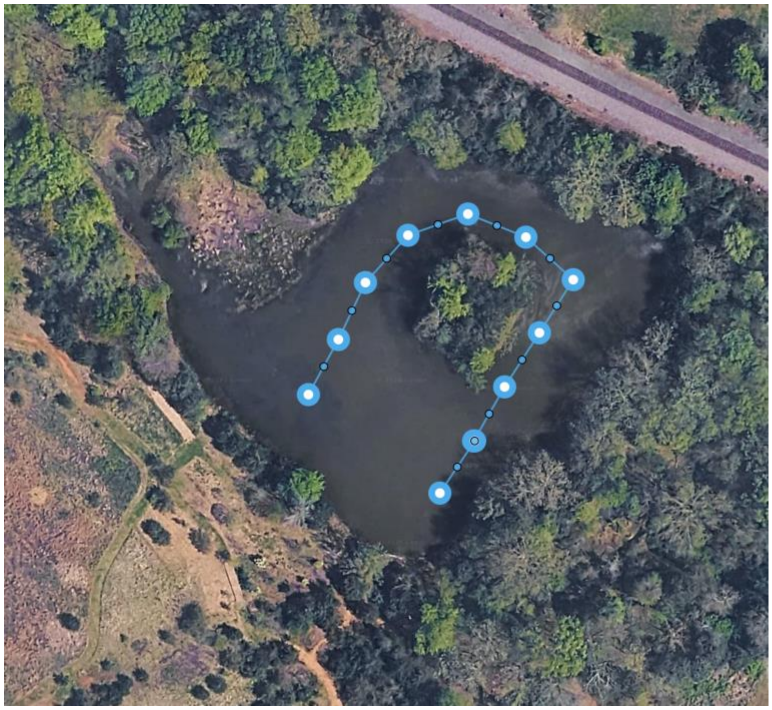

Figure 5a. *Surveyed area and spatial distribution of sampling points. Source: Google Earth.*

Figure 5b. *Captured Bluegill (Lepomis macrochirus). Source: Elisa Dass.*

Data and Results

A total of 18 adult fish were caught during this survey, consisting of Bluegill (*Lepomis macrochirus*), Green sunfish (*Lepomis cyanellus*), and golden shiners (*Notemigonus crysoleucas*), with Bluegill being the most abundant species (Figure 5c). More fish were caught near the beaver dam, while fewer appeared in shaded areas and near the center of the pond. The average length was 3.1 inches for Bluegill, 3.6 inches for Green sunfish, and 4.0 inches for

Golden shiners. These measurements, especially for Bluegill, suggest that the fish population is relatively young, tentatively about one year old (Virginia Department of Wildlife Resources).

Estimated Total Pond Population

To develop a preliminary estimate of adult fish abundance, I divided the 18 fish captured by the nominal sampled area of 5,000 square feet, calculated as 10 feet × 50 feet × 10 sampling points. This produced an observed catch rate of 0.0036 fish per square foot (3.6×10^{-3}). Applying that rate to the pond's total area of approximately 73,000 square feet yields an extrapolated estimate of 263 adult fish. Because seine capture efficiency, fish movement, habitat variation, and unequal distribution were not measured, this figure should be treated as a rough index rather than a precise population estimate.

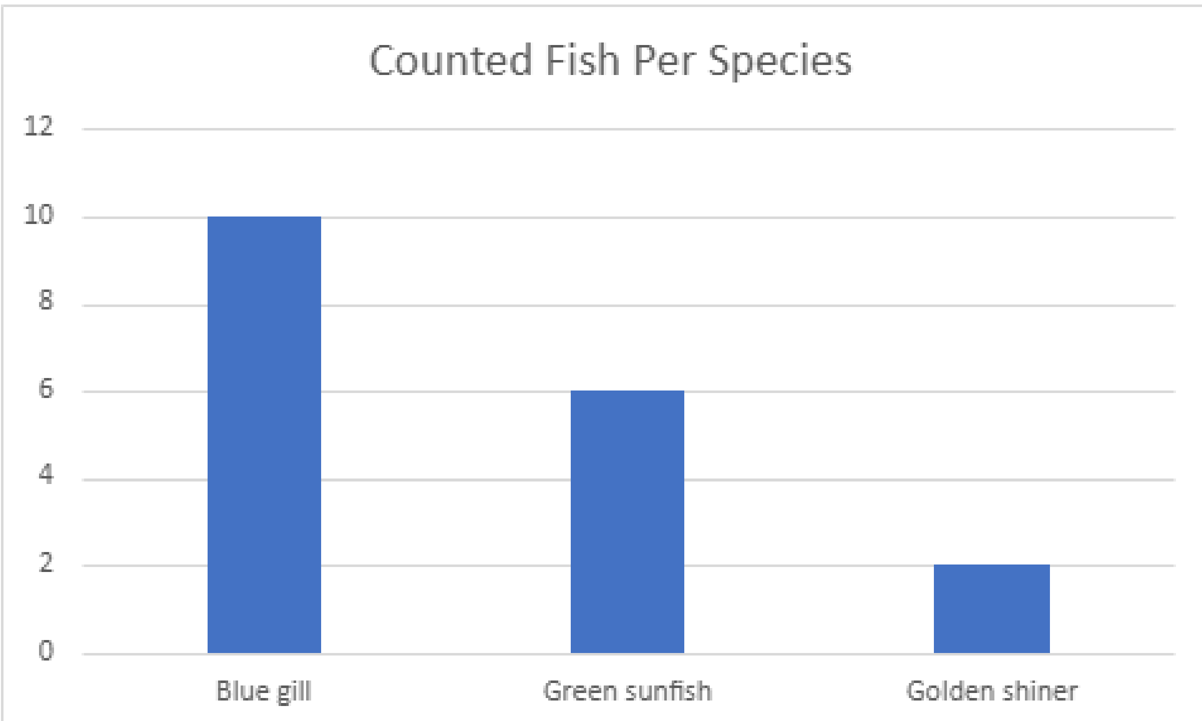

Figure 5c. Number of fish by species retrieved from seine net.

Discussion

Implications

The fish population estimate was lower than expected, possibly because fish avoided or escaped the net. The estimate also does not account for the large number of minnows and fry that slipped through the net. However, because the pond is still being established and sampled specimens appear to be on the younger side, the population may be smaller than initially suspected. That said, the fry population was visibly substantial. The macroinvertebrate survey recorded substantial bycatch of minnows and fry, and field technicians noted swarms of fish too small for the seine net swimming alongside the net.

The pond is most likely undergoing natural stocking through the stream channels, indicating an increasing fish population and evidence of successful reproduction.

Additionally, the pond lacks a largemouth bass (*Micropterus salmoides*) population, which can help regulate fish populations in some freshwater systems. That said, during the macroinvertebrate survey, some of the fry exhibited characteristics of largemouth bass; however, they were too young to be confidently identified.

Limitations

The absence of species in seine samples, such as the largemouth bass, does not necessarily indicate absence. Larger fish species tend to occupy deeper waters that the seine net may have missed (Davis, 2026); therefore, the captured data should be interpreted cautiously.

Conservation Plan

While natural regeneration is already occurring through beaver activity, stream connectivity, and early fish reproduction, rewilding efforts should be guided by the survey findings to improve long-term pond health. The vegetation survey showed that invasive species accounted for 48% of total vegetation cover, with Marsh Dewflower present in wet habitat where it could spread quickly. Because the patches are currently small, hand removal is the most practical first step. This species has weak stems and can be removed manually, but any remaining fragments may resprout, so careful removal and disposal are advised. If Marsh Dewflower expands beyond manageable patches, aquatic-safe herbicides may need to be considered. Mowing or brush-cutting along the banks should be avoided, as these methods may leave plant residue and encourage regrowth (Sweany, 2026).

The survey also found limited floating aquatic vegetation, suggesting that the pond’s aquatic plant community is still developing after recent water-level changes. Planting native emergent and wetland species would help stabilize shorelines, reduce erosion, improve water quality, and provide additional habitat for macroinvertebrates, amphibians, fish fry, and other wildlife. This recommendation is especially important because the macroinvertebrate survey found a high proportion of organisms tolerant of poor water-quality conditions, indicating that habitat structure and water quality should continue to be improved and monitored.

Native vegetation should be selected from nearby productive wetlands and transplanted carefully into designated areas around the pond, especially where shoreline erosion, sparse aquatic vegetation, or invasive pressure is most apparent. Suitable species include swamp rose mallow (*Hibiscus moscheutos*), soft rush (*Juncus effusus*), ditch stonecrop (*Penthorum sedoides*), dense St. John’s wort (*Hypericum densiflorum*), marsh seedbox (*Ludwigia palustris*), false waterpepper (*Persicaria hydropiperoides*), and river bulrush (*Bolboschoenus fluviatilis*). These plantings would support the pond’s transition into a more stable wetland ecosystem while reducing opportunities for invasive species to dominate.

Figure 6a. *Marsh seedbox (Ludwigia palustris) after initial transplanting. Source: Elisa Dass.*

Figure 6b. *Marsh seedbox (Ludwigia palustris) beginning to establish itself after one week. Source: Elisa Dass.*

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