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Campus as a Living Laboratory

Olentangy Bottomland Hardwood Forest Trail: A Beneficial and Sustainable Development

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Table of Contents

Executive Summary.....2

Introduction.....2

Background3

 What is a Bottomland Hardwood Forest?.....3

 Current Use and Management.....5

 Figure 1. Hydrograph of the Olentangy BHF.....6

Our Proposal.....6

Trail Use and Benefits.....7

Trail Construction and Cost.....8

 Construction Process.....9

 Figure 2. Projected Trail.....10

 Cost.....11

Discussion.....12

 Future Work.....13

Conclusion.....14

Literature Cited.....15

Executive Summary

The Ohio State University Wetlands currently offer many research and educational opportunities. However, we believe that the bottomland hardwood forest in the Wetlands is not being used to its fullest potential. This site, if used properly, allows for additional educational and recreational opportunities. We propose that constructing a hiking trail spanning a large portion of the bottomland hardwood forest will make this ecosystem a useful resource for both OSU students and the Columbus community. The trail will provide educational opportunities, increase environmental awareness, and improve and enhance the character of the community. However, trail construction is limited by costs, location, and environmental impact. This paper gives information about bottomland hardwood forest ecosystems and the current and future use of the forest found adjacent to the Ohio State University Wetlands.

Introduction

Increased urbanization has influenced the biodiversity and structure of various ecosystems. Urbanization has resulted in both beneficial conservation efforts and harmful land use changes. Interactions between humans and the environment can be facilitated through parks and recreational programs or can occur without an institution or organization establishing a guideline for proper recreational use. For instance, local parks implement recreation management to maximize user enjoyment and minimize improper park use. Management of recreational opportunities and ecosystems helps reduce anthropogenic effects on fragile ecosystems. However, unless management and site objectives are clear, recreational use of habitats tends to occur unsustainably with more environmental impact (Marion & Leung, 2004).

The bottomland hardwood forest (hereafter BHF) at the OSU Wetlands has suffered from a lack of recreational rules. This fragile environment performs many ecosystem services that are valuable to humans and to surrounding areas. Such ecosystem services include flood control, sediment storage, refuge site use by migratory animals, and runoff buffering and filtration (Environmental Protection Agency, 2012). However, current user-made trails, vegetation trampling, littering, and other human activities have impacted the natural state of the BHF.

This paper proposes the construction of a hiking trail that allows for more environmentally friendly access to the BHF adjacent to the OSU Wetlands. We believe that a dedicated trail will help increase awareness about conservational issues, offer educational opportunities, limit environmental impacts, and present the public with the chance to enjoy and explore an ecosystem they might not have seen before (Moore & Ross, 1998). This paper offers background on BHF's and a study of past trail management. Information is presented on the advantages of constructing a trail and how to effectively implement trail-oriented recreation in the OSU BHF. We will also focus on suggestions, setbacks, and criticisms of trail construction in the forest.

Background

What is a Bottomland Hardwood Forest?

The key feature of BHF's is their flooding regime. BHF's are deciduous forests that are periodically inundated with water (Natural Resource Enterprises, 2011). These ecosystems are found adjacent to waterways with broad flood plains. BHF's retain excess water and prevent flooding downstream. As a result, the water saturated soils in these forests tend to accumulate and produce many nutrients used by various biota (Ober, 2009). However, the United States Environmental Protection Agency indicates that BHF's perform a variety of ecosystem functions beyond flood control (2012). The water retention capabilities of these ecosystems allow BHF's to serve as a nutrient, contaminant, and water buffer to adjacent aquatic ecosystems. Ober found that by retaining both water and nutrients, BHF's are distinguished as unique ecosystems with high primary productivity (2009).

BHF's are unique in several ways. These uncommon ecosystems feature a wide variety of vegetation and animal species as a result of nutrient rich soils (Ober, 2009). The EPA reported that the three common tree taxa found in BHF's are gum, oak, and cypress (2012). Nonetheless, the unique mixture of moist and carbon saturated soils allows for a diverse assemblage of vegetation to thrive (Ober, 2009). Trees in BHF's tend to be structurally different from trees growing in other types of forests. Seasonal flooding causes erosion at the base of the trees, exposing root structures

(Environmental Protection Agency, 2012). Eventually, the trees fan out and become wider at the base of the trunk. Exposed and complex root structures create a heterogeneous habitat with multiple microhabitats for wildlife to utilize (Ober, 2009).

BHFs are home to various types of wildlife. Assuming that the Olentangy River BHF is similar to other BHFs, it contains a diverse assemblage of both flora and fauna (Ober, 2009). However, visitors to this particular ecosystem typically see only a few dominant species such as groundhogs, deer, or squirrels (personal observation). This could be caused by nearby suburban developments and the limited connectivity of the Wetlands to additional wooded areas (Alberti, 2005). Nonetheless, vegetation biodiversity should be both promoted and maintained in the OSU BHF in order to support wildlife. For example, the Lower Mississippi Valley Joint Venture found that wildlife populations are most healthy in diverse, multi-species tree stands due to a greater variety of food and increased habitat heterogeneity (2011). BHFs are also home to many other common species such as the white-tailed deer, the Ohio state animal (McCoy, n.d.). These ecosystems also contain squirrels, rabbits, and groundhogs. The Olentangy BHF is home to many aesthetically pleasing species of small mammals and rodents. BHFs serve as habitat corridors, food sources, and protection for the diverse wildlife they contain (Natural Resource Enterprises, 2011).

BHFs used to span across nearly 30 million acres of North American land. Much of this land was in the Southeastern United States. To this day, approximately forty percent of original BHFs still exist. This decline can be attributed to many factors. The largest factor causing the decline of BHFs is the conversion of forested land to farmland for agricultural use (Environmental Protection Agency, 2012). The various ecosystem functions, noted by Ober, are beneficial to the surrounding ecosystems, wildlife, and humans (2009). For example, water and contaminant buffering helps to mitigate pollution to aquatic systems, and is therefore important in promoting biodiversity (Environmental Protection Agency, 2009). This background information suggests the importance of BHFs and why we believe the public should learn more about these distinct ecosystems. The majority of the public does not know much about BHFs (Ober, 2009). Therefore, the preservation of the remaining forests is important. With the OSU

Wetlands and BHF very close to campus, the public has the opportunity to protect and learn about such a unique and valuable ecosystem.

Current Use and Management

The current state of the Olentangy BHF encompasses a sharp deviation from a natural, untouched forest condition (personal observation). The forest is underappreciated, and to a certain level, abused. Informal inquiries of OSU faculty and students lead us to conclude that most of the public and the majority of students aren't aware of its existence. Nonetheless, the Olentangy BHF is located next to the bike trail and as a result, has the potential to draw in recreational bike trail users and wetlands users. The forest floor has suffered from improper user interaction: vegetation trampling can decrease vegetation cover and increase erosion (Sun & Liddle, 1993). Currently, there is an unorganized network of user-made trails spanning the forest floor. These trails are very ambiguous; there is no signage and they lack managerial designation. The BHF has also been overrun with poison ivy and honeysuckle, influencing biotic assemblages and posing a hazard to human health. Lynn McCready, Ohio State Research Associate and Interim Director of the OSU Wetlands, indicates that the northern section of the Olentangy BHF was previously cleared of invasive species and is now in a much healthier state, demonstrating the positive effects of management intervention (Lynn McCready, personal communication, 2013). Constructing well-mapped trails with corresponding signage will not only increase public awareness and knowledge, but also will also prevent people from venturing into sensitive areas of the ecosystem and further degrading the forest floor.

Our Proposal

Sustainability involves methods that do not completely use up or destroy natural resources. The Merriam-Webster definition specifies that this approach involves using a resource so that it is not depleted or permanently damaged (2013). Our proposal is to construct a sustainable and resilient trail through The Ohio State University's BHF at the Wilma H. Schiermeier Olentangy River Wetland Research Park.

There are many elements in need of consideration while constructing a trail. The most critical factor is environmental impact. The future trail should have as little impact to the ecosystem as possible. The most efficient way to minimize impact is to accurately and precisely plan, design, construct, and maintain the trail. Soft trails use the current site materials or low impact materials such as gravel to create the trail substrate. Using soft trail materials prevents the effects of asphalt and concrete on the ecosystem. A sustainable trail requires less rerouting and minimal long-term maintenance. Trails of this nature accommodate the existing ecosystem and minimize harm to plants and wildlife (Havel, 2009). It is important to maintain and promote biodiversity while constructing the trail; habitat loss and degradation are one of the leading causes of global biodiversity decline. As a result, it is essential to plan landscape and habitat management efforts with conservation in mind (Ahern, Leduc, & Lee, 2006).

There are many reasons why we care about the current state of the Olentangy BHF. As of now, the user made trails are ineffectively used and damaging to the environment. Constructing a trail would reduce negative environmental impacts and increase recreational and educational opportunities. The future trail will help enhance Ohio State's image as an environmentally friendly campus. With the help of campus groups such as Students for a Sustainable Campus and The Parks and Recreation Club, this trail could potentially draw in new students who are interested in being part of the sustainability movement. The trail will encourage student groups to visit and learn more about the work being done at the Wetlands, the sustainable nature of our trail, and BHF's through tours and possible educational signage.

Trail Use and Benefits

Trails provide access to natural and scenic areas, which gives a community the opportunity to explore their local ecosystems. They promote health and fitness, relaxation, family togetherness, and environmental awareness (Moore & Ross, 1998). The proposed trail will allow for casual hiking and birding in the Olentangy BHF, and offer educational opportunities for the local community. These uses increase the value of the Wetlands to the general public.

The trail will provide an opportunity for residents to use the BHF for exercise and personal health. According to *Trails and Recreational Greenways: Corridors of Benefits*, "Walking for pleasure is our nation's most popular outdoor recreation activity. Free time is often fragmented, making long trips more difficult; an accelerated pace of life makes opportunities for frequent outdoor escapes on our own terms more important than ever" (Moore & Ross, 1998). Creating a walking trail through the BHF will encourage the community to become active and explore the urban green space provided by the Wetlands. The Texas Department of Health recommends more facilities use trails to help community residents reach a goal of walking five days a week (2013). Access to green space in urban areas offers a safe and inexpensive means to exercise, giving the public the opportunity to increase physical activity and lower the risk of chronic health conditions (Rails to Trails Conservancy, 2013).

In addition to the personal health benefits it would provide, the BHF trail offers other opportunities to the community. The new trail would allow for hikers, birders, and other naturalists to explore and appreciate the BHF. It provides access for visitors to interact with the natural world in an urban setting, which improves the public health well-being of the whole community (Rails to Trails, 2013). The trail will also improve the quality and character of the Columbus community. Trails provide friendly places to meet and socialize with neighbors and are often a source of neighborhood, community, and regional pride (Moore & Ross, 1998).

Implementing signs once the trail is built will provide additional educational opportunities at the Olentangy BHF. Proper signage allows managers to effectively educate visitors on the ecology and conservation of BHF's. Signage throughout the trail would provide descriptions of wildlife, vegetation, trail sustainability, and locations within the Olentangy BHF. These educational tools would be ideal for field trips for grade school students to learn about BHF ecosystems and to become more environmentally conscious. Bulletin boards located at the entrances of the trail can be used for ongoing communication of community activities promoting sustainability and wellness. Using signs would the Wetland's message of environmental sustainability and conservation bring to the public.

While the trail will provide additional opportunities for recreation and education, it will also improve the health of the BHF ecosystem. By establishing a single, formal trail to follow, the proposed trail would minimize the creation of user-made paths through the BHF. Concentrating the human impacts to a single location allows the ecosystem to become healthier by reducing the degradation of the forest floor. With a trail spanning the Olentangy BHF, managers are more effectively able to access and remove invasive species, and work to restore the BHF to a more natural state.

Trail Construction and Cost

The most popular trails in high use areas that are inundated with water are usually elevated trails (Steinholtz et al., 2007, p. 34). As shown by the hydrograph in Figure 1, the Olentangy BHF's water level varies, rising upwards of eight feet on occasion. If the management officials want to allow access during periods of flooding, the construction of boardwalks or other elevated walkways is a valid option. According to McCready, boardwalks are not a desired option for the Olentangy BHF due to the Olentangy River dams posing a danger during periods of high water levels. McCready believes that boardwalks will give the public access to hazardous areas, such as the dams, during dangerous conditions, such as periods of high flow, so we rejected boardwalks as a possible trail type.

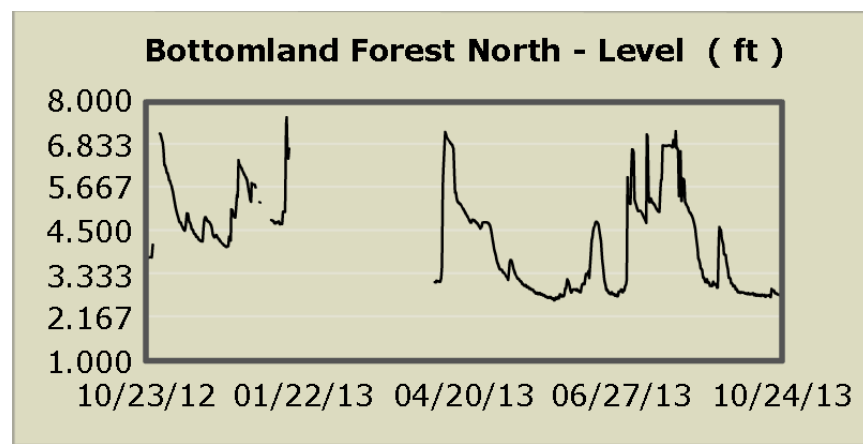


Figure 1-Hydrograph of the Olentangy Bottomland Hardwood Forest
Source: Lynn McCready

After researching the various other types of trail surfaces, we chose to focus on creating a low-impact trail that was both inexpensive and long-lasting. Instead of our initial idea, boardwalks, Lynn McCreedy would prefer gravel. In addition to being safer than boardwalks, gravel trails have many other benefits as well. Gravel serves as a permeable surface and will create less runoff than systems with impervious surfaces. Additionally, the size of the gravel and the design of the trail will prevent trail erosion, which will be discussed in the following section. Lining the trail with fallen tree logs will help keep the gravel in place, further dampening environmental impacts. The natural look of gravel trails also makes them more aesthetically pleasing than boardwalks or elevated trails.

Construction Process

Before the trail can be built, it must be mapped out using GIS software. We have provided a rough map in Figure 2 showing where we would like the trail to go using Google Earth. According to Google Earth, our proposed trail is approximately 2,373 ft. in length, and with a variation in elevation of only ten feet across the entire trail. This remains well within the guidelines of the U.S. Forest Service's *Trail Construction and Maintenance Handbook*, which recommends that an average grade for a trail not exceed ten percent (2007). Ideally, the trail will follow the length of the Olentangy River and have two entrances at either end of the bike path. Having two entrances will provide easy access to the BHF trail from the north and south sides of the Wetlands. We chose a linear trail rather than a looped trail because of the relatively narrow space available in the BHF. The trail we have mapped will approach the banks of the Olentangy River about midway between the two entrances. This will provide for access to the location of a fishing area to potentially be developed in the future. In addition to taking into account a new fishing site, we wanted to establish a length of the trail that would be in sight of the river in order to create a scenic trail system with an aesthetically pleasing landscape.



Figure 2- Projected Trail
Source: Google Earth

Tim Brugeman, landscape architect and retired park district manager of Hancock County, Ohio, gave insight into what materials are generally required to build a gravel trail. Brugeman suggested starting with larger rocks to stabilize the base of the trail. These rocks are known as river rock and can range from two to three inches in diameter. After the base has been established, the trail should be covered with about two to three inches of size 57 gravel. Size 57 gravel is about $\frac{3}{4}$ to one inch. Size 57 and P gravel are the two main gravel types used for walking trails (T. Brugeman, personal communication, 2013). Size 57 gravel will better suit the purposes of the Olentangy BHF trail because the stones are large enough that they will stay in place during flood events. P gravel, on the other hand, has a tendency to erode due to it being smaller than size 57 gravel. Fallen tree logs from around the BHF can also line the trail to keep

the gravel in place and persuade people to stay on the trail. Building a crown, or a slight elevation in the center of the trail, will allow for rainwater to be drained from the trail so that it is not inundated with water. After the trail materials have been laid down, a compacter will be used to set the gravel. This step ensures the gravel will stay in place during floods and visitor use. Because the purpose of this trail is for more casual recreation than the current bike path, we want to prevent bikers from using the trail. This can be accomplished by installing a dividing post in the middle of the trail entrances as well as signage indicating that no bikes are allowed.

Cost

Costs associated with the construction of a new trail are difficult to generalize due to the extent of variables that are involved. According to Jones Topsoil in Columbus, size 57 gravel costs around \$30 per ton while large rock used as the trail base is cheaper at \$20 per ton. Total cost depends on the length of the trail: longer trails require more resources and cost more. Based on a trail that is 0.5 miles long and four feet wide, the cost would be between \$3,500 and \$4,500, not including labor.

Once definite plans are set, companies are willing to provide a price quota for labor costs. To help negate some of the costs for labor, volunteer groups can help clear area for the trail at no cost. These volunteer groups can help clear vegetation and remove invasive species such as garlic mustard and honeysuckle. Local organizations and Ohio State student groups that may be interested in helping are Friends of the Lower Olentangy Watershed (FLOW), Students for a Sustainable Campus, and the Parks and Recreation Club. These groups have previously had volunteer outings at the Wetlands and would possibly be interested in helping again. This would help with costs for general labor and only require hiring people with special skills and expertise. In addition, these groups could continue to maintain the trail. Keeping vegetation at bay would encompass most of the work after completion, something that can easily be handled by volunteers. Whole Foods, a sustainable grocery store that has held outings in the Wetland Research Park previously, might also be interested to help again to improve the forest ecosystem.

There are many resources of local funding to help pay for the construction and maintenance of the trail. To start, the Wetlands facility has money set aside that will help put the project into motion. Lynn McCready informed us there may be additional funding available from the City of Columbus, Metro Parks, the Sierra Club, FLOW, and Franklin Soil and Water Conservation District. Once the Wetlands Advisory Committee approves the trail, these organizations could be contacted to gauge support. Moreover, the Ohio Environmental Education Fund gives out grants for educational trails such as the one proposed.

Discussion

There are several potential arguments that project planners must consider and respond to in regards to the creation of hiking trails in the Olentangy BHF. First, one might argue that establishing trails will negatively affect the natural systems and equilibrium in the forest. Clearing vegetation to create the trail will certainly harm the ecosystem to some extent. There will also be an increase in human traffic and greater potential for littering in the area. Although these arguments are valid, proceeding with the project will still bring benefits to the environment that outweigh the costs. By creating a defined trail, there will immediately be less trampling and degradation of the forest floor, assuming visitors follow the established trail instead of making their own paths. Furthermore, the recommended trail type is low impact permeable gravel—this will not wash away easily during flooding events.

Some skeptics might view trail construction in the Olentangy BHF as a waste of time since there is already the Olentangy River Bike Trail running next to the forest. However, the Olentangy River Bike Trail is used mostly by bikers and joggers. Currently, there is no established place to hike. This new trail will promote more quiet, secluded recreation and education. Also, it is hard to fully appreciate the intrinsic value of the forest just by walking along the side of it. To really appreciate the BHF, we feel that one must explore inside of it. This task is difficult for some, such as the elderly and families, without a recognizable hiking trail. To make sure the trail is used effectively, or used in the way project planners intend it to be used, signs will be installed that inform users to stay on the path and to refrain from bike use while enjoying the trail. The trail

will offer additional opportunities that the Olentangy River Bike Trail does not offer. Educational signs that the Wetlands could construct after the implementation of our trail will inform users of the types of trees, birds, and attributes that are characteristic of BHF's. These signs could also stress environmental awareness and offer a brief discussion of the importance of conservation.

Many will also argue that this money could be better spent elsewhere. For example, it might make more sense for the OSU Wetlands decision makers to decide to expand upon and improve the facilities that have already been established, such as the main building or the Wetlands ecosystem. However, we believe that in the long run, having trails in the BHF will generate more traffic to the OSU Wetlands because of additional recreation and educational opportunities. With increased traffic comes a greater sense of awareness, and perhaps additional donations. BHF's are becoming increasingly rare as humans develop new land. Therefore, if publicized enough, a trail that creates access to this important natural area will influence researchers and students to visit the Wetlands more often. The trail will also create additional activities at the Wetlands, supporting visitor enjoyment and group outings.

Future Work

Once the proposed trail has been approved, the next step to constructing the trail is to actively seek funding from the Wetlands facility, the City of Columbus, and other donors. The contractors and distributors previously mentioned will need to be contacted to get a general idea of the timeline and possibility of constructing a trail in the Olentangy BHF. Project planners will also need to find an organization or company that can survey the study area using geographic information systems and software to determine the path the trail should follow. Many local landscape companies were not willing to do trail construction; managers will need to contact companies, perhaps those outside the city or state, to find a contractor willing to work on the trail. After construction, the overall success of this hiking trail will depend on how well the trail is promoted and how effectively the educational components are incorporated. We suggest the Wetlands managers distribute flyers around campus and host a ribbon-cutting ceremony and wellness events in order to boost awareness of the Olentangy

BHF trail. Once it is well established, the trail will offer many future opportunities for development, including fishing areas along the Olentangy River that would provide more public use of the trail. Managers will need to get in contact with student and community groups to request long-term voluntary maintenance of the trail. All of these factors will ensure that the trail project is successful from the start and into the foreseeable future.

Conclusion

The current use of the Olentangy BHF is both ineffective through the lack of designated trails and environmentally damaging due to vegetation trampling by visitors. Our proposed trail would allow access to this neglected piece of the Wetlands, providing the local community with a new source of recreational and educational opportunities. Constructing a low-cost, low-impact gravel trail through this ecosystem will provide more green space for the public while mitigating much of the human impacts on the BHF ecosystem. The trail construction and project in general will provide a framework for other ecosystem managers who are striving to promote sustainability and conservation. Overall, the creation of a walking trail through the Olentangy BHF would benefit the ecosystem, the research park, and the general public.

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