16th Emiquon Science Symposium

(presenting author in **bold**)

Session 1

Occupational History of the Confederated Peoria in the Central Illinois River Valley
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Dickson Mounds State Museum

The Peoria Tribe of Indians of Oklahoma is a confederation of Kaskaskia, Peoria, Piankeshaw and Wea Indians united into a single tribe in 1854. These as well as various other Illinois tribes constitute The Confederated Peorias, as they then were called, originated in the lands bordering the Great Lakes and drained by the mighty Mississippi. They are Illinois or Inoka, descendants of those who created the great mound civilizations in the central United States two thousand to three thousand years ago.

The Range of the Illinois confederation encompass the entirety of Illinois, however of particular interest to these indigenous groups were the backwater lake ecosystems which make up much of the Central Illinois River Valley. Including places such as Emiquon which is a peewaaliaki (Peoria) Placename. This presentation will explore that history including but not limited to village patterns, game the tribe subsisted on and which flora and fauna were culturally significant to the Peoria.

Regional Wetland Bird Planning by the Upper Mississippi / Great Lakes Joint Venture
Greg Soulliere
UMGLJV Science Coordinator

Bird habitat management is implemented at local scales, but effective conservation of migratory birds involves an understanding and integration of population-level priorities. Bird habitat joint ventures (JVs) step-down priorities from continental conservation plans, like the North American Waterfowl Management Plan, to 22 regional geographies blanketing North America. Conservation agencies and organizations use JV regional priorities, expertise, and financial resources to inform and deliver local management actions. The JV partnerships consist of networks of administrators, bird habitat managers, and scientists, including technical experts who generate estimates of breeding focal species abundances and deficits in JV regions based on continental goals. They also estimate forage needs for birds occurring in JV regions during the non-breeding period and translate those needs into habitat objectives using energy-based models. The UMGLJV used biological models with species life history information to generate breeding habitat objectives for wetland birds using NWI wetland classes (i.e., emergent, aquatic bed, forested, and unconsolidated/open water) and relevant NLCD upland classes (i.e., grassland herbaceous, hardwood forest). For the non-breeding period, the UMGLJV generated habitat objectives using energy values for the same wetland types (4 NWI classes), as well as calculations of forage needs for bird abundances expected to occur in the region during migration and winter periods. Increasingly, the UMGLJV is also integrating social concerns, such as hunting, bird watching, and improving water quality, into conservation design. Whereas habitat-

quantity objectives are based on the biological needs of breeding and non-breeding birds, social considerations are used to target habitat retention and restoration in locations that achieve multiple biological and social objectives. Finally, the UMGLJV identifies information gaps and uses assumptions in regional planning, but the JV also financially supports monitoring and research to test planning assumptions and fill information gaps over time. New research information, spatial data, and technical tools result in periodic updates to JV conservation strategies with an iterative process.

The Microbial Biome in Thompson Lake During Early Restoration Phase

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Like recent discoveries about the human microbiome, members of the species-rich bacterial community in ecosystems respond to changes, often quickly, and serve as a biotic indicator of health. In this study, we described the composition, and thus the biotic responses, of the lake microbiome through 16S and 18S Illumina sequencing to gain an idea of the "health" of Thompson Lake during the early stages of restoration (i.e., before connection with the Illinois River). Where possible, we related water quality characteristics (e.g., depth, temperature, Secchi depth, TN, nitrate, TP, SRP, pH, chlorophyll) to changes in the microbial communities from 2008-2016 sampled no less than bi-weekly through ice-off months. The dominant phyla of bacteria found throughout the nine-year study were the highly diverse Bacteroidota and Proteobacteria and the numerically abundant Actinobacteriota (Actionomycetota). Surprisingly, Planctomycetes, whose members include anaerobic ammonia oxidizers, were abundant throughout the study and shared dominance with the forementioned phyla after 2010. In 2008, Thompson Lake had punctuated, exceptional water clarity events and a soluble phosphate (SRP) spike accompanied by an initial cyanobacterial bloom (family Nostocacae) that persisted into 2010, after which the planktonic autotrophic part of the community gave way to eukaryotic algae. Annually, the bacteria exhibited clear seasonal patterns with a notable trend among the Bacteroidota that included members of the Cytophagales and Chintophagales families, which are important in carbon polymer decomposition, and Flavobacteriales. This study presents baseline data for microbial communities in the use of monitoring restoration conditions in a shallow lake found on a floodplain isolated from its parent water source.

Algal and zooplankton export from the Emiquon Preserve to the Illinois River during the summer drawdown of 2020

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The Nature Conservancy

Completion of a water control structure at the Emiquon Preserve has provided the opportunity to quantify several indicators associated with the Emiquon Key Ecological Attribute (KEA) related to the export of food from the Preserve to the Illinois River for riverine and backwater fishes. Related to this KEA, we collected weekly water samples during summer drawdowns of 2020 and 2021 from Thompson Lake, sites within the main pumphouse ditch, and at the pumps to quantify exports of algal and zooplankton abundances and biomass from the Preserve to the Illinois River.

Zooplankton are very small animals, generally microscopic, that play an important role in freshwater systems, both as consumers of algae and as valuable food resources for fish (especially young fish), waterfowl, and other organisms. Data from the 9-week drawdown in summer of 2020 showed substantial export of zooplankton to the river in June (range = 4224 to 13,269 ind/L) and July (range = 1267 to 3150 ind/L). Export of algal biomass from the Preserve was significantly higher (65.5 ¬± 8.8 ¬μg/L) than algal biomass in the Illinois River (18.6 ¬± 2.4 ¬μg/L) throughout the summer drawdown. These data support the importance of managed connections between previously isolated floodplain habitats like Emiquon to riverine systems that typically support lower abundances of the zooplankton and algae that are essential food resources for riverine fishes and other organisms.

Zooplankton production in a restored Illinois River backwater and its contribution to mainstem river zooplankton

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In the 1990's the invasion of the silver and bighead carps (bigheaded carps) reached the Illinois River. As planktivores, bigheaded carps have the potential to drastically impact the basal plankton resources of the systems they invade. Multiple studies have found that both zooplankton and phytoplankton were significantly reduced after the introduction of bigheaded carps in the Illinois River. Historical studies comparing zooplankton abundance in main channel, side channel, and backwater sites on the Alton Reach of the Illinois River found that the floodplain backwater lakes were a major contributor to the zooplankton community. The Nature Conservancy's Emiquon Nature Preserve is a restored backwater lake on the La Grange Reach of the Illinois River. Previously disconnected due to the levee system, bigheaded carps have had less of an impact on this system's plankton resources. A water control structure (WCS) became operational in 2016 allowing for management of water levels in Emiquon through discharge of water into the Illinois River. The plankton rich waters of this backwater have the potential to benefit the depleted plankton communities of the adjacent Illinois River. In 2020 zooplankton samples were taken before, during, and after a water release event to investigate the influence of the Emiquon zooplankton community on that of the river. Total zooplankton abundance increased significantly in the river adjacent to the WCS outflow then quickly declined back to pre-conditions once waterflow ceased. Zooplankton community composition will be compared to assess how the community has shifted in response to this event.

Session 2

Drawdown and the Changing Wetland Vegetation Communities at Emiquon Preserve

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Illinois Natural History Survey

We monitored the response of wetland vegetation to restoration efforts at Emiquon Preserve during 2007-2021 relative to desired key ecological attributes identified by The Nature Conservancy (TNC). We mapped the wetland vegetation of Thompson and Flag lakes during

fall of each year to document changes in wetland area, plant species composition, and vegetation assemblages. Spatial extent of wetland vegetation and other cover types grew rapidly during early years of restoration, and vegetation communities developed without supplemental planting or little hydrological manipulation. However, changes in vegetation communities observed in 2015-2016 suggested that the emergent marsh at Emiquon was in a state of decline. Consequently, TNC initiated a drawdown in 2016, and removed approximately 6 feet of water by July, 2018 to dry out the substrate and encourage regeneration of the marsh community. Since the drawdown, moist-soil vegetation has flourished, but emergent marsh communities have yet to return to a level seen during the initial restoration. We will present responses of the major vegetation communities (i.e., aquatic bed, persistent emergent, hemi-marsh, non-persistent emergent, shrub-scrub, and open water), soil characteristics, and invasive plant species to the initial drawdown and water manipulations since, and relate our data to future management of Emiquon Preserve.

The Effects of Water Drawdowns on Marsh Bird Nest Survival at Emiquon Preserve, IL
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Marsh birds are birds that are habituated to changing hydric conditions and are often associated with complex vegetated habitat interspersed with open water that provides protection from predators and a space to forage. Unfortunately, marsh bird populations are experiencing declines worldwide, and these are believed to be driven by wetland loss and degradation, something that is characteristic to the heavily altered landscape of Illinois. Illinois originally had an estimated 8.9 million acres of poorly drained hydric soil, however by the 1980s, 90% of this wetland acreage was lost due to drainage for agricultural expansion and urbanization. Proper management of the remaining wetland habitat is believed to be the solution for mitigating further marsh bird losses. The Nature Conservancy at Emiquon Preserve manages their wetland habitat through a controlled drawdown of water from June to August after marsh birds have initiated nesting. However, knowledge on the effects of water-level manipulation for nesting marsh birds is limited, and we are particularly interested in learning more about the effects water drawdowns have on nest success and predator access to nests. In 2020 and 2021, Emiquon Preserve underwent an intense (4.5 ft) and a minimal (1.5 ft) drawdown, respectively. In both years we searched suitable habitats (hemi-marsh, dense emergent) and located marsh bird nests (Least Bittern, Common Gallinule, Black-crowned Night-Heron, American Coot) (n=158) at varying water depths and distances from the shore. We set up continuously recording cameras at a subset of nests (n=80) to record predators at the nests and we revisited the nests throughout the season to document their fate. We found that nests in shallow water and following an intense drawdown faced an increased risk of predation by mammals. These results suggest that high intensity and early season drawdowns for wetland management may be exacerbating predation risk at marsh bird nests.

Mortality and Recruitment in Largemouth Bass, Bluegill, and Black Crappie in the Emiquon Preserve
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The Emiquon preserve is a restored backwater of the Illinois River owned and managed by the Nature Conservancy, known for its recreational fishing, aquatic vegetation, and abundant migratory birds. Despite regular water level management to promote waterfowl and aquatic vegetation, its effect on sportfish growth and recruitment is not well understood. Little is known about how water level management and associated biological predictors affect fish growth and recruitment in the Emiquon preserve. Therefore, the aim of my study was to determine how annual growth, mortality, and year-class strength of bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), and black crappie (*Pomoxis nigromaculatus*) are affected by water level management and food abundance at the Emiquon preserve. Age and yearly incremental growth were determined from sagittae otoliths (bluegill = ~361, black crappie = ~355, largemouth bass = ~376) collected in 2010, 2015, 2016, 2020, and 2021 to build a master chronology from the date of initial lake restoration. Linear mixed effect models were used assess annual growth and annual mortality and year-class strength were estimated from catch-curve and catch-curve residuals. Hopefully this data can help identify and inform management practices conducive to the growth and recruitment of Emiquon sportfish.

Evaluation of Fish Passage via Whooshh Innovations, Inc Fishway and FishL Recognition System

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Invasive carps, particularly Silver and Bighead carps, are a persistent threat to our Illinois waterways and additional methods that aid in their management, control, and removal are being explored. Silver and Bighead carps, collectively known as bigheaded carps, are often attracted by water flow for upstream movements and spawning. To evaluate if this behavior can be exploited for their removal, we assessed both nonnative and native fish passage using a Whoosh Innovations fishway installed at The Nature Conservancy Emiquon Preserve's water control structure. The objectives of this study were to evaluate (1) if fish will be able to use the ladder, and (2) factors attracting fish to the area and to use the steeppass. Over the course of multiple trials between fall 2020 and spring 2021, we measured a suite of water quality parameters before, during, and after fishway operation. In addition, we collected zooplankton samples daily during the same time period. We used wifi-controlled outdoor security cameras to record fish passage over the steeppass and into a holding pool during 2020, while a scanner equipped with Whooshh Innovations FishL recognition system was installed in 2021 trials. A total of 10 species used the fishway during the multiple trials, including almost 1900 over 98% of which were Gizzard Shad.

Session 3

Yeomen of the Wetlands
Clare Howard and **David Zalaznik**

Wetland scholar William Mitsch has written that wetlands are the kidneys of the world. Like human kidneys, wetlands are life sustaining to the global environment. Wetlands received international recognition in 1971 with the first Ramsar Convention on Wetlands of International Importance held in Ramsar, Iran. The Ramsar treaty now has 160 signatory nations. Ramsar established Feb. 2 as World Wetlands Day.

The science and understanding of wetlands have evolved beyond waterfowl habitat. Ongoing global field studies provide mounting evidence of the critical role wetlands play in the environment. But still today, most people don't know about the Ramsar Convention, don't celebrate world wetlands day and don't understand the critical role wetlands play in global and human survival. Some of this failure to understand has to do with how humans see.

Wetlands need science and evolving knowledge to survive, but they also need a social movement to change the way we see. Throughout Illinois, individuals and organizations are working on wetland projects that coalesce into a social movement.

Some of these people and projects in Illinois committed to wetlands include Elliida Lakota, a native American woman, and Michael Wiant, an environmental anthropologist; Gary Sullivan, senior conservation ecologist with The Wetlands Initiative; Bud Grieves, former mayor of Peoria; John Ryan, found of Water Resources Inc.; Gurnee Mayor Kristina; Donald Hey, co-founder of Wetlands Research; Doug Blodgett, The Nature Conservancy based at Emiquon Preserve; Doug and Diane Oberhelman, owner Quail Lakes Wetland Sanctuary; farmers John Franklin and Jim Fulton.

Wetlands are becoming a social movement and are gaining the power to be heard. Yeomen of the wetlands are farmers, ecologists, ornithologists, hunters, scientists, politicians and business people all spreading appreciation and understanding of the swamps, bogs, marshes and wetlands of our world.

Win-Win Collaboration: Update on Osprey Hacking in Illinois
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Ospreys (Pandion haliaetus), a large fish-eating raptor species associated with aquatic ecosystems, were listed as endangered in Illinois in 1977 and downgraded to threatened in 2020. Nationwide, osprey population increase and range expansion have occurred since the banning of DDT and other persistent organochlorine pesticides, and through recovery efforts such as hacking. Although the first osprey hacking program in the U.S. started back in 1979, Illinois did not begin hacking ospreys until 2013. Between 2013 and 2021, 94 osprey chicks -- 59 males, 28 females, and 7 unconfirmed -- were hacked at two sites (including a site along the Illinois River) in Central Illinois. To this date, the hacked chicks have come from three source populations, with the majority from Chesapeake Bay and Westport River. In 2019, Illinois began partnering with Mass Audubon,Äôs South Coast Osprey Project (SCOP) in acquiring the chicks from its breeding population along Westport River. SCOP monitors 100 nests in the Westport River

population where the number of breeding pairs has exceeded the availability of nest platforms locally. The statewide number of breeding osprey pairs in Illinois has increased from 17 in 2013 to 50 in 2021 based on confirmed nesting attempts, with the majority of the pairs located in Cook and collar counties in northern Illinois. Despite the availability of nest platforms in those areas, about an equal number of the osprey nests were still built on cell towers and utility poles as opposed to nest platforms. Moreover, a fast growing number of osprey pairs have used cell towers since 2019. All these suggest that ospreys have the potential to become a nuisance in the northern, populated region of the state. Thus, the hacking program in rural central Illinois is important for the state-wide recovery of ospreys in establishing self-sustaining breeding populations.

Population Viability Analysis of Two Hacked Osprey (Pandion haliaetus) Populations in Central Illinois

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Osprey (Pandion haliaetus) populations plummeted in the mid-20th century due to loss of nesting sites and the widespread use of organochlorine pesticides. While Osprey populations in North America have rebounded to historic levels or higher since the ban of those synthetic chemicals, populations in some states, including Illinois, are still considered threatened or endangered. "Hacking" is a reintroduction technique common for recovering raptor species because of its potential to encourage site fidelity in the translocated individuals. The Illinois Osprey Hacking Program was initiated in 2013, with up to six juvenile Ospreys translocated annually to each of two hack sites in central Illinois. We are asking a central question: How many Ospreys should be hacked in order to establish self-sustaining breeding populations at those sites (i.e., Banner Marsh and Lake Shelbyville)? We conducted a population viability analysis (PVA) for the hacked Ospreys at those sites using vital rates obtained from previously published literature on the species. Two main findings are apparent regarding the viability of those hacked Osprey populations: 1) to achieve self-sustaining populations, a minimum of 42 and 52 male juvenile Ospreys must be hacked at the Banner Marsh and Lake Shelbyville hack sites, respectively and 2) regardless of how many male Ospreys are hacked, the carrying capacities of the populations, represented by the number of artificial nest platforms intended specifically for the species, must be increased to a minimum of 14 platforms within a 50-km radius of each hack site.

Environmental Factors Driving Recruitment and Growth of Freshwater Drum From Four Large Rivers

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Recruitment and growth are important dynamics driving fish populations that are regulated by a multitude of abiotic and biotic environmental factors at a range of scales. However, there are few studies that evaluate the effects of multiple environmental factors on fish recruitment and growth in large rivers. Rivers are complex and heterogeneous systems, and most studies of fish recruitment and growth in rivers are focused at relatively small spatial scales. Moreover, the limited studies that are available often focus on sportfish rather than nongame or "rough" fish, which can often be integral to riverine biotic communities. The aim of this study was to determine environmental factors driving fish recruitment and growth at broad spatial scales in large rivers. We chose freshwater drum (*Aplodinotus grunniens*) as our focal species, and collected them from the Illinois portions of four major Midwestern rivers: the Illinois, Wabash, Mississippi, and Ohio rivers. We determined year class strength using catch-curve residuals and GLM was used to explore the relationship between year-class strength and environmental variables that drive freshwater drum recruitment, and mixed-effect linear modeling was used to evaluate age-specific and environmental influences on freshwater drum growth. Studies like ours are important for compiling life-history data about native nongame fishes like freshwater drum, which is useful for management agencies to better understand how these unique species are likely to fit into our future fisheries management programs.

Session 4

Evaluation of Selected Physiological Responses to Sub-lethal *Cyathocotyle bushiensis* and *Sphaeridiotrema spp*. Experimental Infections in Captive Lesser Scaup (*Aythya affinis*)

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Since 2000, thousands of lesser scaup (*Aythya affinis*; scaup) die annually during migration through the Upper Midwest, USA from *Cyathocotyle bushiensis* (Cb) and *Sphaeridiotrema spp*. (Ss) intestinal infections after consuming infected exotic faucet snails (Bithynia tentaculata). Faucet snails have reached Pool 13 of the Mississippi River raising concern of further spread to Pool 19, a critical mid-latitude stopover area for scaup. Although not all trematodiasis infections result in mortality, we hypothesize that sub-lethal infection may affect subsequent migration and fitness through decreased body condition, as indexed by white blood cells (WBCs), liver selenium (Se) concentrations, and total body measures (e.g., mass and body fat). We experimentally tested these physiological parameters in captivity with wild-caught and captive-reared scaup. Between July 2019 and October 2020, 44 male and female wild-caught scaup received a single sub-lethal dose (x = 96 Ss and x = 169 Cb or x = 157 Ss and x = 175 Cb) of metacercariae while 28 birds served as controls. During the same time frame, 16 male and female captive-reared scaup received a single sub-lethal dose (x = 293 Ss and x = 124 Cb) of

metacercariae while 8 birds served as controls. We collected blood and mass measurements from all birds prior to dosing (i.e., day 0), on day 5, and on day 10 when all birds were euthanized, necropsied, and the right liver lobe was collected for heavy metal analysis. Infected birds initiated an immune response to trematode infections; however, wild-caught scaup experienced a more intense immune response along with the depletion of important trace nutrients, such as Se, leading to mortality in some trematode infected wild-caught scaup. Infected birds experienced a predicted physiological reaction to the treatment, with those in better body condition (i.e., captive-reared birds) exhibiting less of a physiological response.

Prevalence of Tularemia in Birds of Prey: A Role for Hawk Flies?

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North American raptors can be infected by a gram-negative coccobacillus, *Francisella tularensis*, or tularemia. *F. tularensis* can be transferred to a host via direct contact with another host, including ingestion or inhalation, and contamination of water. Raptors can be parasitized by Hippoboscidae flies (louse flies), but it is unknown if they can transmit tularemia. In this study, we explored potential modes of transmission of tularemia within raptors and Hippoboscid flies by determining the prevalence of the pathogen in hosts with direct ELISA and indirect IgM ELISA. A direct ELISA was used to detect the presence of the pathogen in flies and in the plasma of birds hosting flies An indirect ELISA for IgM against *F. tularensis* LPS was used for birds to detect the prevalence of antibodies in the plasma. The highest prevalence of *F. tularensis* was in larger predators (GHOW, RTHA, & TUVU). The higher prevalence may occur because these raptors have a diet high in rabbits – or other mammals, putting them at a higher risk. Most of the birds that had tested positive for tularemia in the direct and IgM indirect ELISA had shown that they had illness and symptoms when submitted to the rehabilitation center. The symptoms corresponded to the birds that had tested positive. Birds that were sprayed by skunks had a high probability of testing positive for tularemia. Further studies could also test raptors caught in the wild, rather than birds admitted into the rehabilitation center, and we could use IgY ELISA to test for antibodies signaling a history of exposure to tularemia.

Spatial Distribution of Extractable Metals in Sediment Leached from Iron Foundry Slag Deposit at Carp Lake, Davenport, IA, USA

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Slag, a byproduct of the iron and steel smelting process, can contain elevated concentrations of metals such as cadmium, copper, iron, lead, nickel, zinc, and others. Before federal regulations required proper disposal, foundries deposited slag into the environment across the Midwest. Carp Lake, south of Davenport, IA, and part of the Nahant Marsh complex, has a slag deposit estimated to be 4,786 m^3 (6,261 yd^3) that was dumped on its northeast shore since as early as the 1920s. Due to environmental weathering, metal-laden slag is liberated from the pile and accumulates in the lake sediment. The metals persist indefinitely in the sediment and are a

secondary contributor of metal contamination to the aquatic ecosystem. Since Carp Lake comes in direct contact with the Mississippi River during flood events, a study was conducted to better understand the extent of contamination prior to developing detailed remediation plans. Sediment samples were collected from 16 locations across Carp Lake and analyzed to determine the extractable concentrations of Cd, Cu, Ni, Pb, and Zn. A bathymetric map of the lake was developed using sonar and a Lowrance chart plotter. The effect of sample site distance from the edge of the slag pile and the depth of the samples were tested to determine if a relationship existed with the concentrations of individual metals. A relationship was found between the distance from the slag pile and the contamination within the sediment. However, there was no relationship between the depth of the sediment and the contamination of heavy metals.

Characteristics of Microplastic Contamination Agricultural and Wetland Areas
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Plastic production and consumption have become a common aspect of everyday life for many countries around the world and has led to a dramatic increase in microplastic pollution. Microplastics are small pieces of plastic, usually defined as pieces less than 1-5 mm and can be placed into three different categories: fibres, fragments, and beads. Although microplastics are a known pollutant in aquatic areas, information surrounding microplastic pollution in terrestrial areas is scarce. For the purpose of furthering knowledge on microplastic contamination in soil, during this experiment, density separation was used to extract microplastics from agriculture wetlands and floodplain wetlands and quantified. Soil samples were collected from the floodplain and three wetlands located on the Franklin Research and Demonstration Farm in Lexington, IL. After testing, it was found that larger microplastic were, in total, higher in concentration in each sample location. Additionally, the three samples from the floodplain samples contained more microplastics than the three wetland samples. By furthering research of microplastic pollution, we may one day be able to apply our knowledge to understanding microplastic pollution in affected environments and how it affects organisms and ecosystems. Due to little research involving microplastic pollution, this project can aid us in understanding microplastic contamination in various areas.