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# Ohio State Olentangy River Wetland Research Park Bioreserve Pond Transformation

Stephanie Hyland; Marisa Murphy; Tarek Akkari; Alexis Paden; Ajla Karalic

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A program of Energy Services and Sustainability
Aparna Dial, University Director, Energy Services and Sustainability
Dial.15@osu.edu

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**Executive Summary**

In this report, we summarize the importance of wetlands for the environment, for industry, and for the basic needs of animals and humans alike. We discuss the significance that early childhood education holds for the understanding and future conservation of this vital ecosystem. We created a child-friendly, interactive curriculum utilizing the bioreserve pond, lobby exhibit, and other supplemental activities for visiting schools. By outlining the Ohio Science Standards for our target age group, grades K-3, we established a set of goals and expectations for the interactive activity. In order to meet these goals, and provide an easy to use and flexible guide for tour groups, we developed a lesson plan and instructor outline that includes suggested areas for discussion and assessments that will reinforce what the students learn and experience. The report also addresses social, economic, and environmental concerns including possible funding sources and the mitigation of environmental impacts.

## Introduction

Today, the natural sciences are mostly taught to children from a secondhand perspective, while The Olentangy River Wetland Research Park (ORWRP) is home to an alternative, stimulating learning experience. Wetlands are an invaluable aspect of nature, and they play an important role in the planet's ecosystem by storing carbon, providing habitat to many species, and purifying freshwater. Likewise, they are also an important medium for education. Educating primary school children is necessary to ensure a better future for the planet and its inhabitants. When thinking about early childhood education, most people would recall sitting at a wooden desk and staring at a chalkboard, having no recollection of what was being taught. Research shows that children are more apt to learn in an interactive environment than a standard classroom setting (Dillon et. al, 2006). There is a demand from primary schools for field trips to the ORWRP, but the park is ill equipped to entertain and educate lower grade levels.

Although the ORWRP gets requests for field trips, they have to turn the schools away because there is no system in place to accommodate younger children. In order to create an engaging learning environment for grades K-3, the bioreserve pond at the ORWRP will be transformed into an attraction where students can take part in hands-on learning. The bioreserve pond, located in the rear of the Heffner Teaching and Resource Building, is currently not in use by the research facility even though it provides the perfect setting for a hands-on exhibit.

Activities, such as dip netting, will be paired with a lesson plan for students to learn about wetlands and fulfill the goals of the Ohio Science Standards. This paper will examine the Ohio Science Standards that must be met, introduce an interactive lesson plan for schools in the Columbus area, and address potential criticisms associated with these actions.

## Importance of Wetlands

The importance of wetlands for the economy, wildlife, and health of the environment is unrivaled. Wetlands have multiple functions that benefit the natural world as well as industry and agriculture. They act as 'natural kidneys' by filtering impurities and excess nutrients that are in water (Ohio Environmental Protection Agency, 2013). This purification is extremely beneficial to Ohio since it is an agricultural state on Lake Erie. Without filtration, farm runoff would end up in Lake Erie, which many people depend on for drinking water. This saves millions of dollars annually by providing a natural alternative to costly wastewater treatment plants. Not only do wetlands filter excess nutrients before they enter drinking water, but they also serve as a temporary domain for migrating birds and provide habitat to one third of all endangered species. Wetlands also act as carbon sinks, and much like large forests, they play a significant role in global carbon sequestration (Office of Environment and Heritage, 2013). Carbon sequestration is a key method for the mitigation of greenhouse gas emissions and preserving the overall health of the planet. These credentials suggest that wetlands provide numerous services to ecosystems, but are treated as having less value.

As wetlands continue to be drained or destroyed, the consequences become more severe for Ohio's ecosystems. The Ohio EPA reports that about 90% of Ohio wetlands have been lost or impaired (U.S. Environmental Protection Agency, 2013). This alarming statistic shows the need for a strong conservation movement. By educating young minds, the next generation will have the knowledge to make powerful sustainable decisions. All of the previously mentioned services that wetlands provide for the planet and its living species prove wetlands to be extremely important to Ohio's ecosystems, and show that it is necessary to educate communities and preserve existing wetlands.

**Significance of Early Education**

Educating primary school children of these dangerous effects will prepare them to make environmentally conscientious decisions in their adult lives. Educating young visitors in a captivating manner could ignite a lifelong passion for wetlands and other environmental issues. After conducting studies on children's perceptions of wetland habitats, Sarah Anderson and Brian Moss of the Department of Environmental and Evolutionary Biology at the University of Liverpool found that positive exposure to wetlands in early education could play a key role in wetland conservation (1993). Providing opportunities for firsthand experiences with nature is central to a child's relationship with the outdoors. Statistics show that children between the ages of eight and eighteen currently spend eight hours a day indoors with electronics (Coyle, 2010). This trend is cause for concern because of the evident disconnect between children and the outdoors. It is not possible for kids to develop empathy or concern for something that they are not familiar with, so children need more exposure to natural elements such as the earth, water, wildlife, and plants (Waller, 2007). Comprehending what nature looks and feels like provides a baseline for recognizing changes in the environment, which is crucial for understanding the importance of conservation.

Schools can play a key role in getting kids back outside through outdoor education programs. According to the World Wildlife Foundation, outdoor education helps kids improve their long-term performance in the classroom and on standardized tests (Coyle, 2010). It also allows kids to form connections to natural settings through their imaginations. Through a process called "co-construction," children retain what they learn through narratives developed on site, and these ideas are supplemented through dialogue with adults (Waller, 2007). This facilitates stronger understanding and connections with the subject space by encouraging explorative thinking. In the proposed lesson plan, specific boundaries are not identified for dialogue and content to allow for open interpretation and flexibility for the children. Free thinking and exploring will be encouraged, but certain guidelines must be followed to meet educational standards.

## Ohio's Science Standards

The Ohio Science Standards provide specific topics that are taught in each grade level. In order for children to be prepared for secondary school and higher education, students must demonstrate and understand basic science knowledge before they can be exposed to more complex concepts (Ohio Department Of Education, 2014). The state of Ohio sets the science standards for every grade to map out what students should know before they move on to the next grade level. The concepts and knowledge that students learn are the building blocks for what is to come in the following years of study. For our project to be effective and supplemental to what students are learning in the classroom, we must adhere to standards set by the state of Ohio.

The focus set by the Ohio Science Standards for all students K-3 are similar enough to use the same lesson plan and activities while at the ORWRP. The fundamental goals for these four grades are to develop skills for systematic discovery, and to understand the physical world around them by using scientific inquiry. Students must be proficient and able to use scientific processes, make simple observations about the natural environment, and be able to ask questions. They must become familiar with gathering data using tools and equipment to extend their senses and make clear observations. The students should be communicating about investigations and observations by writing, drawing or speaking. Due to nature's diversity, exposure through personal observations and experiences is a requirement of the Ohio Science Standards (Ohio Department Of Education, 2014). The lesson plan encompasses the similar concepts within grades K-3, and the specifics of each grade are detailed below.

## Kindergarten

Kindergarten students should be making connections between living and nonliving things, and know that each have specific physical properties that can be used to sort and classify them (Ohio Department of Education, 2014). The topics that kindergarten classes cover are the physical and behavioral traits of living things. The types of investigations being done include exploring, describing, comparing organisms in Ohio, and emphasizing physical traits and behaviors, such as growth and reproduction, which influence survival. Students must understand how living things respond to their environment, and a relevant example is frogs depending on food sources in wetlands. In addition, the curriculum entails recognizing the difference between how plants and animals obtain their food, which is discussed further in grade 1.

**Grade 1**

The primary topic covered in the Ohio Science Standards for grade 1 refers to the basic physical needs of living things. The focus is that living things need energy to survive, which comes from the sun, food, and water (Ohio Department of Education, 2014). Animals require basic components like water, shelter, and air to survive in their environment. Students should understand that living organisms obtain energy in order to grow and reproduce. Observing energy trophic levels at the wetlands will be helpful in understanding the links between organisms in an environment (Ohio Department of Education, 2014). Emphasis will be put on where organisms obtain their food and how this determines what species can thrive in an ecosystem. Likewise, in grade 2, the relationship between species in a single environment is covered.

**Grade 2**

The topics covered for grade 2 are interactions within habitats that focus on how ecosystems work. Using observations, students should understand the functions and interactions of the living and nonliving parts of an ecosystem, and that the environment can affect them (Ohio Department of Education, 2014). The changes an environment experiences can be implicit or explicit, and these alterations affect its inhabitants as well. An example of this is how beavers building dams can directly affect the flow of water. If changes to an environment interfere with an organism's needs, it must relocate in hopes to survive. Students should recognize that there are animals and plants that once lived on the earth and have gone extinct because their environmental needs were not met. Fossils left behind by extinct organisms show similarities between the past and present species. Connections can be made at the wetlands by observing the plants and animals, and how their needs are fulfilled in the ecosystem. The fulfillment of these essential resources creates healthy organisms, and their life cycles are discussed in the next grade.

**Grade 3**

The topics covered in the Ohio Science Standards for grade 3 are behavior, growth, and changes in organisms. The focus is on exploring life cycles and the relationship between an

organism and its natural environment (Ohio Department of Education, 2014). Students should recognize that physical and behavioral traits affect an organism's ability to survive and reproduce. The offspring of individuals of the same species resemble each other, but they differ in traits. Sometimes the differences give certain advantages in survival and reproduction, and those traits are carried on to offspring. It is important to emphasize that the next generation resembles its parents, and clarify the common misconception students have that traits from parents can be selected and passed down. The offspring instead can learn behavioral traits from their parents, such as how to hunt for food.

## Application of the Ohio Science Standards Standards

With all of the Ohio Science Standards in mind, students visiting the ORWRP will use hands-on activities to learn about organisms, their survival mechanisms, and their role in the ecosystem. The students will learn to determine if something is alive, where it can be found in the ORWRP, and how each organism obtains its food. The key points students should understand are how plants and animals interact with one another, and the connections within the food web. When showing students living things, the focus will be on associations made through interactions and observations. Students should observe that living things have adaptations that help them thrive in their environment. A number of animals that can be found at the ORWRP have specific physical traits to show this. For example, a blue heron's beak helps it catch fish. Students will be encouraged to think on their own with minimal explanation from leaders during activities found in the lesson plan.

## Lesson Plan

In order for the ORWRP to accommodate field trips from primary schools, the current tour must be substituted with an interactive lesson plan designed for younger visitors. By creating a universal lesson plan, the visiting students will have a basic model to follow during the field trip. Using this lesson plan, children will understand the value of wetlands, and develop an understanding of the importance of protecting them. The children will also understand the different types of wetlands, their features, and become familiar with the organisms that inhabit them.

In order to ensure each child has sufficient knowledge, each field trip will begin with a brief discussion of the components of a wetland. Teachers/tour leaders should explain a basic definition of a wetland corresponding to the students' comprehension level, and discuss how valuable the ORWRP is to surrounding ecosystems. Next, the different parts of a wetland should be discussed, so that children will be able to connect what they observe at the wetlands to actual terms and definitions. This general information should be discussed in school prior to the field trip, and will be reiterated at arrival.

Brent Macolley is in charge of the day-to-day operations at the ORWRP. He will welcome each group, and will announce the upcoming activities. Once the children have a basic understanding of the ecosystem, they will be directed to the dry land activity. In this simple game, the teacher will discuss food chains. This activity will allow children to play with imitation plants and animals to understand how all components are interconnected. For example, the leader could ask what organisms a certain animal consumes, and the children holding those organisms would hold their model in the air.

Each tour will then be divided into two separate groups: one to remain outside, and one to head into the lobby. The first group of fifteen children or less will travel to the bioreserve pond to start hands-on activities. First, children will observe their surroundings to understand the ecosystem firsthand. After simply observing the water, the students will be allowed to put on waders and enter the pond. The children will also be given dip nets and encouraged to explore the pond with them. The goal is to catch organisms in the nets and get a glimpse of what lives underwater in a wetland. By experiencing the pond hands-on, children will understand what a wetland really looks and feels like.

Meanwhile, the group inside touring the lobby will begin with the interactive tank and touch-table. The tank holds a wetland model, and children will get a close up view of what a wetland looks like below the surface. Models and replicas of animals and insects located at the ORWRP can be found on the touch-table. Students will be encouraged to use their hands to feel and familiarize themselves with these organisms. The children can also observe the ORWRP's pet turtle in its tank while inside. After having time to explore the tank and touch-table, the students will be directed to the television screens on the lobby wall showing live bird footage. The birdhouse group will implement live stream footage from inside birdhouses around the ORWRP that will be displayed on the lobby monitors. Visiting groups can observe what is

currently in each birdhouse, and discuss the different kinds of birds that live in Ohio wetlands. The groups will switch after completing their respective activities. The outside group will head inside and vice versa.

At the end of the activities, teachers are encouraged to follow the evaluation activity to supplement children's basic understanding of a wetland through dialogue. The entire lesson plan, found in Appendix I, has two versions of the evaluation activity. The first version is a list of questions with an answer key that teachers can use to facilitate a verbal assessment and discussion. The second evaluation activity asks the same questions, but is in a printable form for the children to take as a quiz. Both forms ensure that the Ohio Science Standards are met for the field trip.

It is also important to note that since a detailed lesson plan was created, the accompanying teachers and chaperones, rather than the park staff, can lead the field trip in attempts to minimize disruptions to research. After a brief introduction by Macolley, teachers can use the lesson plan to guide and supplement the interactive experience. The students will benefit from the familiarity of the instructor and the flexibility of their learning experience. Additionally, Macolley, and his staff will not have to dedicate time to leading the entire field trip. Overall, this interactive lesson plan was created to allow students in grades K-3 to tour the ORWRP in an educational, yet exciting, manner. Since there will be no ORWRP staff present for the duration of the field trip, there are potential social criticisms.

**Social Concerns**

Creating an outdoor classroom produces potential social concerns. The safety of students visiting the ORWRP is of the utmost importance. After review of recommended chaperone to student ratios in the Columbus area, we feel that one adult per five students is appropriate for the ORWRP interactive pond. Center of Science and Industry (COSI) requires this specific ratio for their field trips, and with a similar hands-on approach to science, a 1:5 chaperone to student ratio will suffice at the interactive pond (COSI, 2013). With this in mind, we advise that the ORWRP staff recommends that visiting schools have three chaperones for the outdoor portion of the lesson plan. With fifteen students in the water at a time, this will allow chaperones to watch over a manageable number of students to ensure the safety of all. Lifejackets are unnecessary because of the shallow nature of the bioreserve pond, so sufficient safety will be provided by

chaperones. Large classes visiting the ORWRP must be divided into groups of fifteen or less for the bioreserve pond portion of the field trip. Along with safety concerns, there are also potential environmental criticisms.

**Environmental Impacts**

The nature of this lesson plan involves hands on activities that get students into the bioreserve pond, which may bring about environmental concerns. A possible concern regarding the impacts of bringing more people not only to, but also into, the wetlands could have a negative effect on the pond and its inhabitants. Analysis of the National Environmental Policy Act (NEPA) shows that there is no need for an environmental impact statement because according the standards set by NEPA this lesson plan will not have significant effects on either the natural environment or human environment (2007). Since the bioreserve pond is separated from the other research wetlands by the swale, no preventative measures, such as the use of gloves, are necessary. With minimal environmental impacts, the funding of this project is a more pressing issue.

**Funding Needs/Resources**

Another potential obstacle is funding the materials needed to create the outdoor classroom. Pond activities will require 15 dip nets and 15 pairs of children sized waders. The ORWRP already has adult size waders, which can be used by teachers and chaperones. Sturdy metal dipnets can be found on Amazon.com for about $2.75 each, so fifteen of these would cost approximately $41.25. The child size waders run about $64.99 each on Amazon.com, so fifteen of them would cost $974.85. Therefore, if fifteen dip nets and fifteen waders were bought for the ORWRP, it would cost approximately $1016.10. If this cost is too high, the lesson plan could be altered to allow fewer children in the interactive pond at once. This would mean less waders would need to be purchased, and the total cost would be reduced.

In order to provide funding for the purchase of waders and dip nets, there are grants offered specifically for wetland projects. The United States Environmental Protection Agency offers the 5 Star Wetland Restoration Grant which aims to bring students, conservation corps, and government agencies together to support and fund projects that provide environmental education while restoring wetlands (Environmental Protection Agency, 2013). While this project

is not actively restoring the wetland, it creates larger support for the importance of wetlands to communities. Ohio has not received a grant from the 5 Star Wetland Restoration Grant program since 2006. This length of time, along with the relevance of environmental education in the lesson plan, makes the outdoor classroom a perfect candidate for this grant. On average, $10,000 is allotted to each project, but the grant ranges from $5,000 to $20,000 (Environmental Protection Agency, 2013). If awarded this grant, the funding for the outdoor classroom and its materials would be covered, and there might be remaining funds to expand the outdoor classroom in the future.

## Conclusion

In order to educate students about wetland conservation at a young age, an interactive lesson plan, developed specifically for grades K-3 visiting the ORWRP, will be implemented following the Ohio Science Standards, with all potential criticisms in mind. This lesson plan will create a new avenue for outreach by attracting primary school children in the Columbus area. There are many benefits associated with developing an interactive lesson plan for the ORWRP that would teach local students how important conservation practices and wetland ecosystems are. This project can be seen as a starting point for the outdoor classroom. Limiting the lesson plan to this specific group will allow for the evaluation of the positives of the lesson plan, as well as the opportunity to learn where there is room for improvement. This produces an avenue for future projects to recreate the outdoor classroom for other age groups and communities.

Following the Ohio Science Standards, this lesson plan can be supplemented for traditional classroom teaching, and will be a great opportunity for students to learn in a new way. Educating in an outdoor learning environment gives students a chance to experience a wetland's components intimately with a hands-on approach. This program gives the ORWRP a chance to reach out to more of the surrounding community and teach the younger generation about conservation and nature. By incorporating this lesson plan, the wetlands will be able to accommodate not only adults, but also younger age groups during their visits. While it will not be advertised, families can access the lesson plan upon request while visiting the ORWRP. Overall, designing an interactive lesson plan for children in grades K-3 at the ORWRP will eliminate the monotony of traditional classrooms, and produce a worthwhile learning environment that instills creativity and environmental knowledge in young students.

**Appendix I:**

Integrated Lesson Plan and Activity

I. Learning Objectives

A. Students will understand the value of wetlands, and the importance of protecting them.

B. Students will understand the difference between types of wetlands: marshes, swamps, bogs, and fens.

C. Students will understand the different parts of a wetland.

II. Subject Matter: Wetlands

A. What is a wetland?

a. A wetland is an area of land that is covered by water or saturated with water.

b. Different parts of a wetland (Argyll Master Courses, 2014)

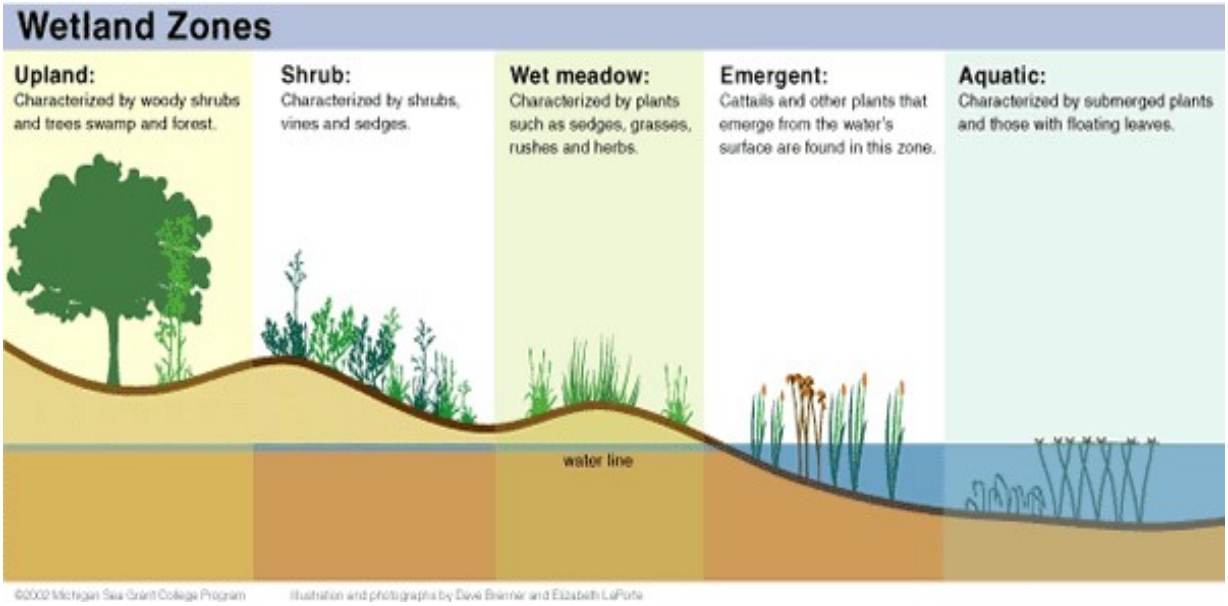
i. upland– place with woody shrubs, trees, and forest

ii. shrub- area with shrubs, vines, and sedges

iii. wet meadow- plants like sedges, grasses, rushes and herbs

iv. emergent – cattails and other plants that grow out of the water's surface

v. aquatic- submerged plants with floating leaves



B. Why are they important?

a. Filter and clean water, habitat for many different animals, flood control, etc.

III. Procedure:

A. Students arrive at wetlands and approach dry land activity.

a. Take each animal toy and explain how it is related to a wetland food chain. What does it eat? What eats it?

b. Look at the plants and animals. Explain what the children should expect to see at the OSU wetlands.

B. Divide children into two groups.

a. One group stays outside and heads to the interactive pond.

b. The other group heads inside to the interactive lobby exhibit.

C. Interactive Pond

a. Head to the back of the Hefner Building to the interactive bio reserve pond. Have children observe their surroundings, and yell out what organisms they see- fish, frogs, birds, ducks, etc.

b. Give each child a dip net and walk down to the water.

i. Allow children to dip their nets into the water, and see what they can catch.

c. Put on waders and allow the children to walk around in the shallow pond, and experience a wetland hands-on.

d. Feel around

i. Allow children to touch water, the dirt/mud and describe textures.

ii. Talk about different types of plants they see and the animals/insects around them (are they in the water or on land, what do they eat, why are they important, etc.).

D. Interactive Lobby Exhibit

a. Children enter the lobby and view the interactive table.

i. The table is a wetland model that the children are encouraged to put their hands in and explore what happens under the water.

ii. Children can observe the turtle in its tank, and can explore the lobby area.

b. Observe the live footage from newly installed bird houses.

i. Tour leader should explain that wetlands have many bird species and that cameras were installed in birdhouses to give visitors a close up.

ii. Children can watch the multiple screens showing live feeds from different birdhouses around the park.

IV. Evaluation Activity

A. See attached page for a printable version of the evaluation activity

1. Wetlands are found _____. (Nye, 1995)

A: all over the world

2. Are wetlands the same as quicksand? (Nye, 1995)

A: yes

3. Scientists believe that about 1/3 of _____depend on wetlands. (Nye, 1995)

A: endangered animals

4. Can wetlands be rebuilt after hundreds of years? (Nye, 1995)

A: no

5. We have destroyed over _____ of our wetlands in America. (Nye, 1995)

A: half

6. What can you do to help protect wetlands? (Nye, 1995)

A: Write to a congressman, and tell people what you know about wetlands

7. Is there a World's Wetland Day? (Explorit Science Center, 2001)

A: yes. It is on February 2, every year

8. Which cities were built on wetlands? (San Francisco, Boston, Washington D.C.) (Explorit Science Center, 2001)

A: all of them

9. During migration, do birds like to refuel at wetlands on their trek to their "summer or winter homes?" (Explorit Science Center, 2001)

A: yes

10. If one type of plant or animal living in a wetland went extinct, would the rest of the food chain be unaffected? (Explorit Science Center, 2001)

A: no

After a quick introduction from Brent about the wetlands, teachers are encouraged to lead their own tours following this activity plan:

| Tour Leader's Activity | Students' Activity |
|---|---|
| Welcome field trip<br>Explain basic definition of a wetland<br>Introduce dry land activity | Students can play with the dry land exhibit to understand a basic food web |
| Divide children into two different groups<br>Group 1 goes to the interactive pond<br>Have students observe surroundings<br>Dipnets<br>Waders | Students can play with dipnets to see what they can find in the water<br><br>Students can put waders on and walk around in the pond |
| Group 2 goes to the lobby<br>Allow children to play with interactive wetland model<br>Children can observe the turtle tank, the lobby, and the bird screens | Students can play with the interactive wetland tank to get an interactive understanding of a wetland<br><br>Students can observe the turtle tank, the lobby, and live bird camera footage |
| Begin Evaluation Activity:<br><br>Teachers are welcome to print out the questions and administer this activity as a quiz, or as a round of verbal questions with prizes for correct answers. | Students take the evaluation activity to show what they learned from the wetlands tour |

Wetland Quiz:

1. Where are wetlands found?

a. in Ohio b. in the United States c. in North America d. all over the world



2. Are wetlands like quicksand?

a. yes b. no

3. Scientists believe that about 1/3 of _____depend on wetlands.

a. animals b. endangered animals c. plants d. endangered plants




4. Can wetlands be rebuilt after hundreds of years?

a. yes b. no

5. We have destroyed over _____ of our wetlands in America.

a. ¼ b. ½ c. 1/3 1/5

6. What can you do to help protect wetlands?

a. write to a congressman b. inform people about wetlands c. both



7. Is there a World's Wetland Day?

a. yes b. no


8. Which cities were built on wetlands?

a. San Francisco

b. Boston

c. Washington D.C.

d. all of the above.


9. During migration, do birds like to refuel at wetlands on their trek to their "summer or winter homes?

a. yes

b. no

10. If one type of plant or animal living in a wetland went extinct, would the rest of the food chain be unaffected?

a. no

b. yes

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