The Ohio State University
Campus as a Living Laboratory

Creating the Infrastructure for a Living Laboratory at the Miller Ecological Park and Other Preparations

Travis Copeland, Rachael Dininger, Alissa Finke, Courtney Fisher, Monica Sheakley

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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

The Miller Ecological Park (MEP) has worked with previous Ohio State University students to come up with action plans for restoring their wet prairies and vernal pools. In order to create a new proposal for the MEP, we focused on utilizing these natural areas as a resource in order to create a Living Lab for local children to use through educational classes and extracurricular activities such as Boy/Girl Scouts. We aim to get children out of repetitive classrooms and into a fun, natural learning environment. With this specific goal in mind, we discuss the various steps the MEP will need to take in order to create a Living Lab. The steps needed before the creation of a Living Lab are outlined in an appendix we provide at the end of this paper. A Living Lab is defined as having four main goals: co-creation, exploration, experimentation, and evaluation. However, within our recommendations, we neglect experimentation and evaluation for co-creation and exploration because we believe these allow the schools to easily adapt their curriculums to include the MEP. This unique Living Lab, tailored to the MEP's needs, can be described as an interactive trail with hands-on exhibit that allows participants to think critically about their environment. We explore some interactive educational activities that could be utilized with the Living Lab as well as physical changes to infrastructure that are necessary to develop the Living Lab. Signage is looked at in detail and considered a crucial part of our discussion as signs serve as the vector for the educational content within the Living Lab's interactive trail. Many instructors at the local schools who teach science have not been formally educated as science teachers, so signage will help guide tours. By creating a Living Lab that allows children to interact in an educational way with their environment, we hope to fight current phenomena such as Nature Deficit Disorder and the sedentary lifestyle associated with the modern technological age.

Introduction

With the advance of technology, American children are gradually becoming disconnected from nature. There has been a decline over the years in outdoor education as schools become more restrictive about the use of class time (Sanders, 2004). We are seeking to combat this problem in Lebanon, OH, by utilizing the natural capabilities of the Miller Ecological Park.

Our goal is for local children to connect with nature through learning opportunities in the fields of biology, ecology, and general life sciences. To do this, we are focusing on the planned addition of a Living Laboratory to the property that can be used by local schools and Boy/Girl Scout troops. This Living Laboratory will consist of an interactive trail that connects the Bowman Primary Elementary School to a restored prairie and wetlands at the southeastern corner of the MEP (Figure 1). Along this trail, we propose signs should be present to provide information on significant features within the landscapes as well as guide and direct visitors.

We will also be suggesting infrastructure additions to supplement the educational experiences of local children. Specifics regarding the suggested infrastructure is explained in detail in a later section. Ideally, our aim is to provide resources that fit into the existing curriculums of local schools. With these additions, students would be able to connect with nature with the added benefit of learning about science through experience. We recommend this infrastructure be implemented within the framework of the prairie and vernal pools at the MEP so that existing ecosystems can be utilized. The Living Lab will be a project to be undertaken in the future, once the prairie and wetland areas are restored. This time scale is necessary to have the Living Lab meet its full potential. This method will be cost-efficient because it will capitalize on the park's natural state without requiring an unnecessary amount of land changes and will allow for full functionality of the Living Lab.

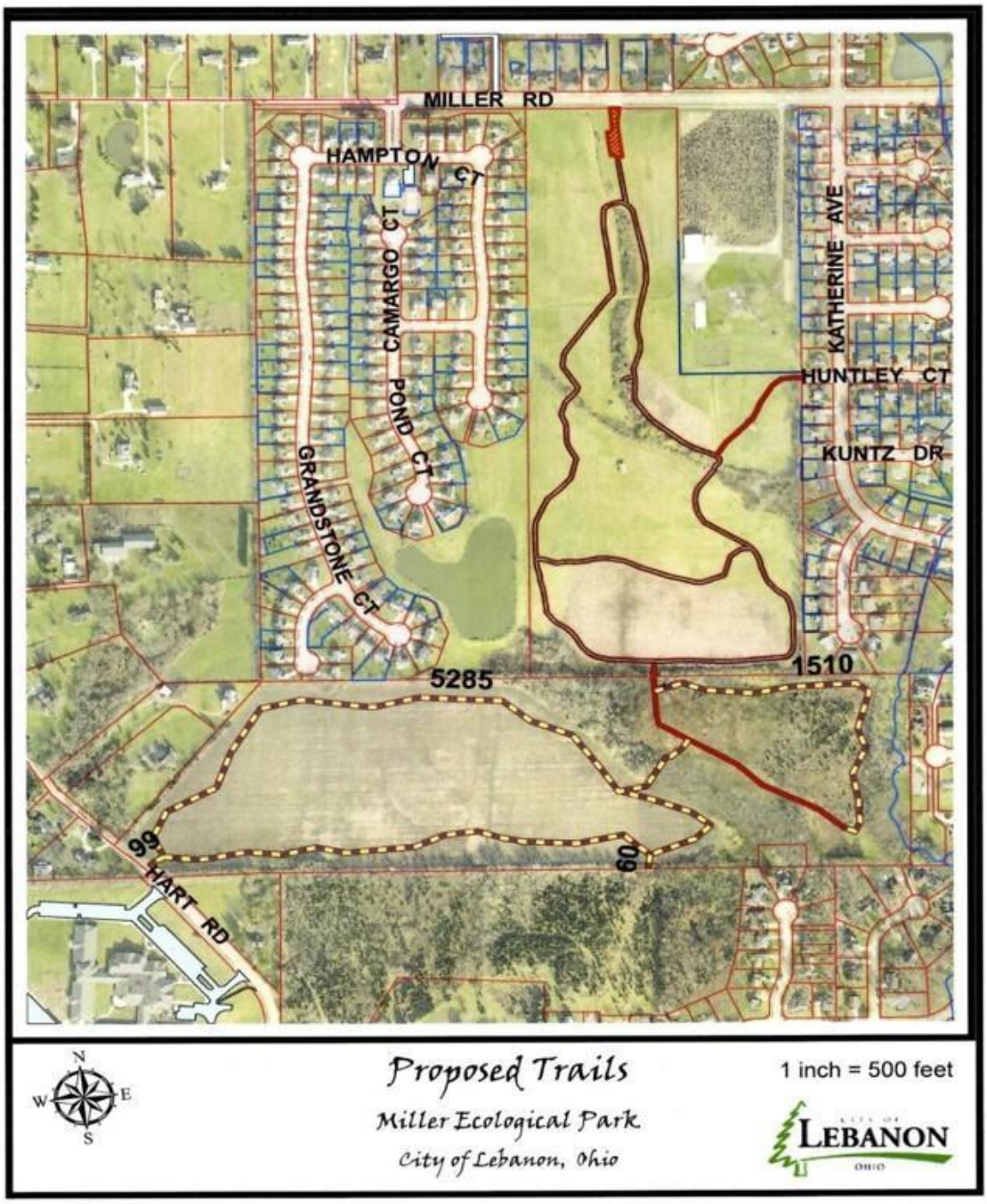

Figure 1 Proposed trail (highlighted in yellow) for the Living Lab at the MEP (Image from Tim Huitger)

History

The Will and Harriet Miller Ecological Park (MEP) is a 92-acre city park located in southwestern Ohio, in the town of Lebanon. The park, which was previously farmland, was sold to the city of Lebanon in 1993 by Edwin and Margaret Miller. In 2008, the decision was made to use the land as an ecological park and funding to launch the project was secured in 2009 by the Warren County Foundation. The mission of the MEP is to "perpetuate a legacy of environmental stewardship" through community outreach and educational programs. The MEP is divided into two main parts: a passive recreation area and a preservation area. Each section accounts for roughly half of the land owned by the MEP. Included throughout these areas are prairies and wetlands which support a diverse population of wildlife (Huitger, T. Personal Communication. October, 2014).

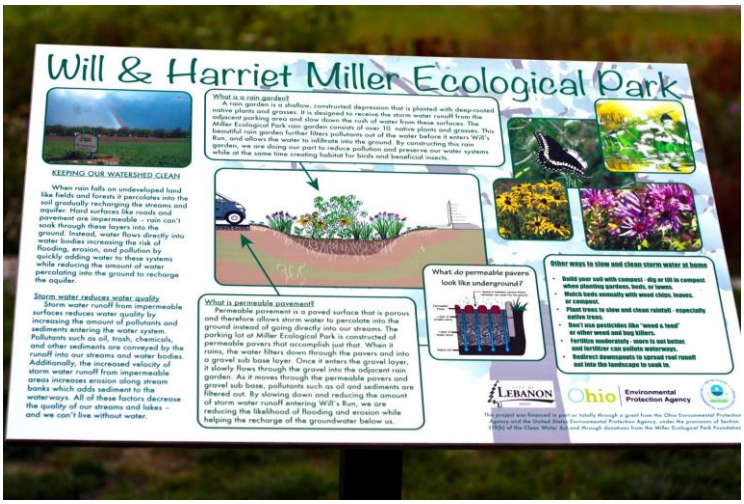

Figure 2 Existing Sign at main entrance of the MEP (Image from Monica Sheakley, 2014)

In the thirty years prior to the land's acquisition by the city of Lebanon, it was cultivated by a single farmer who reported no major issues with pests or diseases (Bakus, Nauman, Palus, Rucker, & Stewart, 2013). In 2013 he reported that, while he owned the land, there were no apparent issues with soil erosion, ponding, or waterlogging. The area was used to grow corn, soybeans, and wheat. The farmer also asserted that he practiced no-till methods for the last five years he farmed and that it had not been heavily plowed since 1986. However, the use of powerful herbicides during this time period has led to caution in considering the possible carryover of chemicals in the soil.

In recent years, The Ohio State University has been involved with the park, specifically the School of Environment and Natural Resources. Currently, the prairie area at the MEP is undergoing restoration based on the recommendations made by an Ohio State research group in 2013 (Bakus et al., 2013). While in preliminary stages, the park also received similar help with

managing the small vernal pool areas (Anderson, Duplain, Goldberg, Schick, & Swanzer, 2013). The land was considered ideal for prairie restoration and, although the process is not expected to be complete for several years, several prairie plants have already started returning, signifying early success. A full soil survey was completed in 2013 and thirty acres were designated for prairie restoration.

In addition to The Ohio State University, the Miller Ecological Park has been privileged to work with other organizations. The most notable of these, the Boy/Girl Scouts of America, who have used the park to their educational advantage. One of the most noticeable ways these groups have participated with the MEP can be seen in the various bird nesting boxes that the Girl Scouts constructed and placed around the interior of the park (Figure 3). For a particular Eagle Scout project, one scout built an observation shed overlooking an entire area of nesting boxes. Other projects lending to a natural play area have been constructed by these groups around the north end of the property (Huitger, personal communications, October 2014)

Figure 3 MEP Bird Box (Image from Monica Sheakley, 2014)

What is a Living Laboratory?

The official definition of a Living Lab is "a real-life test and experimentation environment where users and producers co-create innovations." Living Labs have been characterized by the European Commission as Public-Private-People Partnerships (PPPP) for "user-driven innovation" (Open Living Labs, 2006). The four main goals of a Living Lab are co-creation, exploration, experimentation, and evaluation. This means that to be a Living Lab, a site should allow for users to learn through experiences with the natural area by having the freedom to access different parts and experiment in a real-life setting. Participants can then evaluate observations and results on their own.

The Ohio State University has implemented their own "Campus as a Living Laboratory" for the benefit of students. The project is continually updated as student-proposed projects are

considered yearly and occasionally implemented. An existing example is a botanical garden on Ohio State University's west campus, where a wide variety of flora exist along walkable pathways. These plants are all labeled and create a learning experience by simply walking through the area. Other projects under consideration include the use of green-buildings on campus (Pore, Igoe, & Valentino, 2014) and plans for urban agriculture (McKinley, Weller, 2014). These important real-life examples show exactly how The Ohio State University is familiar with the concept of Living Labs and is able to fully implement them. This is important to note because Living Labs are a relatively new concept; by seeing real life examples, we are able to synthesize certain expectations and goals of these projects into something functional for the Miller Ecological Park.

In our interpretation of a Living Lab, we will be focusing on certain aspects while intentionally neglecting others. While we believe co-creation and exploration are essential for the Miller Ecological Park, we have determined a necessary shift away from research and evaluation. These elements, while traditionally important, simply do not fit into the scope of use for the intended demographic. This is based on age, as our intended audience for the Living Lab will be young children, mainly in the age range of 5-14. The proximity of the park to local schools and the current involvement of Girl and Boy Scouts of America make this demographic the most realistic to consider in designing the lab.

While we will admittedly be neglecting elements of research and evaluation, these will be feasible possibilities in the future. All additions made to the park will be designed with the intention of keeping them open for future expansion. The goal in neglecting these aspects initially is to get plans in motion for quicker use by the local schools and to allow for a solid foundation for the future of the Living Lab to grow and expand upon.

Why A Living Laboratory?

In order for a Living Lab to be relevant to the issues in society, we must first look at these issues and identify what needs to be addressed. As stated before, children are finding their time outside shrinking while structured activities are becoming the norm indoors. We, the authors, are all on our way towards graduating with degrees in some sector of environmental science. Why? We were all exposed at one point in our childhood to favorable memories made outside.

We can conclude, based on experience alone, that exposure to nature provides children with environmental values. Mental and physical health can also be affected through exposure to nature. Obviously, it is healthier to run around outside than sit indoors in a stasis in front of the television. Thus, incorporating environmental education and instilling a healthy love of the outdoors is important in modern curriculums. Living Laboratories are one of the most effective ways to bring nature and children together. The various interactive activities stimulate an interest within children, effectively allowing them to learn about the world in a way that they would not be able to within a traditional classroom setting. Additionally, our Living Lab will be built within the constructs of the natural ecology of the MEP. These natural surroundings allow participants to learn more about the area in which they live and develop an appreciation for their local environments. A Living Lab at the MEP would then be beneficial for the local community because as children develop an appreciation for the town they live in, they will grow up and be able to instill these values in future generations and perhaps even spread their enthusiasm to their parents or other family members.

Although Living Laboratories are a relatively new concept, there are several effective Living Laboratories in existence found within the United States and internationally. These provide insight into the great potential of Living Laboratories, and show how versatile they can be. The existence of other Living Labs suggests that there is enough interest amongst the people to sustain the labs and ensure their maintenance. These pre-existing Living Laboratories also provide some ideas about the different programs that could be possible for the Miller Ecological Park.

Within the United States, there are currently multiple functional Living Laboratories established which the Miller Ecological Park could reference in going forth with the creation of their own interactive learning lab space. One of these parks is River Legacy Park, an ecological park in Arlington, Texas. At River Legacy Park, programs exist that enable educators to visit the park with students. The students are able to participate in a wide variety of activities, from nature hikes to scavenger hunts. They offer different levels of programs for varying age groups, enabling the park to be useful at multiple developmental levels. In addition to their school programs, they also offer activities and classes that are open to the general public (River Legacy Park, 2013).

When looking at all aspects of pre-existing Living Laboratories, one factor remains the same: all of the Living Laboratories built were formed in spaces that were naturally suited for their themes. This holds true for the Miller Ecological Park. With pre-existing vernal pools, significant acreage, a rain garden, a prairie habitat and a newly acquired field space, it is the perfect template for an environmental Living Laboratory. It is also conveniently located within walking distance of two local schools, making it an ideal field trip for the students.

Although we chose not to highlight the community aspects of the Miller Ecological Park Living Laboratory, the general community could benefit greatly from its existence as well. Many of the programs offered to the schools could also be given to public groups as well once the learning lab is established.

As environmentally passionate students, our research group took interest in having a positive effect in the lives of young minds by taking the classroom outside. The MEP presents the perfect opportunity to promote sustainability within the local community through the relationship the MEP has with the local school district. A Living Laboratory will bridge the gap between visiting nature and creating a positive emotional and educational connection to the native environment. This project is a positive step in the right direction for sustainability by focusing on environmental education for young generations

Adapting the Living Lab to a Set Curriculum

Though it may seem to be common knowledge that children are leading more sedentary lifestyles, it is always useful to provide adequate research. According to "Why Environment Education is Important," most kids are spending their free time watching television and playing with electronics (Project Learning Tree, 2010). Constructing a Living Lab at the MEP could help alleviate this modern epidemic present in the community.

We understand, through correspondence with local schools, that the curriculums of visiting students follow the National Geographic Guidelines. We are not aiming to change the curriculums of visiting classes, rather we are looking to adapt lessons from a natural environment into their set lesson plans. We feel, in addition to exposing children to nature, a Living Lab would help children learn about the environment, biology and other life sciences. Hands on activities are recommended to help children fully connect with nature and would be able to easily

fit within any curriculum. Simple activities such as leaf tracings are easy ways to engage kids in an artistic manner, while identifying and naming leaves that they found can help them think critically and gain a better understanding of the environment around them. Activities such as these also allow children to get out of the classroom and have more fun, as they are not confined to a space which they associate with forced learning. Children will also be able to take home physical reminders of their trip to have fun souvenirs to remind them of their time outdoors. Through the sources located in the Appendix, we offer a few different resources for teachers to consult when they are creating lessons to incorporate the MEP's future Living Lab. These different worksheets and activities are able to be adjusted for grade levels and can encompass a wide variety of visiting groups. This means lesson plans can easily be tailored to different levels of learning as well as different subjects based on curriculums.

Hands-on experience is another critical part of learning for early childhood. American education is highly dependent on auditory and visual learning; hands-on and tactile learners often find themselves at a loss in the classroom. An outdoor environment would provide these hands-on learners lessons in their comfort zones and may find their love of learning (previously exhausted from lesson plans aimed towards audio-visual learners) rekindled by experiences they can fully absorb. In an email from Carrie Vaughan, an elementary school teacher at a nearby school, she states that future sessions at the MEP cannot exceed 49 minutes if they are not visiting for a full-day field trip. Since time constraints are an issue, the lesson plans we are providing have estimates of completion times. These can be modified as needed by teachers or used as they are. It is important to note that these are merely suggestions we are offering to enhance the ease of transitioning lessons from the classroom to outside at the MEP's Living Lab. We only intend to guide the process of creating curriculum-based lessons rather than create them ourselves.

Figure 4 Example of a recycling bin from Free Green can (Image from Free Green Can, 2009)

Physical Changes for the Living Lab

In addition to tailoring lessons to fit the MEP, we also recommend some physical changes. One large change we recommend is the addition of recycling and trash bins along the paths present due to increased foot traffic. Adding recycling bins will give

the MEP a more environmentally concerned image, encourage visitors to recycle and possibly even raise awareness of its importance. The use of recycling bins could also be used as an educational opportunity for visiting classes as recycling could be a topic for a short lecture and children could learn what in their lunches could be recycled. When real life examples are provided for children, it will be easier for them to grasp the concept of recycling. One obstacle with recycling and trash bins that may arise deals with the cost of these resources. We have reached out to Free Green Can, a recycling company who places free cans into public places, such as parks, schools, fitness centers, convention centers, etc. Free Green Can, Figure 4, offers a recycling can that also has an attached trash can and is completely free. Should the MEP be unable to come to a decision with their local governing bodies over the placement of trash and recycling bins, Free Green Can could be a valuable asset to the MEP.

Another response to the increased foot traffic we expect would be the inclusion of more toilets at the MEP. During our last visit, we noted only one portable toilet was available for use. Younger kids, some still getting used to going to the restroom, will need bathrooms throughout the park that are easy to access. We give the suggestion that more restrooms should be built or placed throughout Miller Ecological Park, making it more accessible for everyone who visits. Park and Restroom Structures Inc. give cheap and durable suggestions on public restrooms if a more permanent addition than portable toilets are necessary. They give different examples of color, stone, and texture available for permanent toilet fixtures. On their website, there are also different pictures of restrooms you can click on to get information on certain types of restrooms. Park and Restroom Structures Inc. will be a great reference when it is time for more restrooms to be placed throughout Miller Ecological Park.

As well as restrooms and recycling/trash bins, we also recommend an area for children to rest and sit in. The MEP currently has one picnic shelter, though it is located far from the wetland area. In order to allow for full day field trips, we recommend another picnic shelter closer to the wetlands area where the Living Lab will be based. This will allow a solid spot for teachers to keep children in a single area when teaching lessons that do not allow for them to explore the wooded area. Teachers may also find an added picnic area beneficial as a sort of ‘home base’ for their students to gather when they are completing an assignment that allows them to interact with the wetlands systems on their own, or even just as an area to have lunch.

Signage within the Living Lab: A Wayside Exhibit Approach to Interpretive Signage

Another physical change we feel is integral to the creation of a Living Lab at the MEP is the addition of signs. Signage is an integral part of outdoor education, and its benefits run in line with our goals for a Living Lab at the Miller Ecological Park. Using signage as the basic framework of a Living Lab initiates hands-on, interactive learning, while providing direction and structure to a Living Lab platform. Signs are integral to the success of the Living Lab because many of the teachers who will be taking their classes to the MEP are not formally educated as science teachers. These signs will provide them with all the information they need to educate their students and complete the hands-on activities. These signs will be in line with the Lebanon school district science curriculum. This section provides details on how to construct a series of interpretive signs and how to design them, but does not cover the specific content that will be on each sign.

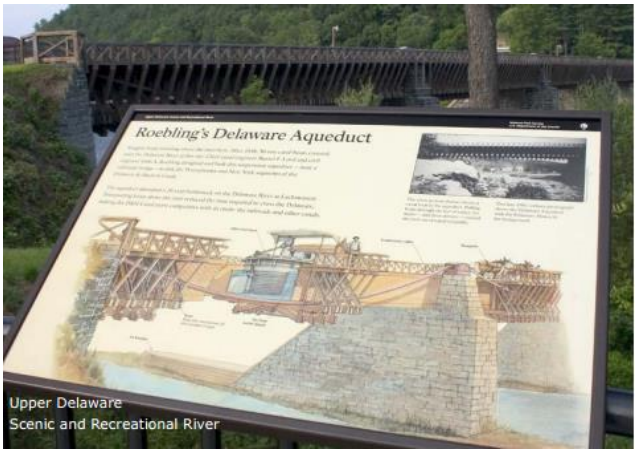

Figure 5 Example of a low-profile Wayside (Image from Harpers Ferry Center, 2009)

Although there are many methods to construct educational signage, we have found the National Park Service's Wayside Exhibits to be the most comprehensive strategy. A wayside exhibit is a series of outdoor interpretive signs that answer questions visitors have exactly when they have them (Harpers Ferry Center, 2014). These signs define areas of importance, provide interpretation of the surrounding areas, and create flow throughout the Living Lab that will simplify and enhance the experience of visitors. This section addresses how to make wayside exhibits effective, the preparation needed to develop and implement waysides, and finally how to tailor the waysides model for the Miller Ecological Park's Living Lab.

Before designing and creating interpretive signage, we must consider the different audiences we will be addressing. Our primary audience is the Steering Committee of the Miller Ecological Park. We want this group to help create a wayside exhibit that is both functional and feasible for the Ecological Park. Our next audience includes the school teachers who will be

using the Living Lab for educational field trips or classes. We want the signage to pertain to their curriculum and enrich their teaching abilities. Our final audience we must consider consists of the students from local schools. It is critical that their age and learning levels be taken into consideration when creating the wayside exhibit. We suggest holding meetings consisting of representatives from the Steering Committee to answer critical questions about sign content and design. This would involve inviting local teachers and Miller Ecological Park coordinators to sit down and discuss their educational needs and how waysides can meet those needs.

Outdoor interpretive exhibits are complicated to design, but if done correctly, they can connect visitors to the landscape in a direct and meaningful way that enhances their experience. Here we will outline a few simple things we need to evaluate before planning of a wayside. Since children will be outside during their educational program, there will be many things to distract them from learning. It is important to have the wayside attract and focus students' attention on the site while not distracting them with the sign itself. This is a balancing act that must take into account several factors we will address shortly. It is also prudent to remember first impressions count. If the first wayside students encounter is unappealing, they may not stop at others. Additionally, the use of temporary panel materials that can be exchanged out as content changes over the year would benefit a wayside in the long-run (Harpers Ferry Center, 2009). Another concern to consider is how to promote inclusion for all, including persons with disabilities, when designing a wayside (Harpers Ferry Center, 2014).

Alongside these subjects to consider, there are four key factors to making a successful wayside according to the National Parks guide to developing wayside exhibits. The first is having a *significant feature*. This means having a feature in the landscape with a well-documented story and/or having a unique story that answers why readers should care. The goal is to have the reader see a connection to the landscape they are looking at within a three second glance. At thirty seconds in front of the sign, visitors should be able to understand and remember the main story, and at three minutes they should have finished reading and retained all of the information on the wayside. In the field of interpretation this is called the

Figure 6 Low-profile Wayside (Image from Harpers Ferry Center, 2009)

3-30-3 Rule. (Eva Rodriguez, personal communication, October 26, 2014). Secondly, there should be site-specific graphics with at least one graphic that illuminates the story behind the wayside and compels readers. One suggestion is to use historic images or illustrations with the wayside positioned in the same perspective as the original photographer. This creates a tangible connection to the landscape. Graphics of cut outs of the landscape (such as soil profiles) also add depth and interest to a site by showing the reader what they may not be able to normally see. The third key factor is to have safe and accessible visitor access to the wayside. In order for our audience to be comfortable and safe while interacting with the wayside and the surrounding environment, there must be adequate space designated for each wayside. This is to ensure people can gather without disturbing the flow of foot or bike traffic. Without this designated space, there could be issues of flow within the trail that goes through the Living Laboratory. We recommend having the waysides either protrude from the main trail or have subsequent trails that diverge to the wayside then back to the main path. The fourth and final key factor to making wayside exhibits successful is to have regular maintenance on each sign. Depending on the material used for waysides, panel materials last 2-25 years (average 5 years) before they need to be replaced. Additionally, it is suggested to have regular scheduled cleanings of signs twice a year, along with general site and trail maintenance to ensure the sign can be viewed safely (Harpers Ferry Center, 2009). If all four of these key factors defined by the National Park Service can be met, then we believe a wayside exhibit will be the best solution for interpretive signage in the Miller Ecological Parks Living Lab.

When focusing on waysides, we come across two types: low-profile exhibits and upright waysides. Low-profile exhibits will be our main focus for the Miller Ecological Park, because they give “site-specific interpretation about features that visitors can readily see” (Harpers Ferry Center, 2009). Each sign’s content will focus on a specific landscape feature within the Miller Ecological Park. We recommend four primary low-profile waysides throughout the Living Lab to ensure that there is meaningful information in each main landscape and that a wide range of educational topics can be covered. Since the Miller Ecological Park has both vernal pool wetland and wet prairie ecosystems, two of the four signs should be designated to highlight these two unique ecosystems. The last two signs can focus on broader topics and may discuss the connectivity of landscapes or succession patterns of the surrounding ecosystem. These four low-

profile waysides should be arranged cohesively with the topics they discuss in the order they appear on the walking trail in the Miller Ecological Park.

The main purpose of a wayside is to quickly and effectively interpret information for a reader and tell a story. In order to enhance what the visitors are experiencing, a wayside should combine a compelling title, graphics, and text design in the interpretation of the story each sign is depicting. This can be done by having primary visuals and bold graphics that together convey the focus and meaning of the wayside. It is beneficial to note that each wayside should visually align with landscape, so that readers focus on the intended features described within the wayside and the signs do not cover up what they are trying to explain. Although waysides are a primary source of information for visitors, they should not be text heavy and should contain appropriate jargon for their audience. According to the National Parks studies of wayside exhibits, the attention span at any given sign is relatively short, only 30-45 seconds on average. This time may be even shorter as an audience lowers in age class (Harpers Ferry Center, 2009). The first sentence is crucial in capturing the reader's attention and should make the reader want to read more. The subject matter may be very complex and therefore the first sentence must layout the subject clearly and without unnecessary detail. The text should also be written in an active voice and answer the question, "so what?" Additionally, the main imagery that is telling the story should be labeled and should explain why features are relevant or of value. The most successful wayside makes only one point that blends harmoniously with the setting.

Considering the guidelines above and the students who will be utilizing this wayside exhibit, we find it most suitable that text within the sign should correspond with fourth through ninth grade reading levels. This is due to the proximity of local schools to Miller Ecological Park, which are the intended primary users of the Living Lab. In order to accommodate these students, the first sentences of a wayside (answering why a reader should care) need to be boldly but simply written for the younger readers who are less likely to read beyond the first few lines.

As the wayside text becomes more in depth, so should the language being used. This will ensure that multiple age groups and learning levels are able to benefit from each wayside. Additionally, to encourage interaction with the landscape and hands-on learning, each wayside should present an activity for readers to engage in. These can be activities such as prompts that read, "Look for me here!" that are accompanied by images and a short description of a particular species. For example, a picture of salamanders could be used for the wetland wayside or

different plant species for the wet prairie wayside. It may also be beneficial for younger audiences to have 3D elements that explain why features are relevant. This engages different learning types and creates more appeal to get involved with the subject matter.

Figure 7 Example of texture in a Wayside (Image from Harpers Ferry Center, 2009)

The next step, after working out the design of each wayside, is to choose panel sizes and decide if removable, non-permanent sections of a wayside should be used. Due to the fact that information is always evolving, we suggest having signs that can be easily updated with school curriculums throughout the years. The size of a panel is based on the graphics used, the written content, and the location of the wayside. It is suggested to use the same panel size throughout a wayside exhibit (Harpers Ferry Center, 2009). Below is list of potential options:

- 42 x 24 - used for high-quality panoramic images
- 36 x 24 - this is the most common size and has room for a large graphic, and fits 75-100 words of main text (recommended for the Miller Ecological Park)
- 24 x 24 - has room for a single simple graphic and about 75 words of mail text and two small captions
- 6 x 12 - is low to the ground and most often used as identification panels for plants or architectural features, and fits about 25 words

Though we recommend mostly low-profile exhibits, the MEP may also be able to utilize another commonly used wayside: upright waysides. An upright wayside is a sign that is usually found near the beginning of trails or at the entrance of a park. An upright wayside informs visitors about the area they are about to enter. In the case of the Miller Ecological Park, this type of signage would represent an area where visitors can gather information about the park itself, such as a map of the trail, the description of the Living Lab area and how to get to it, along with bulletins for upcoming events and park rules. This is a critical component of the wayside exhibit as it will be the main way to direct visitors to the Living Lab and give descriptions about how the Living Lab is used. Unlike low-profile waysides, upright waysides do not direct visitors' attention to specific landscape features. Instead, this signage provides only necessary information

and orientation to show people where they are located and how to get to their next destination (Harpers Ferry Center, 2009). In the Miller Ecological Park's case, additional trail signs or guides may not be needed. The upright wayside should be accessible to pedestrians and located in the front of the park as visitors begin to make their journey on the trails. These signs have large panels (36" wide by 48" high) and are generally grouped with trash and recycling bins. Some upright waysides have small roofs and lighting to make them useful after dark. A proper upright wayside can act as its own small visitor's center that is always on duty (Harpers Ferry Center, 2009). The Miller Ecological Park already contains the foundation of a great main entrance sign, which can be improved by suggestions the National Park Service makes regarding upright waysides.

As great as waysides are, there is such a thing as having too many signs. Having too many waysides creates clutter and overwhelms visitors (Eva Rodriguez, personal communication, October 26, 2014). In order to avoid the stress of developing a wayside exhibit we suggest involving media specialists when making key decisions. One point of contact is the Harpers Ferry Center, who can provide assistance with the planning, design, development and production of media products, etc. (Harpers Ferry Center, 2009). The production phase is usually handled externally through an interpretive media production firm, such as ECOS and Pannier (Eva Rodriguez, personal communication, October 26, 2014). Please refer to the appendix for contact information for references cited throughout this section. Finally, please refer to the National Parks Service, Department of Interior *Wayside Exhibits: A Guide to Developing Outdoor Interpretive Exhibits* for more detailed information regarding development and production of wayside exhibits.

Figure 8 Upright Wayside (Image from Harpers Ferry Center, 2009)

Discussion

In order to implement all of our ideas for a Living Lab at MEP, we must understand that this is a community project and thus it relies heavily on community input. Naturally, we must address concerns that may arise in response to the project. The major concern relates to the impacts our Living Lab may have on the environment. Since hands-on activities are suggested, the MEP must account for visitors (mainly children) running amok in the wetland areas. This will be controlled by the designated hands-on areas. We believe that there is no way to provide an immersive environment for children without including hands-on areas, but by limiting these areas to specific patches within the wetlands we will be able to lessen the environmental impacts. Our project also assumes that previous steps have been taken to include boardwalks or other non-intrusive paths that will reduce the wandering of visitors into undisturbed areas. Other concerns are not as immediate, but may need to be kept in mind and worked out with the community. One such concern may be the issue of allotting time necessary within school curriculums to allow for classes at or field trips to the MEP.

In addressing these criticisms, we may also look at other benefits of creating a Living Lab at the MEP. Children are currently facing a phenomenon known as "Nature Deficit Disorder," which hypothesizes that a decrease in time children spend outdoors is linked to a wide range of developmental disorders (Louv, 2008). While this disorder is not a medically identifiable one, it is hypothesized that it may lead to higher rates of recognized disorders such as ADD, ADHD and depression. Although NDD is not an official disorder, various other studies have linked outdoor play and learning to increased cognitive functions (Wells, 2000) and reducing symptoms of ADHD (Kuo & Taylor, 2004). Nature Deficit Disorder, according to Louv, is primarily caused by urbanization and parents not allowing children to play outdoors for fear of dangerous situations. These two causes can be overcome if we create a Living Lab at the MEP. Children will be able to get out of the indoor school environment and have a safe, supervised area where they are able to enrich their experience with nature. This also takes pressures off of families that may find it hard to send their child outdoors to play should they live in an unsafe neighborhood or be unable to provide enough supervision for outdoor play.

We understand that this is a large undertaking that requires steps not included in this draft of our Living Lab proposal. To address this, we have created a table in the appendix that will

provide the MEP with the resources necessary to carry out these crucial steps before beginning work on this proposed Living Lab. The table is structured in a time-oriented manner. Steps that will need to be taken before and after the implementation of the Living Lab are labeled as such. These are only stepping stones to the final products the MEP can create, and we urge the MEP to look further into available media and sources that outline the procedures we recommend.

Conclusion

We believe a Living Lab at the Miller Ecological Park is the best solution to help fulfill the Miller Ecological Park's desire to connect local students to the park through interactive outdoor education. Under our definition of a Living Lab, the MEP will be able to incorporate co-creation and exploration in field trips for the students. This basic structure of the Living Lab that we suggest will serve as a strong foundation for any future educational programs the Miller Ecological Park might plan to implement. A Living Lab would help alleviate current issues such as Nature Deficit Disorder and allow children to have a healthier, more active educational area where tactile learners will finally be able to shine.

We are firm believers that with our recommendations, the Miller Ecological Park will be prepared to take the next step in outreach and expansion. By implementing our simple suggestions, such as signage and other physical additions, a hands-on learning experience will be created for the students that will be unrivaled in the area. We look forward to witnessing the progress and accomplishments of the park in the near future.

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Appendix

Stage	*Resource Name and Description*	*Contact Information*
Before Focusing on the Living Lab: Resources for Phase I		
Restoring the Wetlands	*MAD Scientist Wetland Restoration*: This program is an ecological and wetland consulting firm. From their site: "MAD provides quality wetland and ecological consulting to clients in the public and private sectors. Clients include engineering and environmental consulting firms, universities, park districts, industries and municipal governments. Clients have come to rely on MAD Scientist & Associates for full wetland services (delineation, permitting, mitigation and monitoring), stream characterizations and aquatic studies, ecological risk assessments, botanical surveys, threatened and endangered species and critical habitat surveys and other specialized ecological services."	http://www.environmentalconsultingohio.com/wetlandexperts.php 253 N. State Street Suite 101 Westerville, OH 43081 Phone: (614) 818-9156 Fax: (614) 818-9157 Mark A. Dilley Founder and Co-Owner Professional Wetland Scientist (Society of Wetland Scientists) and Certified Ecologist. mark@madscientistassociates.net
Volunteers/Extra Wetlands Restoration	*OSU Ecological Engineer Society:* This OSU-run club has focused on restoring wetlands in the past and has worked in various cities in OH to help implement rain gardens, dig vernal pools, remove invasive plants, etc. This may provide a good resource for volunteers who are familiar with wetlands work and are enthusiastic about what they do.	https://www.facebook.com/OSU.EES
Preparing Paths	*Constructing Wetland Boardwalks and Trails:* This online document details the need for boardwalks and trails through wetlands and how to implement the ideas. It also includes a list of other websites that may be of use.	http://aswm.org/pdf_lib/2_boardwalk_6_26_06.pdf

During and After Living Lab Construction: **Resources for Phase II**		
Wayside Signs	*Harpers Ferry Center:* Harpers Ferry Center is where most information for the wayside signs was sourced from. Contact Harpers Ferry Center for assistance with media development strategies, project management, and to use wayside IDIQ contracts. Call or email them to obtain project cost estimates, to get answers to your wayside exhibit questions, or for HFC assistance in developing and producing wayside exhibits.	Harpers Ferry Center 67 Mather Place Harpers Ferry WV 25425 **Phone:** (304) 535-5050
Finding Fauna	*Ohio Amphibians:* Since Tim expressed an interest in children finding amphibious fauna, this website is a good spot to begin. It provides resources to contact to begin a salamander survey and describes different environments in which they can be found along with other Ohio amphibians.	http://www.ohioamphibians.com/salamanders/
Lesson Plans	*Tree Online:* This website is an environmental education resource created by the Penns Valley Conservation Association. Each lesson plan/worksheet is divided by grade, then subdivided by season, topic, etc. This is a good source for teachers to utilize when they are creating lesson plans for their students.	http://treeonline.wordpress.com/
Lesson Plans	*The Inclusion of Environmental Education in Science Teacher Education*: This book encompasses a wide array of activities for teachers of various grade levels to utilize in the classroom. These chapters span from the history of environmental education to including environmental education in urban schools with limited outdoor interactions. It is available for purchase online- through a google search, it comes up at over $100. However, it can be purchased through Springer.com for a discounted price of 30 Euro or ~$60.	Bodzin, A. M., Klein, B. S., & Weaver, S. (2010). *The inclusion of environmental education in science teacher education*. Dordrecht: Springer.