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Sylvan Dell Nature Preserve Project

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ENST 411: Environmental Community Project Spring 2020
Professor Amanda Wooden
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Table of Contents

I. Project Background

The Sylvan Dell Nature Preserve and Farm in South Williamsport, PA. Sylvan Dell is a 229 acre plot of farmland that contains a wetland on the south section of the property. It lies just south of the West Branch of the Susquehanna River. The first humans we know of to settle on this land were the Susquehannock and later the Haudenosaunee (Iroquois) Native Americans. In the late 18th century, white settlers took the land away from the Haudenosaunee and the Porter and Allen families became owners of this farmland. The famous ornithologist Robert Porter Allen lived on the Sylvan Dell property where he was influenced by the broad range of bird species that would visit the wetland. Porter Allen would go on to save the Whooping Crane and Roseate Bill from extinction during his conservation work in New Jersey (Dunn. 2020).

This semester our group worked with community partners Jim Dunn and Brian Auman, who provided support and guidance on each of our projects. Our partners have been familiar with the Sylvan Dell site and its potential as a nature park for many years. Jim Dunn is an Armstrong Township Supervisor as well as a member of the Lycoming County Planning Commission. Brian Auman is a Landscape Architect with experience in community design and environmental solutions. Their hard work led to Lycoming County's purchase of this land from the farmers in March 2020, with the intention of transforming the area from conventional farm to a nature park. Jim and Brian are working to devise a comprehensive strategy of conservation, recreation, and education for the site.

II. Project Goals

The Sylvan Dell project is one that has been in the works for over ten years and that will continue to go on long after we are finished with this class and project. As a result, the Sylvan Dell project itself has some broader goals that direct the decisions that we have made in our research. Generally, the goals for the ultimate nature preserve include the restoration and expansion of the wetlands and floodplains, the transformation of traditional farming land into regenerative farming, increasing the population of beavers as a keystone species, the establishment of oak-savannah meadows, and the creation of habitats for local waterfowl. The Sylvan Dell site will also serve a practical function in stormwater management. In addition to these ecological goals, the project leaders want to create walking and biking trails throughout the site in order to connect the preserve, the Susquehanna River, Bald Eagle Ridge, and the city of Williamsport in order to facilitate greater community engagement with the land. The final major overarching goal of the project will be the implementation of programs that further engage community members, increase environmental education, and address local social inequalities.

Our group was also given a set of three smaller and more specific goals to work off of in our own project. The first major goal was to complete wetland landscape mapping of the site to accurately mark the different types of land use in greater detail. The second major goal was the organizing of a Bioblitz event as well as soil sampling for the site in order to catalogue the organisms on the site and understand the soil type, quality, and hydrology. The third goal was organizational sustainability, which entailed planning programming for the future nature

preserve as well as planning and networking for the renovation of the farm house on the property using recycled materials from the farm. Each of these goals as well as the major goals of the entire Sylvan Dell nature preserve have guided the initial development of our own project goals.

However, after several weeks of working on this project, a couple major changes, including the outbreak of Covid-19 and taking a group site visit to Sylvan Dell during which we walked the property on February 22nd, influenced the direction of our goals. At the end of the project, we still had three major goals that were similar to the ones we began with: Landscape Mapping using Geographic Information Systems (GIS), SylvanBlitz: A Collaborative Educational Opportunity for Ecological Data Collection, and Educational Programming & Native American History Relevance. Each of these individual goals is described in detail below.

i. Landscape Mapping using Geographic Information Systems (GIS)

This goal of the project is to use GIS (Geographic Information Systems) to update the landscape features and wetland areas that the community partners have for the site. In 2017, the Department of Environmental Protection compiled a report outlining the extent of the wetland that wraps around the south end of the Sylvan Dell property. Our community partners requested that we digitized the site again to analyze whether there have been changes in the wetland area. Our partners expressed concerns that over the last few years the farmer was encroaching on the wetland areas to maximize his available farmland. It is essential to find the baseline area of wetlands, because now that the property is under control of Lycoming county they can move forward with their plans for seeding tall grasses that will expand the wetland back to its prior area. It is important to have the most accurate analysis of the current wetland area, so that they can calculate how much area should be expanded in the future.

The landscape analysis goals remained the same even after this component had to be reevaluated when Bucknell switched to remote learning given the way the world has been flipped upside down by Covid-19. The plan as of March 6th, the Friday before spring break, was to get materials from Janine Glathar, Digital Pedagogy & Scholarship Specialist, GIS & Spatial Thinking, for an on-site walk of the wetland perimeter. Brian Quinn, Duane Griffin, and Brian Auman would all go to the wetland and walk around the borders of the wetland site carrying GPS equipment. This information recorded with equipment supplied by Janine Glather would then be transferred into ArcMap and the wetland map would be created given the provided data. This became impossible after the switch to remote learning, because we couldn't meet together anymore to take the trip to the site. After the remote learning transition we transferred our focus to digitizing the wetland area based on satellite images. We took images from a wetter period and a drier period and mapped the wetland area given these images.

ii. Sylvan Blitz: A Collaborative Educational Opportunity for Ecological Data Collection

The goal for ecological data collection was organizing and conducting a BioBlitz event. Our community partners thought it would serve as a great collaborative educational opportunity for undergraduate and graduate students to get on the site and identify species together in a single day or week event. The vision was, and still is, to create an educational program joining up multiple universities, creating a one-of-a-kind collaboration. The site will then act as a common ground for educational networking and recording data, and a replicable event. Our first and only visit was not as long as we had hoped for, because we were asked to leave the site by the previous owner. Spending more time on the site would have helped with programming the Blitz event, allowing the group more time to map out the event on the site. In late February, the group focused on connecting with professors to organize a BioBlitz event that would take place in the Fall of 2020. Upon leaving the area after the shift to remote work, the group instead started researching case studies of BioBlitz held across the United States to form an idea on how to organize an annual collaborative educational opportunity that would serve the goals of this project and the Sylvan Dell Site.

iii. Educational Programming & Native American History Relevance

The goals for this portion of the project were built from a combination of sources: the general site goals, ongoing discussions with community partners, and some unforeseen changes and new information that arose as the project continued over the semester. Initially, there were two major goals that we were hoping to achieve. The first task was planning programming possibilities for the future nature reserve at Sylvan Dell. This would include compiling a list of feasible programs that could be developed on the site, including recreational, educational, and research-based programs, as well as the particular process of establishing a community garden. The second major goal was to look into setting up an event for renovating the farmhouse and other buildings that were acquired with the purchase of the site. This was to be done utilizing recycled materials found around the Sylvan Dell site and was to be done through a partnership with the Susquehanna River Heartland Coalition for Environmental Studies. However, after attempting to contact this organization and not receiving any replies and being sent home from campus as a result of COVID-19, it became apparent that the goal of setting up this event would not be feasible for our project timeline.

In addition, during our initial site visit to Sylvan Dell to understand a bit more about the property and the goals of our community partners, some rather interesting information came up about the Native American history of the land. It came to our attention that there was a high likelihood of Native American artifacts present throughout the site, and we were also told a story in which one of the previous owners had uncovered a Native American canoe on the property and had sold it off without any attempts to contact the tribes who had originally lived there. This raised some immediate ethical red flags for our group, and ideas about educational opportunities, and we decided it would be critical to include this information in our research somewhere.

After adjusting our original goals for what was initially called the “organizational sustainability” part of the project, we determined the ultimate goal to be the creation of several documents with information regarding programming and the Native American historical relevance to the site, which was split into three major parts. The first part of this project component was the creation of a guide for educational and recreational programming with information about how to establish a community garden, relevant recommendations in establishing other possible programs, and additional information resources for our community partners. The second part of this programming project component was to create a document compiling a list of several feasible specific programs that could be designed and implemented at the nature reserve. While the first part discusses general advice and information for how to go about designing programs, the second part provides actual names and examples of programs that can be implemented. The third and final part of this programming project component was the creation of a guide to recognizing the Native American history of the land, the importance of properly incorporating it into future programs, and the legal obligations of addressing the probable artifacts still present.

III. Project Component 1: Landscape Mapping

i. GIS Methodology

To complete this section of the project we used a program called ArcMap made by Esri. This program uses Geographic Information Systems (GIS). GIS is a framework for gathering, managing, and analyzing data. Rooted in the science of geography, GIS integrates many types of data. It analyzes spatial location and organizes layers of information into visualizations using maps (What is GIS?, (n.d.). The first data source that we used came from Lycoming County GIS, a department of the Planning and Community Development part of the Lycoming County Government. Their mission statement is, ”To develop, design and implement land records, mapping products, geographic analysis, and field data collection services to be delivered efficiently and effectively using state of art technology to serve Lycoming County departments, citizens and governmental partners at all levels”(GIS Mapping and Data Services, 2019). They received their information in a Department of Environmental Protection (DEP) report. In 2017, Andrew Klinger, a water biologist in the DEP, compiled a report that included the list of observed vegetation, flood storage potential, expansion potential, and soil hydrology data at the Sylvan Dell site as seen in Appendix B. He also created data for use in GIS outlining the wetland area and four different types of wetland: open-water, emergent, shrub, scrub, and forested.

Our strategy for digitizing the wetland area in GIS was to use Landsat images along with the data created by Klinger in the DEP report as reference points. The source of our Landsat images came from EOS Landviewer (EOS - Spatial Data Analytics, GIS Software, Satellite Imagery, n.d). The website allows one to search through satellite images that are made available free for public use from The National Aeronautics and Space Administration (NASA) and the European Space Agency (EAS). The site allows one to search images based on date, satellite, level of cloud cover, sun angle, and image capturing type. However, before searching for images it was essential to establish which satellite image dates we would choose for the

project. To show the different ranges in both season and weather pattern we chose a date during a wet period and one during a dry period over the last year. First, we went to the USGS database to find the discharge rates of Bald Eagle Creek over the last few years (USGS, n.d.). Looking at this graph in discharge rates we could see when the wetland would likely have the highest and lowest levels of inundation. It is essential to look at USGS data, because this factors in melting snow and runoff that may not be apparent just from looking at weather patterns. We also looked at Weather Underground, a site that records the weather history for each day. The records for South Williamsport are listed, including the amount of precipitation in inches. We identified several dates that would work for dry and wet periods before searching for images in EOS Landviewer.

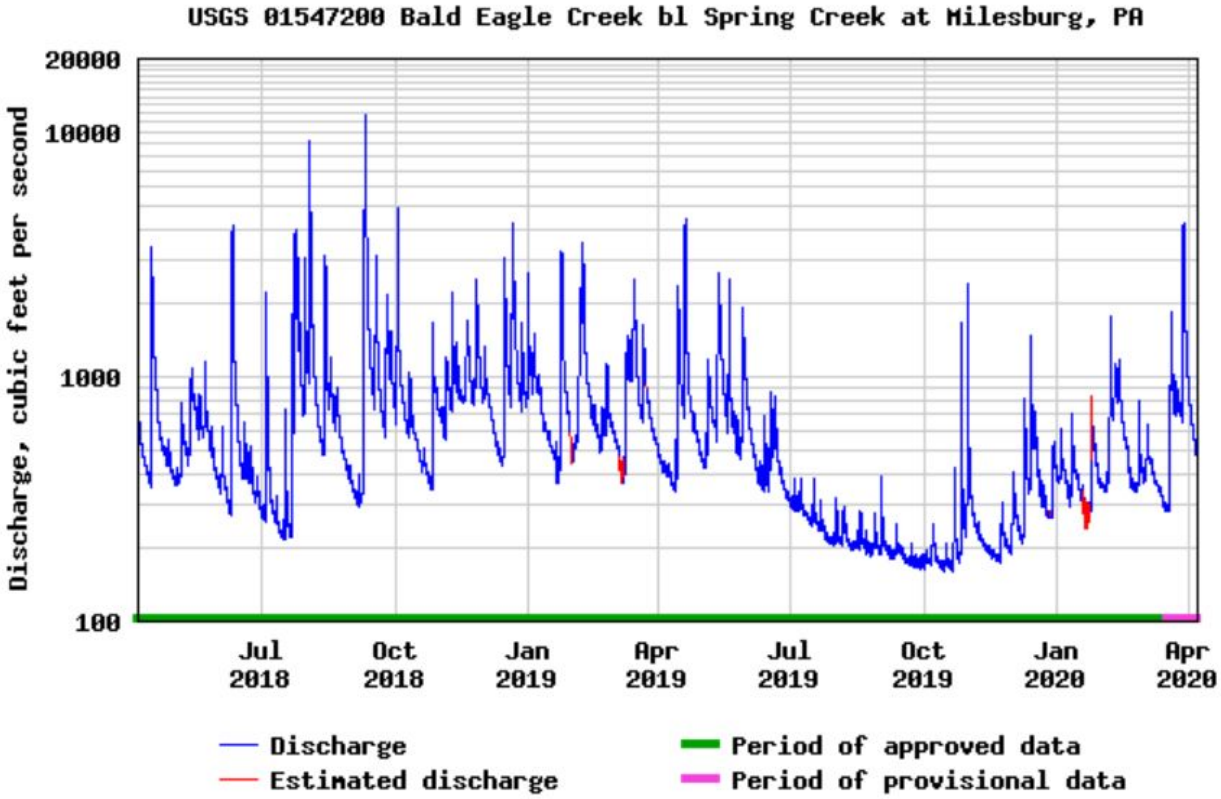

Figure 1. USGS data on the discharge rate of Bald Eagle Creek over a two year period.

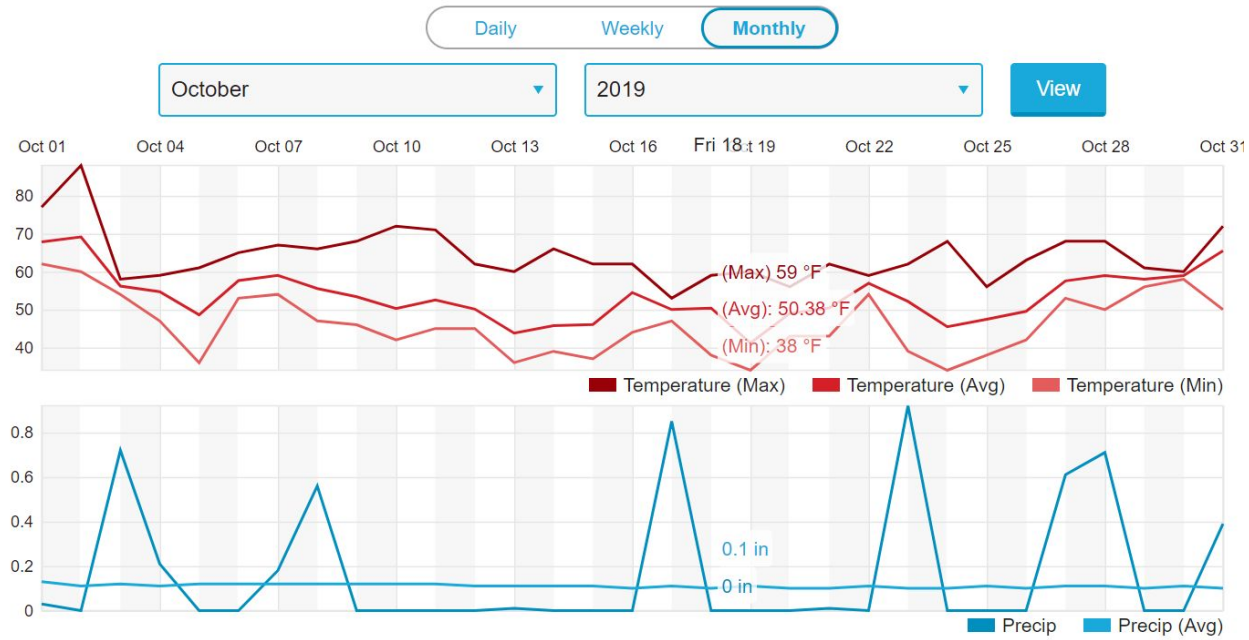

Figure 2. Monthly weather data from October 2019 taken from Weather Underground.

In Landviewer we only wanted images from the Sentinel 2B satellite, because it delivers the highest quality images of any satellite that is offered. The Sentinel 2B was launched in March of 2017 two years before the Sentinel 2A and four years before Landsat 8, which meant it had the most updated and high tech image capturing technology of any other satellite.[1] We also limited our search settings to images with less than 10 percent cloud coverage, so that none of the site was blocked off. This made the wetter period more difficult to find, because with wet periods there is much more cloud coverage. Through this process we decided upon October 28th for the wetter period date and March 9th for the drier period.

[1] Sentinel-2B Successfully Launches Landsat Science. (n.d.). Retrieved April 27, 2020, from https://landsat.gsfc.nasa.gov/sentinel-2b-successfully-launches/

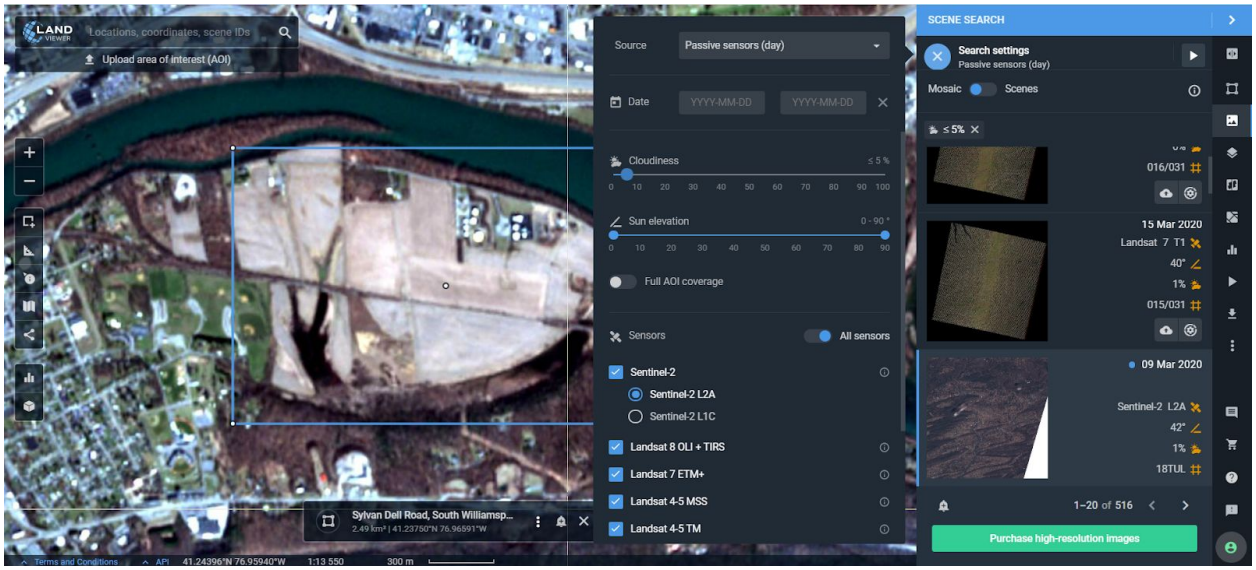

Figure 3. EOS Landviewer interface in the satellite image search section. The displayed image is the natural light image of Sylvan Dell on March 9th.

EOS Landviewer also allows one to modify the index applied to the images. The index is a combination of spectral bands from red, blue, and green visible light along with thermal, shortwave, and near infrared band types that can be manipulated to show different types of objects on the ground. Essentially, objects reflect differing levels of light and combine different patterns of visible light and infrared waves, allowing us to detect things that we cannot see just from our own eyes. In this project, I used the Normalized Difference Vegetation Index (NDVI) and Green Chlorophyll Index (GCI). These provided ways for us to more clearly see the difference in things in grasses and straws that would separate the farming areas from the wetlands, because the basis of these combinations(Brecht, 2018). We were also able to more clearly define the open-water areas from the land area by using these indices. Once we selected the different indices that we would apply to the images, we downloaded them as TIFF files, so that their geographical location would be saved along with the images.

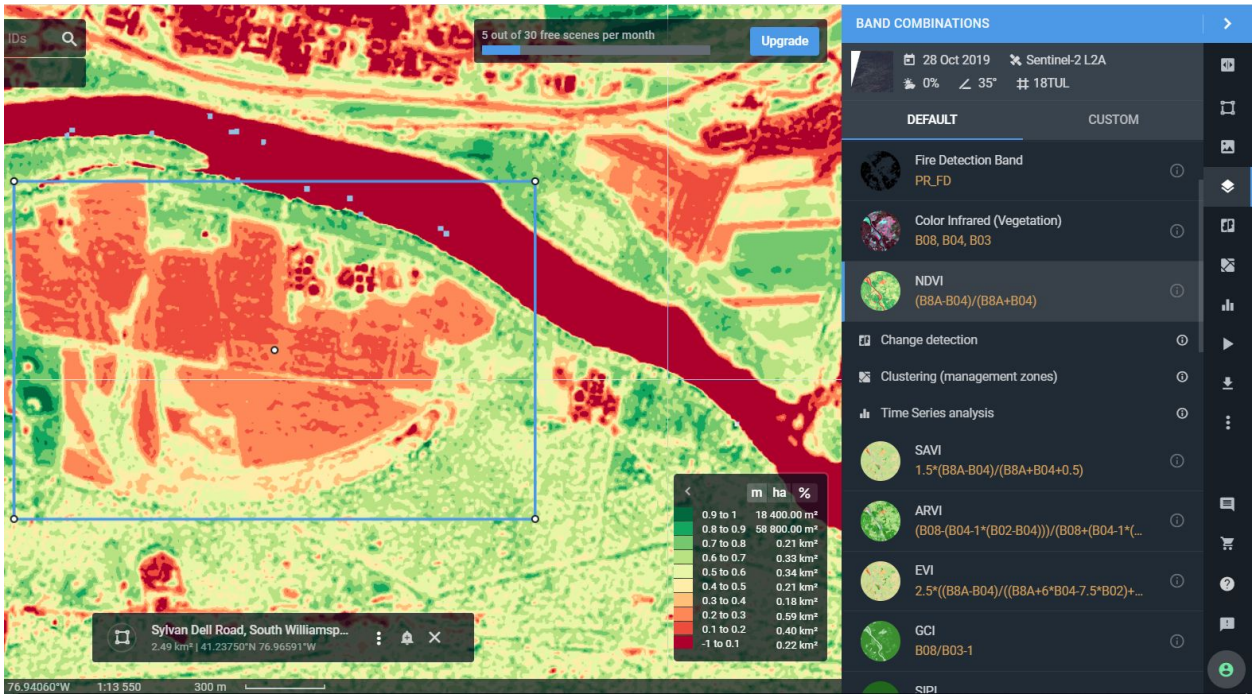

Figure 4. October 28th image with an NDVI applied to the image. Dark red indicates water or buildings. Lighter greens and yellows are a spectrum of different vegetation types.

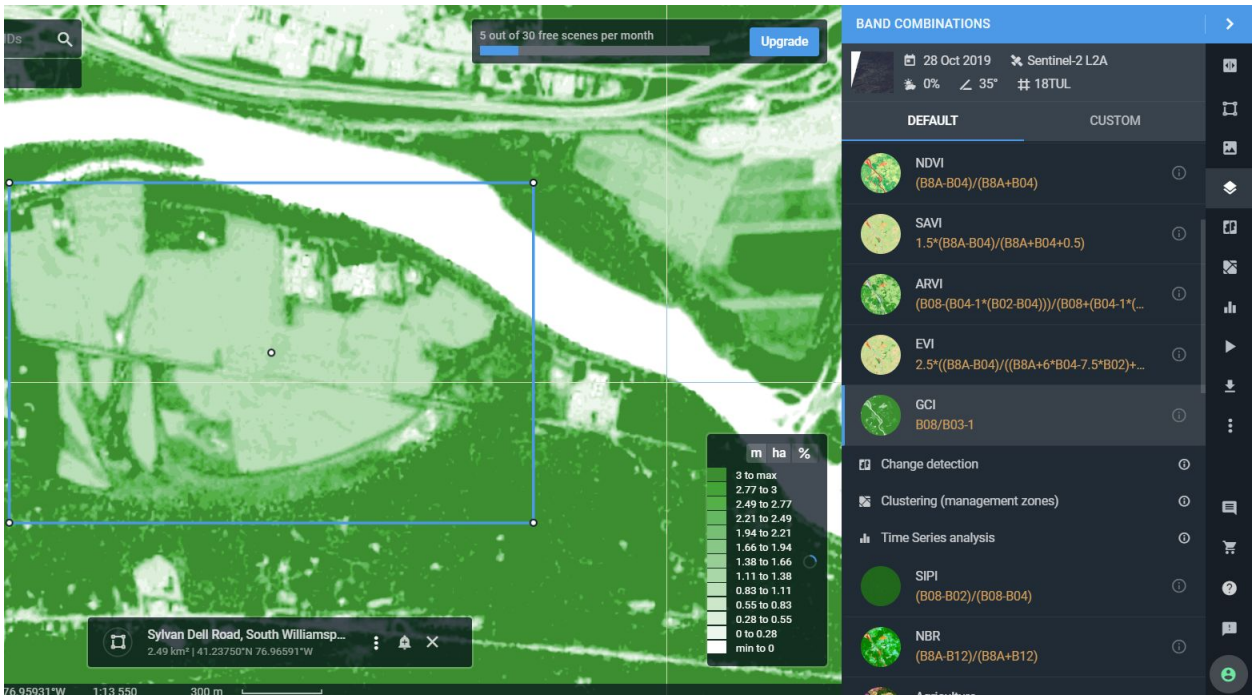

Figure 5. October 28th image using GCI. The range depends on levels of chlorophyll found in an area, so open water is completely white while forested areas are dark green.

We used the Bucknell VPN to gain access to ArcMap 10 which is the GIS program that would allow us to digitize the wetland. We then imported the images we downloaded from EOS Landviewer as well as the data that was created by the DEP report. Once our reference points were in the software we could create feature classes for each date where we would edit polygons for the shape of the wetland. When creating the size for each date, we turned the natural color, NDVI, and GCI images on and off depending on what provided the best information for the wetland area we placed vertices marking where the vegetation type was marked in changes in colors. We did this all around the outside borders of the wetland for both dates until it was completely filled in.

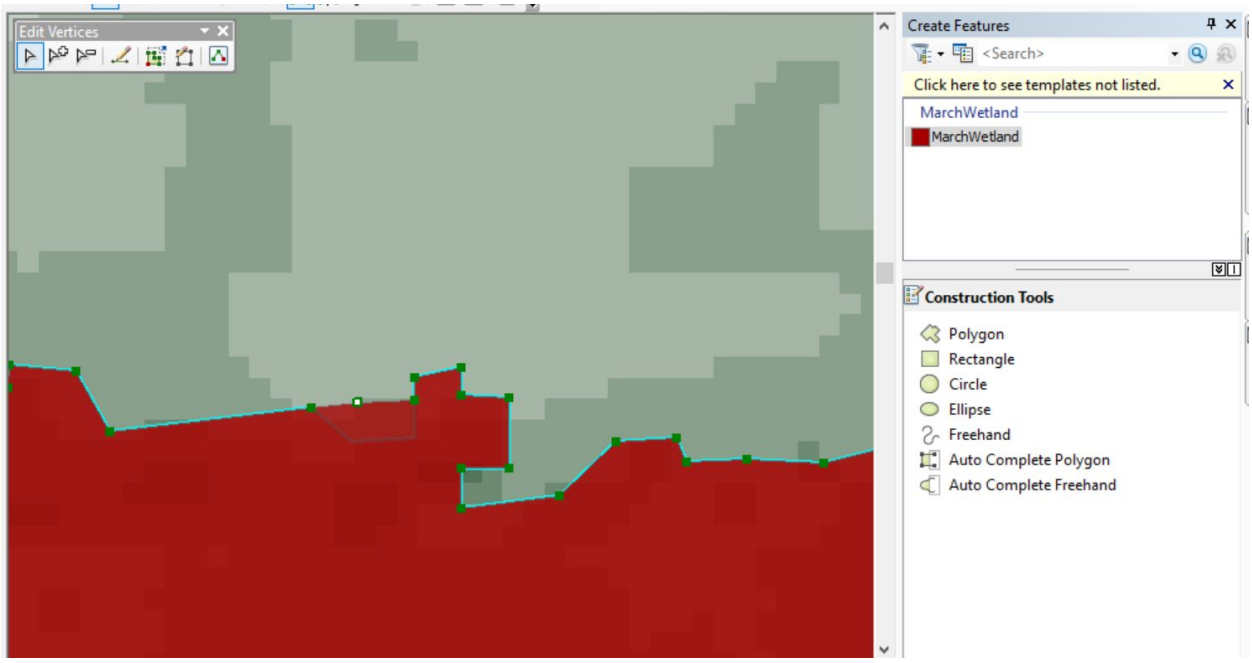

Figure 6. The red area marks the wetland area from the March 9th image. Each green square marks a vertex as part of the polygon.

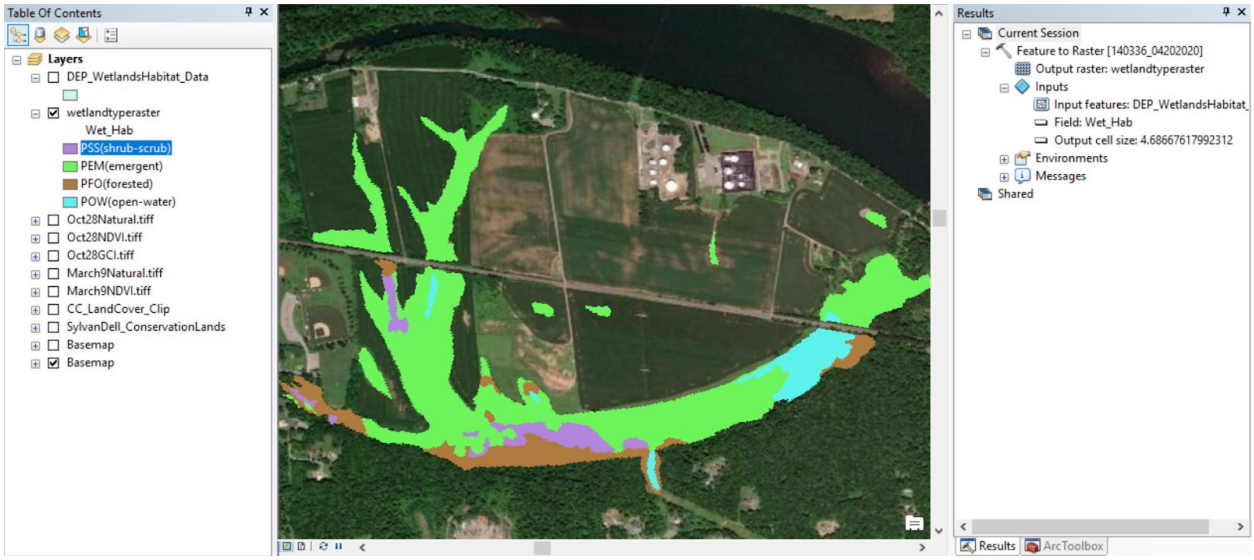

Figure 7. Imported DEP wetland data after we converted it to a raster file based on wetland type to more easily see the different types of wetland. Green is emergent, blue is open water, brown is forested, and purple is shrub-scrub.

Next we wanted to outline the open-water areas, so within the October wetland and the March wetland classes we began editing another area for wetland type. To do so, I added another field to the attribute table for habitat type depending on emergent wetland or open water wetland. When editing each polygon I added this information, so that we could separate the areas in symbology later. Using mainly the GCI applied image, we were easily able to see where the open water areas were by the strict contrast of the white areas among the green areas marked for vegetation.

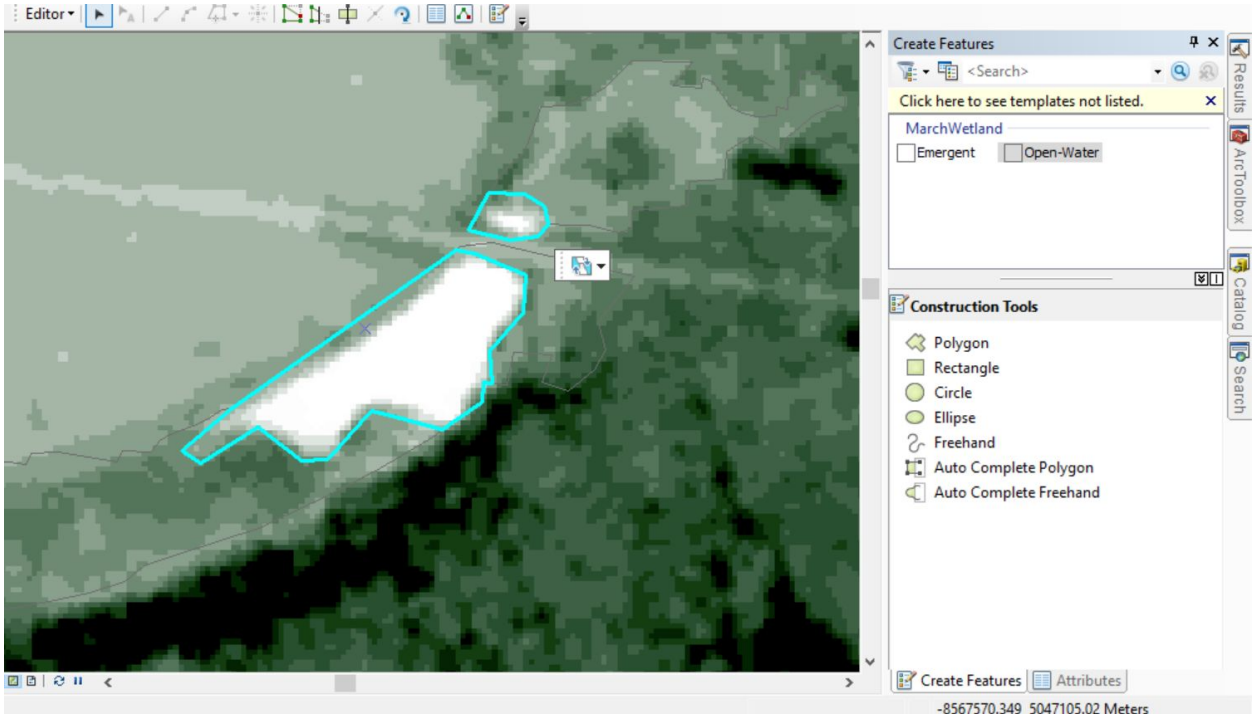

Figure 8. October 28th image using GCI to digitize the open-water wetland area shown by the white outlined

Finally I changed the symbology of each date's feature class to show the open-water areas in blue and the emergent areas in green. I then switched to layout view to add a legend describing this as well as a north arrow and scale to create. I also put the rest of the Sylvan Dell site in the background as a cleaner image taken from arcGIS online to get a clearer image for the final product. We also wanted to show how much area each wetland type occupied, so we used the field calculator to show this.

ii. Limitations

In the GIS section there were many technical issues that made the project difficult to complete. The main limitation was that the project had to be redesigned to be compatible with remote learning. The data collected here wasn't as accurate as one that of a site walk would have been. There is no use of remote sensing that could compare to the accuracy of an on site walk. One of the limitations within the remote sensing was that in the middle of using the EOS Landviewer site the payment structure of the site drastically changed. When we were first using the site one could view 10 images free per day and use all 15 indexes, but in the first week of April the site changed so that only one image was available per day with 0 indices possible. In order to carry on with the project we had to pay $10 per month to see 30 images a month and gain access to six of the 15 indices. Another limitation that comes from the EOS site is the resolution in pixels per meter squared. Our payment plan only allowed for the lowest resolution, so when using the images in GIS the size of the pixel were larger than we would have liked. This made digitizing

the wetlands less accurate than we would have liked as well. If we wanted to upgrade to better resolution we would have had to pay $80 per month.

iii. Results of GIS Mapping

The following maps displayed below contain the displayed image of the digitized wetland area that was produced. The area of open water wetland is slightly larger in the October image, because of all the rain during that month compared to that period in March where there wasn't much rain in the week prior to that image being taken. The resulting wetland area found from our digitized work is also smaller than the area that DEP mapped, as seen in figure 7. Brian auman expressed that the former owner of the land, a farmer, had been encroaching on the wetland area to which is likely to blame for the differences in size between the two that we see.

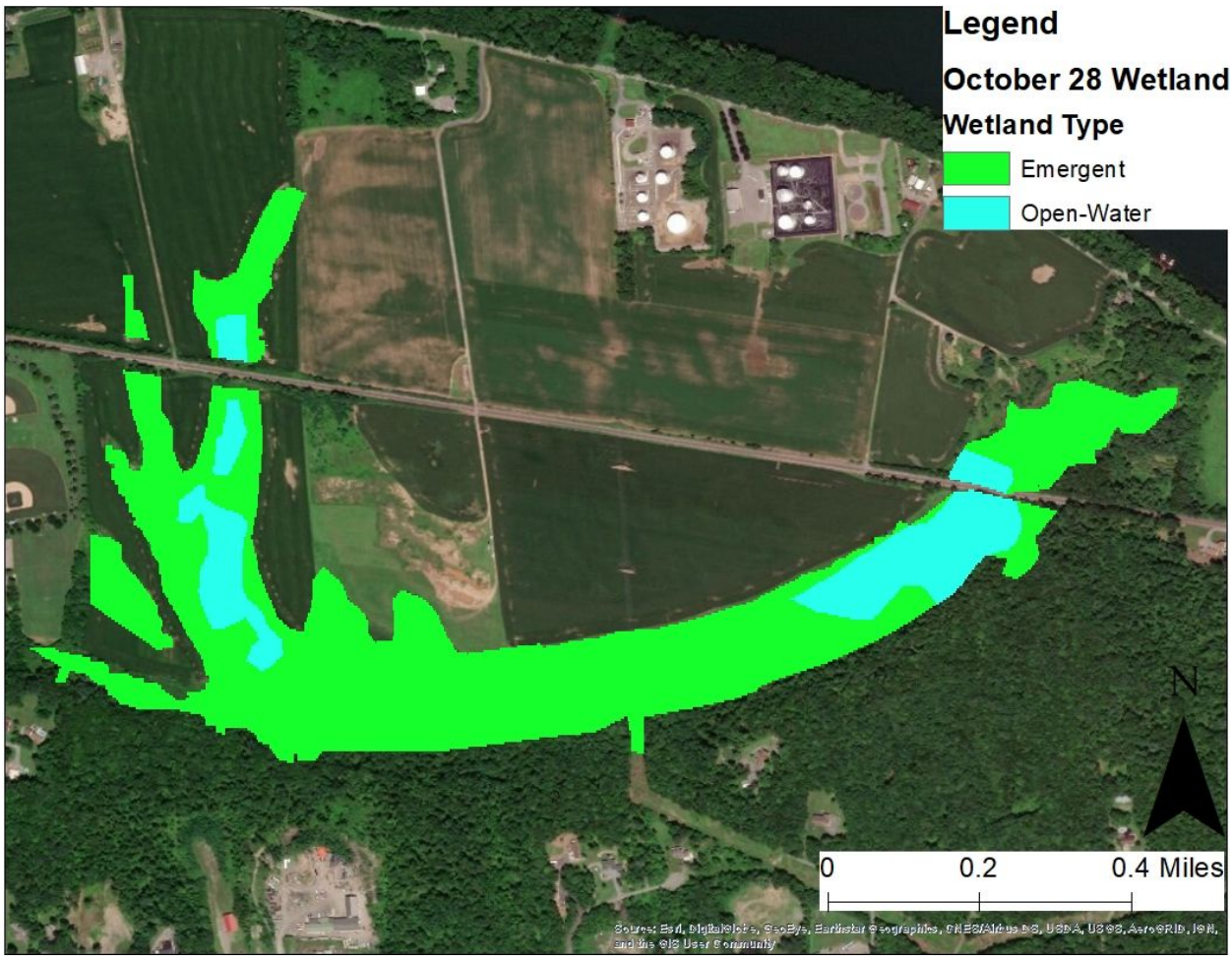

Figure 9. October 28th Wetland area digitized based on emergent areas in green and open water areas in blue against a 2020 basemap layer from ArcGIS online.

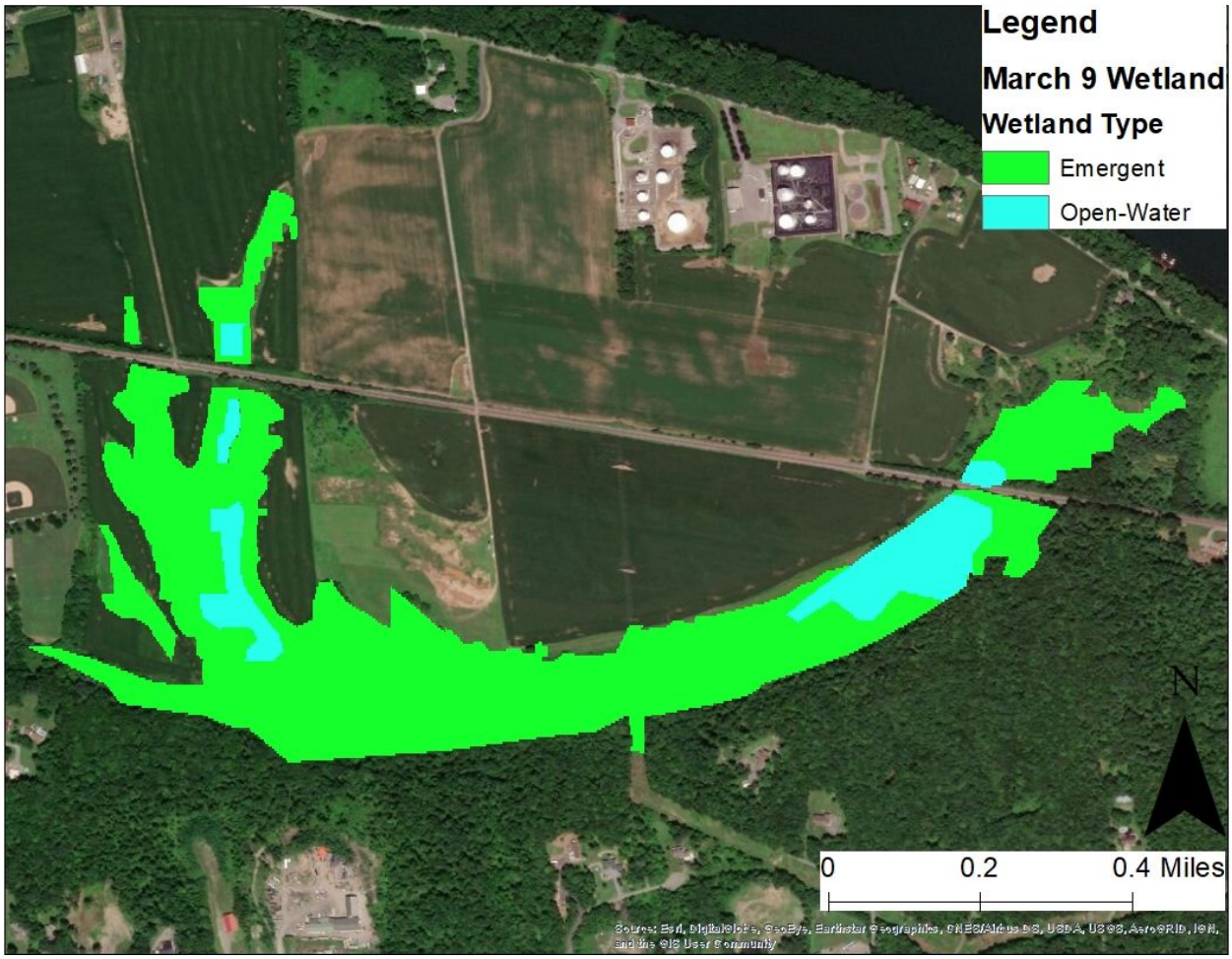

Figure 10. March 9th wetland area digitized based on emergent areas in green and open water areas in blue against a 2020 basemap layer from ArcGIS online.

IV. Project Component 2: Sylvan Blitz: A Collaborative Educational Opportunity

i. Methodology

The group found BioBlitz case studies, literature on the impact of experiential research and community-based learning, and multiple guides on organizing a Blitz event. A traditional one-time event BioBlitz would not satisfy our partner's vision of having a continuous educational opportunity at the site. Hence, the group drew inspirations from two main guides: The Connecticut State Museum of Natural History at the University of Connecticut's BioBlitz [7] manual written by Ellen Censky–the director of the museum– and an article by The Society for Conserving Biology [8]. The group used these guides to create a Sylvan Dell specific Blitz model that meets the goals of the project. The Sylvan Blitz would be a continuous repeated event to ensure covering the entire site , and to document its biodiversity through collaboration of participants from different institutions. The data collected would be continuous to better

document and understand the shifts in biodiversity on the site. The group also found two main studies [9][10] to explain the importance of BioBlitz and its impact on education and outreach.

Conservation strategies have constantly required field-based information. High-quality survey data is required for conservation practitioners to properly address each case. Multiple rapid-assessment approaches have been developed since the early 1990s, typically dealing with large areas, and take months to complete. While these approaches might work in some cases, they are not appropriate when conservation-relevant survey data are needed for a specific site (Parker et al., 2018). These methods include Rapid Ecological Assessment, or REA, which deals with a medium-sized landscape, requires taxonomic experts with strategic partners, takes weeks to months to complete, and has a high cost depending on the location. Another method is the Rapid Biological Inventory, or RBI. The RBIA method that deals with small and medium-sized landscapes, requires taxonomic experts only, and takes a month to complete with costs that reach $300,000 (Parker et al., 2018). A new trend of rapid field-assessment has been adopted by scientists, educators, and conservation practitioners: The BioBlitz. This is a rapid field survey collective effort in which expert volunteers document as many species as possible in a specific site during a defined period. The BioBlitz is an idea and a concept that could be shaped to each location and its needs, meaning it i's flexible.

Generally, BioBlitz has three main objectives. The first objective of an expert BioBlitz is to generate survey data that can be used by conservation practitioners. The second is to enhance research capacity in locations or on topics that are understudied, especially where there are gaps in information that impede evidence-based decision making for conservation and natural resource management. The third is to build working partnerships focused on conservation concerns. Using the guidelines presented by (Parker et al., (2018) along with (*BioBlitzGuideUCONN.pdf*, n.d.), a BioBlitz manual organized for the Sylvan Dell site will help to achieve those objectives. This can be done by students and professors, where the guidelines from (*BioBlitzGuideUCONN.pdf, n.d)* are amended to suit the site appropriately.

Manual Outline

The manual starts by introducing the BioBlitz model and explains the shift in conservation strategies in recent years. The Sylvan Blitz guide explains the social, economic and environmental benefits of the BioBlitz approach. Next the guide explains how to organize an annual event in which scientists, graduate and undergraduate students participate to identify and list the specimens of plants and animals on the Sylvan Dell site and to measure ecological health. The Sylvan Blitz manual provides step by step instructions, checklists, and templates to organize and annually host the Sylvan Blitz event.

When it comes to organizing the collection of baseline data on the Sylvan Dell site, the primary targets are documenting the species of plants and animals on the Sylvan Dell site, analyzing water quality on the site, quantizing the percentage of organic matter in the soil, and

establishing a network of educators as well as students for future research projects on the site. This manual serves as the main guide to accomplish these targets.
The Sylvan Dell team desires to have an educational setting, in which students can connect with nature firsthand. The site itself will serve as an educational site that will benefit the public and gain information from the students, professors, and professional visitors as well. The BioBlitz model is a great tool for educating the public regarding the biodiversity of the site, and for exciting children about science in an enthusiastic manner. The event is filled with energy, where scientists, who rarely get a chance to gather, work together while sharing their passions, motivating children to explore nature and sciences, and increase the public's awareness regarding clean water, fertile soil, and clean air to breathe, which we take for granted.

The BioBlitz will generate for Sylvan Dell a list of species– animals and plants– found on the site, serving as a first step in managing and conserving the site. The list of species, as well as the recommendations of the scientists about how to preserve these species and their habitat, will serve the management of the site by identifying which species need to be controlled, monitored, or eradicated if invasive, while maintaining a low cost compared to hiring experts to conduct surveys and writing recommendations.

Traditionally, BioBlitz kicks off on a Friday, participants gather specimens for 24 hours and continue to count until they are done. However, Sylvan Blitz is not a one-time event. The site has 220 acres to cover. Counting specimens for 24 hours will not cover the whole site. Thus, Sylvan Blitz should be held at least once a month for 24 hours in the spring and summer due to better weather conditions. Sylvan Blitz should start at 5 PM on a Friday and end at 5 PM on Saturday. The reasons for this:

- Weekdays are busy for undergraduate students, professors, and the public.
- Precise starting and ending times add a "race against time" aspect to the event.
- It causes the event to be more persuasive for its shorter time.
- It allows more students, professors, and experts from different universities to participate in different times, preventing the loss of participating opportunities due to the annual reputation of the event.
- Allows time for recaps and announcing final tally at the end of the 24 hours.
- Maintains the night hours for identifying nocturnal animals.

V. Project Component 3: Educational Programming & Native American History Relevance

i. Methodology

The methods utilized for this portion of the project were largely focused around online research. In order to produce the programming guide, we started out with research on the importance of nature-based learning and how it provides significant benefits to both individuals and communities, though with a particular focus on children. The sources found here were largely found from the Early Childhood Learning & Knowledge Center (ECLKC) as well as several other

studies of the relationships between outdoor learning and developmental and community benefits. The next major type of research that was done was finding and reading through past and current State Outdoor Recreation Plans from the DCNR as well as several other strategic plans from conservation-oriented organizations to gain their particular insights and recommendations for program development. In addition, we found and analyzed various community garden start-up guides and case studies of other community gardens in the Bucknell and Williamsport areas. From this we also compiled a list of contacts and websites from several of these local community gardens to provide our community partners with references and resources for the construction of the actual garden.

In order to compile a list of feasible educational programs, the first step taken was research into what other existing nature preserves throughout Pennsylvania, such as the Trexler Nature Preserve, have developed and offered in terms of programming. We found and read through their program schedules as well as details about what each program offers and for whom. In addition, we spent a great deal of time looking through the DCNR Conservation Education Opportunities page, which provided tons of examples of statewide and national programs along with resources on curriculum development. From these sources we examined each program and determined which could be relevant to the particular landscapes of Sylvan Dell as well as which ones could be modified to fit the ecologies present on the site.

The third programming element, the creation of a guide to recognizing Native American history at the site, was arguably the most difficult of the three in terms of figuring out exactly what information could be useful and where to find it. We built this section off of the research that had been done in a previous 411 class for a Sylvan Dell project, which we only came to know about fairly late in the semester. The previous group's work provided us with a fairly comprehensive history of the Native American tribes that lived in the Williamsport area and on the site, as well as the history of their interactions with colonizing groups.

Next we researched state or federal laws or guidelines that related to sites where there is a possibility of Native American artifacts and/or history, which was a fairly general place to start. Eventually, we were able to find a few sources that were of use and of relevance to this particular project, which included Pennsylvania Title 37 (The Pennsylvania History Code), Section 106 of the National Historic Preservation Act, and the Secretary of the Interior's Standards and Guidelines regarding Archaeology and Historic Preservation. We read through these and compiled the regulations and standards which we felt were of most relevance to our community partners.

We looked into sources that could provide us with contacts for tribal leaders, local professors, and local archaeological researchers that could be of help to our community partners in the process of figuring out legal obligations. Finding contacts from local universities and institutions was fairly straightforward, but finding relevant tribal contacts was particularly challenging, especially because there are currently no state or federally recognized tribes in the state of Pennsylvania. Through some additional research into the history of the Susquehannock and

Haudenosaunee (Iroqouis) nations, the ones who were believed to have lived in what is now Williamsport, and locating a Section 106 Tribal Contacts list from the DCNR, we were able to determine that the contacts that would most likely be of relevance to our community partners were from the Onondaga Nation in New York state. Luckily, their own website and the DCNR contact list had a few names and contact information available.

ii. Results

The results of all of this research came in the form of three distinct documents, each of which aligns with a particular goal of the Educational Programming & Native American History Relevance portion of the project. The first document was the **Guide for Educational Programming Implementation at Sylvan Dell**, which consists of the following sections: Description of the Guide, Importance of Nature-Based Learning, Recommendations: Relevant Factors in Developing Programs, Community Garden, Bibliography, and Appendices. The second document created was the **Educational Programs for Sylvan Dell Spreadsheet**, which breaks all the identified programs up into Category/Topic, Programs, and Description and Information on each program. The third and final document created was the **Informational Guide: Relationship Between Native American History and Sylvan Dell**, which consists of the following sections: Purposes of the Informational Guide, Brief History of Native Americans at Sylvan Dell, Possibility of Artifacts on the Site, Relevance to Sylvan Dell Programming, Contact List, Bibliography, and Appendix.

VI. Projects for the Future of the Site

While a great deal of research was completed regarding the Sylvan Dell site throughout this project, we have identified some further topics that can be investigated by future groups that could contribute to the nature reserve even further. Firstly, we think doing extensive research on the **possible grants** that can be applied for would be helpful for the Sylvan Dell community partners, particularly when the implementation of programs is closer to happening. Additionally, once concrete programs are starting to be developed, we believe that **reaching out to possible community partners and/or schools in the Williamsport area** could be a great way to bring community input in and also gain another source of funding and materials. Related to the ideas of engaging with people of all generations and ensuring diversity, inclusion & accessibility, a hugely important type of research that will need to be done is **constructing surveys and focus group/interview questions to be distributed in local communities**. Firstly, we think that surveying the local population will be critical in gaining input from the people who will be engaging with Sylvan Dell. Furthermore, we would recommend at some point a group going out and canvassing the Williamsport area and trying to understand the demographic trends of the community in order to get the best understanding of what programs and recreational opportunities are of interest and how to disperse information about programs to everyone. If Sylvan Dell programs are only to be surveyed or advertised in a few places in Williamsport, then the likelihood that the information will reach all types of people is low. In order to ensure that

everyone has the ability to access the programs and that the programs are meeting the needs of everyone, particular care should be taken in whose input is being taken into account.

Another possible aspect of future projects would involve **more in-depth analysis of the spatial area of the site**. In our project we used satellite images to mark the wetland area, but much more accurate data would be possible if a team were to use GPS equipment. The team would get data that would be able to correct the inaccuracies that are bound to happen when using remote sensing images. The team would need to take someone with experience in identifying different types of wetland, so that they could create a map with all four types of wetland as shown by the DEP.

VII. Conclusions

This project was a huge undertaking and something that truly benefited all of us as students and as researchers. At the beginning of this project when we were just becoming acquainted with Sylvan Dell and the goals of our community partners, it was daunting to be faced with such a massive, decade-long project that holds so much importance to so many people. Working through the problems we faced along the way and the uncertainty of our roles in the Sylvan Dell story was such a valuable experience that has taught us invaluable academic, work, and interpersonal skills that will be taken with us throughout the future. We are so thankful to have been involved in the process of establishing the nature reserve at Sylvan Dell and loom forward to seeing what other groups will contribute and how they will expand upon our work in future years. We are so excited to see what becomes of the Sylvan Dell site and all the wonderful benefits it will provide to the surrounding communities.

VIII. Acknowledgements

We would like to thank Brian Auman and Jim Dunn for all the work that they have put in over the years to make the Sylvan Dell Nature Preserve a reality. Without all the time that they put in none of our projects would be possible. We would also like to thank Professor Wooden for all her guidance throughout the semester as well as Professor Griffin for all his guidance in GIS at every stage of the project. Finally, we would like to thank our fellow ENST 411 classmates.

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XI. Appendices:

Appendix A

SYLVAN BLITZ

A Collaborative Educational Opportunity

ENST 411 SPRING 2020

Huthaifa Aladwan, Brian Quinn, Katie Wisotsky

SYLVAN BLITZ: A Collaborative Educational Opportunity

What Is a BioBlitz?

Conservation strategies have constantly required field-based information. High-quality survey data is required for conservation practitioners to properly address each case. Multiple rapid-assessment approaches have been developed since the early 1990s, typically dealing with large areas, and take months to complete. While these approaches might work in some cases, they are not appropriate when conservation-relevant survey data are needed for a specific site (Parker et al., 2018). These methods include Rapid Ecological Assessment, or REA, which deals with a medium-sized landscape, requires taxonomic experts with strategic partners, takes weeks to months to complete, and has a high cost depending on the location. Another method is the Rapid Biological Inventory, or RBI. A method that deals with small and medium-sized landscapes require taxonomic experts only, and takes a month to complete with costs that reach $300,000 (Parker et al., 2018). A new trend of rapid field-assessment has been adopted by scientists, educators, and conservation practitioners: The BioBlitz. A rapid field survey collective effort in which expert volunteers document as many species as possible in a specific site during a defined period. The BioBlitz is an idea and a concept that could be shaped to each location and its needs, meaning its flexible.

Generally, BioBlitz has three main objectives. The first objective of an expert BioBlitz is to generate survey data that can be used by conservation practitioners. The second is to enhance research capacity in locations or on topics that are understudied, especially where there are gaps in information that impede evidence-based decision making for conservation and natural resource management. The third is to build working partnerships focused on conservation concerns. Using the guideline presented by (Parker et al, 2018) along with (BioBlitzGuideUCONN.pdf, n.d.), a BioBlitz manual organized for the Sylvan Dell site will help to achieve those objectives. This can be done by students and professors, where the guidelines from (BioBlitzGuideUCONN.pdf, n.d) are amended to suit the site appropriately.

Overview

When it comes to organizing the collection of baseline data on the Sylvan Dell site, the primary targets are documenting the species of plants and animals on the Sylvan Dell site, analyzing water quality on the site, quantizing the percentage of organic matter in the soil, and establishing a network of educators as well as students for future projects on the site. This manual serves as the main guide to accomplish these targets.

The Sylvan Dell site desires to have an educational setting, in which students can connect with nature firsthand. The site itself will serve as an educational site that will benefit the public and gain information from the students, professors, and professional visitors as well. The BioBlitz model is a great tool for educating the public regarding the biodiversity of the site, and for exciting children about science in an enthusiastic manner. The event is filled with energy, where scientists, who rarely get a chance to gather, work together while sharing their passions, motivating children to explore nature and sciences, and increase the public's awareness regarding clean water, fertile soil, and clean air to breathe, which we take for granted.

For the site, the BioBlitz will generate a list of species– animals and plants– found on the site, serving as a first step in managing and conserving the site. The list of species as well as the recommendation of the scientists will serve the management of the site by identifying which species need to be controlled, monitored, or eradicated if invasive, while maintaining a low cost compared to hiring experts to conduct surveys and writing a recommendation.

Traditionally, BioBlitz kicks off on a Friday, participants gather specimens for 24 hours and continue to count until they are done. However, Sylvan Blitz is not a one-time event. The site has 220 acres to cover. Counting specimens for 24 hours will not cover the whole site. Thus, Sylvan Blitz should be held at least once a month for 24 hours in the spring and summer due to better weather conditions. Sylvan Blitz should start at 5 PM on a Friday and end at 5 PM on Saturday. The reasons for this:

- Weekdays are busy for undergraduate students, professors, and the public.
- Precise starting and ending times add a "race against time" aspect to the event.
- It causes the event to be more persuasive for its shorter time.
- It allows more students, professors, and experts from different universities to participate in different times, preventing the loss of participating opportunities due to the annual reputation of the event.
- Allows time for recaps and announcing final tally at the end of the 24 hours.
- Maintains the night hours for identifying nocturnal animals.

How to organize Sylvan Blitz:

Recruiting participants:

The Sylvan Blitz does not exist without its participants. They are a key component of conducting a successful rapid field-assessment. The main component in recruiting participants is diversifying the expertise. This is essential to gather better and more concise data. Diversifying the disciplines of participants will lead to a larger tally. The participants should mainly be graduate and undergraduate students for the event to be educational, but professors are crucially needed as they have more expertise, where confidence in identifying species correctly and quickly is crucial for the event due to the 24-hour time constraint. Trust and respect are important in a Blitz event. When a surveyor claims they saw a specific species, it is important to trust that surveyor. For this reason, assigning team leaders to assemble teams is helpful. Rather than the management picking each participant, assigning team leaders from the perspective universities to select reliable participants makes the process easier. For Sylvan Blitz, the team leaders should be professors from the universities invited for the event.

Team leaders' responsibilities:

1) Gather a team of experts to participate in Sylvan Blitz. The team leaders select the undergraduate and graduate students from their perspective institutions to be on their team. The selected participants show be of quality as it is essential to maintain a higher confidence in identifying species.

2) Set the strategy for their perspective teams and determine the role of each team member. For example, dividing team members to take a specific task, such as who records plants' species, who records animals, who keeps the tally etc.
   Keep in mind that participants' main objective is to tally how many species they have found, and not putting a name on each species. That would be the responsibility of the expert in the group. This is why professors are crucial as they have more expertise in determining what the species is, even if they don't have a specific name for it.

3) Communicate with their teams at all times and aspects. They communicate logistics to their team such as:
   a. Location address.
   b. Arrival time.
   c. Materials needed.
   d. Appropriate attire.

- **Note:** This information should be sent to team leaders by the Blitz organizers to team leaders via email.

SITE Preparation:

- Base Camp:
  - An area accessible by the public and by the participants. Since there are no buildings or pavilions on the site, organizers should choose an area large enough to set up tents for scientific and educational activities.
  - Ideally would have access to an electrical supply for lights, laptops, and a coffeepot for the participants.
  - Equipped with tables, and chairs for rest.
  - Internet connection.

Materials Needed:

- Electricity: There is electricity in the base camp.
- Mifi Device: This is to ensure participants internet connection on the site. Can be rented from Bucknell Library through professors.
- Microphones
- Speakers
- Microscopes: Each institution can bring its own.
- Tents: Set up in locations for participants in the field.
- Tables: permanently set in base camp.
- Chairs: permanently set in base camp.
- Tally Boards: permanently set in base camp for public to keep up with tally.
- Duct Tape
- Cups
- Napkins
- Coffeepots

- Educational Activities:
  - End of tally presentations by participants for the public. This should be encouraged as much as possible as it acts as a great gate into science and biodiversity for visitors. This could motivate children to learn more about science and raise public awareness regarding biodiversity.
  - Scientific Programs can be planned to enhance the experience. These programs can be as simple as holding lectures about what biodiversity is, and why it is important. Organizers can invite organizations, nature centers, college green clubs, and experts to provide activities.
  - Holding science college lab sessions on the site for the universities invited. This could be for biology labs, environmental studies and science classes, and geology labs.

Templates:
Species Tally Sheets:

Plant Species Name	Present / Absent	Good / Bad	Notes
Stinging Nettle (Urtica dioica)			
Common Cattail (Typha latifolia)			
Water Plantain (Alisma)			
Silky Dogwood (Cornus amomum)			
Buttonbush (Cephalanthus occidentalis)			
Tree of Heaven (Ailanthus altissima)			
Pickerelweed (Pontederia cordata)			
Water Smartweed (Persicaria amphibium)			
Green arrow arum (Peltandra virginica)			

Table 1.1: A template tally sheet used to identify plant species at the Sylvan Dell site.

Animal Species Name	Present / Absent	Good / Bad	Notes
Phyrganeid Caddisfly larvae			
Red Winged Blackbird *(Agelaius phoeniceus)*			
Green Frog Tadpole (*Lithobates clamitans)*			
Young Northern Brown Snake *(Storeria dekayi)*			

Table 1.2: A template tally sheet used to identify animal species at the Sylvan Dell site.

Water Quality Template Tables:

Water Temperature (Celsius)	
pH	
Dissolved Oxygen (mg/L)	
Alkalinity (mg CaCO3/L)	
Turbidity (NTU)	

Table 1.3: Template table used to test water quality at the Sylvan Dell site.

Chemical	Chloride (Cl)	Sulfate (SO4)	Sodium (Na)	Potassium (Na)	Calcium (Ca)	Mg	NH4-N	SRP
Units	mg/L, ppm	mg/L, ppm	mg/L, ppm	mg/L, ppm	mg/L, ppm	mg/L, ppm	ug/L, ppm	ug/L, ppb
Location #1								
Location #2								

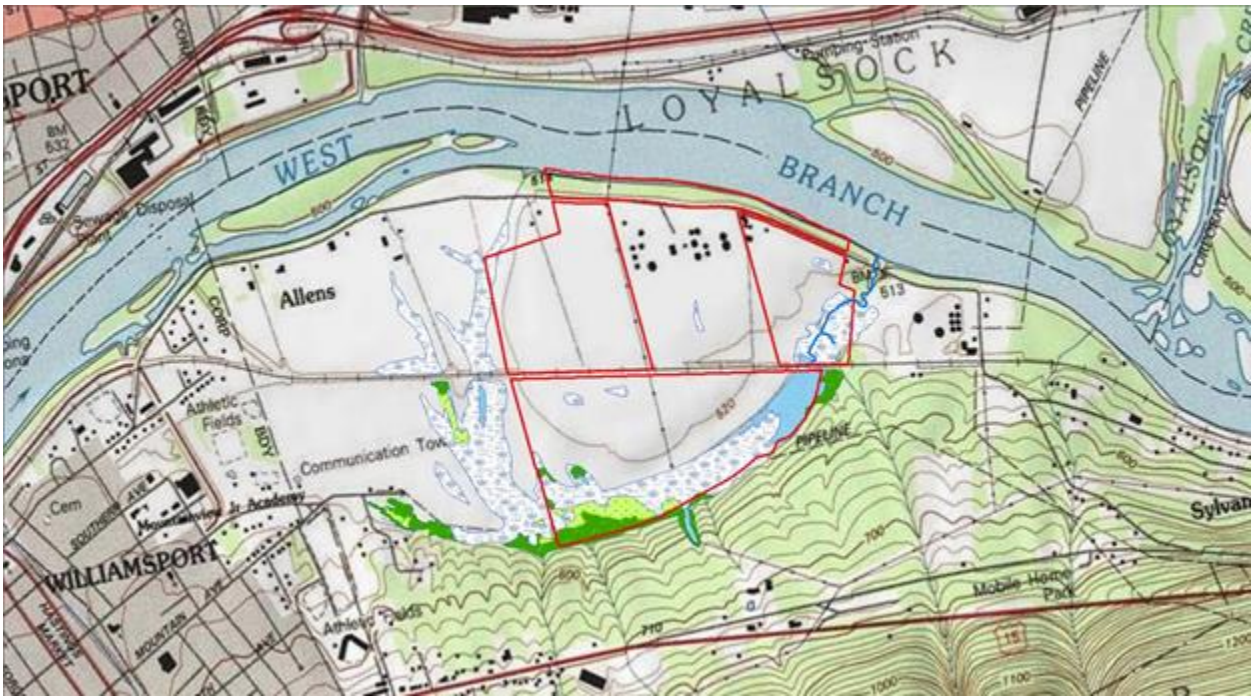
Table 1.4: Template table used to identify chemicals in water at the Sylvan Dell site.

- **Note:**
  - Cl, SO4, and Na → Indication of human activity.
  - Mg & Ca → Limestone geology indication.
  - SRPs → Chemicals added to fertilizers.

Appendix B

Wetland Assessment – September 2017
Prepared by: Andrew Klinger, Water Pollution Biologist 3, Department of Environmental Protection, Bureau of District Oil & Gas Operations, Eastern Oil and Gas District

Wetland Resources
The Sylvan Dell Preserve contains approximately 32 acres of Palustrine wetlands within the parcel boundaries, the main body of which is part of a larger system of approximately 107 acres. This larger wetland system is a backwater swamp with a constricted outlet and is located on the valley floor adjacent to the West Branch of the Susquehanna River. The system is supported by hydrology from several reliable sources, including toe-slope groundwater discharge and surface water contributions from four unnamed tributaries draining the Bald Eagle Ridge. The system is also subject to seasonal flooding from the West Branch. Subsurface portions of the property in both wetland and upland areas also likely serve as a hyporheic zone connected to the West Branch.



The wetlands on site are mostly classified as Palustrine Emergent (PEM) Wetlands (64.6% of on-site wetlands), with some minor components of Palustrine Scrub-Shrub (PSS) and Palustrine Forested (PFO) habitats. Approximately 7.2 acres of the backwater swamp would be classified

as permanently inundated, Palustrine unconsolidated bottom/aquatic bed (PUB/PAB) habitat, which currently supports aquatic life, including fish, and serves as habitat for waterfowl. Observed hydrophytic vegetation in these wetlands included Red Maple (Acer rubrum), Silver Maple (Acer saccharinum), Speckled Alder (Alnus incana), River Birch (Betula nigra), Gray Dogwood (Cornus racemosa), Flat-Top Goldentop (Euthamia graminifolia), Sweet-Scented Joe-Pye Weed (Eutrochium purpureum), Spotted Touch-Me-Not (Impatiens capensis), Rice Cut Grass (Leersia oryzoides), Sensitive Fern (Onoclea sensibilis), Cinnamon Fern (Osmunda cinnamomeum), Mild Water-Pepper (Persicaria hydropiper), Arrowleaf Tearthumb (Persicaria sagittata), Reed Canary Grass (Phalaris arundinacea), Arum-leaf Arrowhead (Sagittaria cuneata), Black Willow (Salix nigra), Cottongrass Bulrush (Scirpus cyperinus), Narrowleaf Cattail (Typha angustifolia), Broadleaf Cattail (Typha latifolia), and New York Ironweed (Veronia noveboracensis).

Wetland Acreage and Types

Wetland Type	Sylvan Dell Preserve Acres	Sylvan Dell Preserve Percent of Property	Total Contiguous Acres
Palustrine emergent (PEM)	31.6	14.0%	76.3
Palustrine scrub-shrub (PSS)	4.8	2.1%	7.1
Palustrine forested (PFO)	5.4	2.4%	14.9
Palustrine unconsolidated bottom/aquatic bed (PUB/PAB)	7.2	3.2%	8.9
Wetland Area Total	48.9	21.7%	107.2
Non-Wetland Area	176.3	78.3%	---
Riparian	25.5	11.3%	---
Total Acres	225.2	100%	---

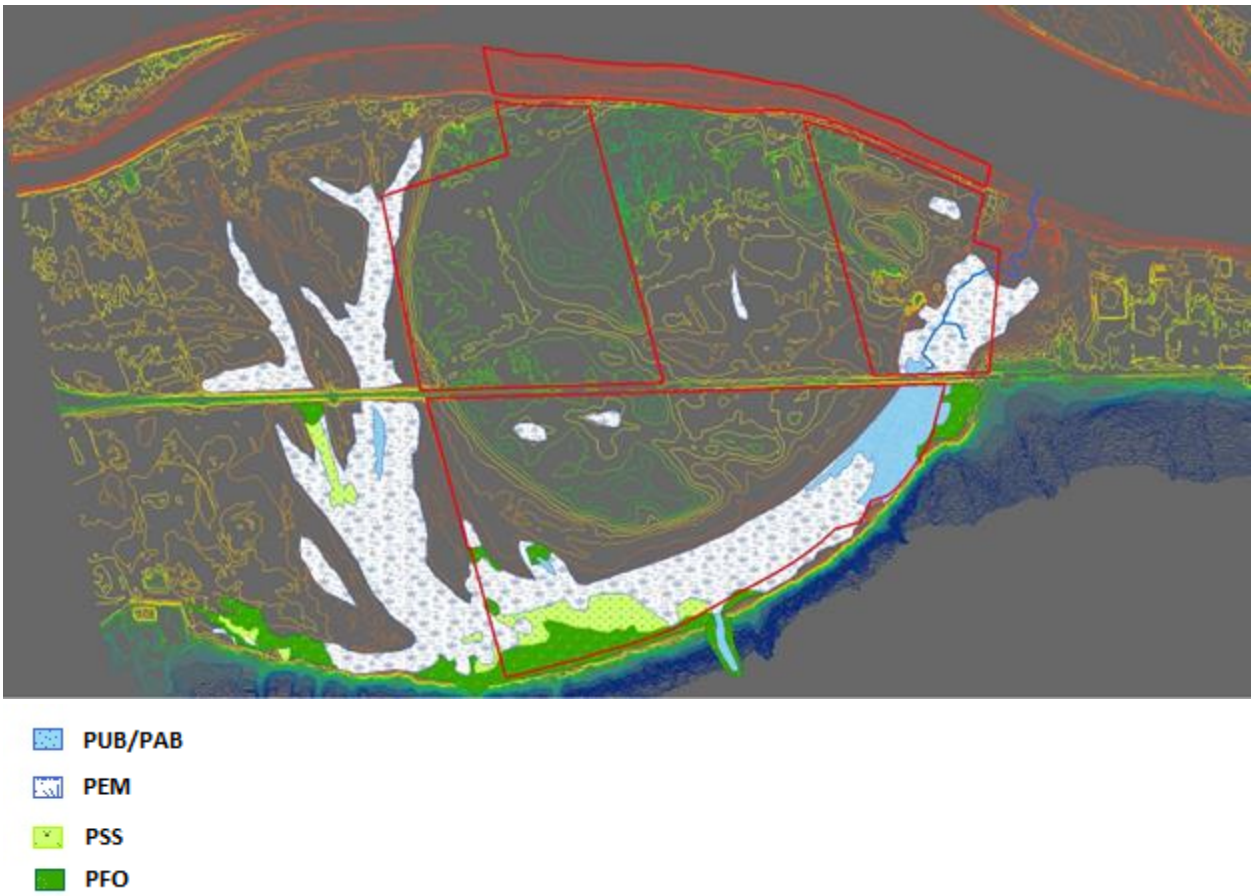
Wetland Restoration/Enhancement Potential

Much of the Sylvan Dell Preserve property has be manipulated for agricultural use. Tile drains are likely present, given the amount of hydrology seen today relative to the degree that hydrology signatures are less obvious or absent in the September and November 1938 aerials. In recent years and today, the drier areas of the property have been in corn and soybean production. There are several patches of stunted growth in these crop fields, observed today and evident across several years of aerial imagery, indicating excessive soil moisture. In some cases, these patches were absent of crops due to inundation. The below figure is an aerial image from summer 2015 and it illustrates some of these areas of stunted crops (A: healthy soybeans; B: stunted, yellowing soybeans; C: healthy corn; D: stunted corn).

Hydrology is the driving force behind the biogeochemical processes in wetlands. Hydrology is therefore the limiting factor in wetland creation/restoration. Clearly, there is ample hydrology present to greatly expand wetland resources on Sylvan Dell Preserve property. The main body of wetlands is excessively saturated and this hydrology could be spread into adjacent areas. Additionally, the ongoing topsoil stripping operation has revealed shallow groundwater that is now ponding in the low-lying areas within and adjacent to the stripping operation. With some minor regrading throughout the Sylvan Dell Preserve property, it likely that historical wetlands could be re-established and new wetland areas created.

The topsoil on the property is rich in organic material and very deep, being alluvial deposits from the adjacent river system. This is a bonus to the project, as soil augmentation may not be necessary to support new plantings.

Since there are approximately 32 acres of emergent wetlands on site, the enhancement potential for the Sylvan Dell Preserve property is also enormous. Native hydrophytic shrub and tree species could be planted in clumps throughout the system. This would not only enhance diversity and increase biochemical and ecological functions, but would also be an opportunity to help control the spread of invasive plant species on site. Currently, there are large patches of non-native narrow-leaf cattail and reed canary grass present on site. Removal of non-native emergent vegetation when followed up with dense native shrub plantings targeted for these areas could outcompete these species and preclude their reintroduction.



Enhanced Flood Storage Potential

The figure below shows the Sylvan Dell Preserve boundaries in white outline. Also shown are the LIDAR contours, which have been enhanced to highlight local topographic relief. The contour lines are color-coded with a rainbow gradient to create an elevation heat map, where red and orange represent the lowest lying elevations, while green and blue indicate higher elevations.

Per LIDAR contours, the normal water surface elevation of the West Branch at the low end of the property is 496 feet (A). Sylvan Dell Road, which occasionally floods, sits at an elevation of 504 feet at its lowest point (B). The little league fields to the west of the project (C) sit at an elevation of 512 feet. The railroad tracks vary from 518 to 522 feet of elevation across the property (D). The banks of the watercourse serving as the constricted outlet to the backwater swamp (E), however sit at an approximate elevation of 500 feet, allowing the river to back up into the backwater swamp during high water events. At the high end of the backwater swamp (F), the elevation that approximately corresponds with the wetland boundary is 508 feet. The property could be lowered and recontoured in various places, so that during flooding events, there would be more overall surface area for flood storage and retention.

While wetland re-establishment and creation is being targeted with the regrading efforts, a strategically planned design that incorporates a highly dendritic pattern of recontouring would

also function to increase flood storage potential on the property, even in areas slated to remain as upland habitat. Seasonally flooded uplands would also help to enhance the overall ecological functions of the property, by serving as transitional habitats between wetlands and uplands.

Water Quality Benefits

Gains produced by increasing flood storage and retention include decreased velocities in the river, as energy is dissipated into the backwater swamp and into low areas created on the property. This could mitigate the effects of flooding in downstream locations and result in decreased erosion and sedimentation.

Additional water quality benefits will instantly be realized just by taking the property out of crop production, because the land would no longer have pesticides or fertilizers applied to it.

The water quality benefits of wetlands are well documented. Once additional wetlands are established on site, water quality-related functions will be greatly increased. These water quality functions include erosion control, sediment retention, salinity distribution and nutrient removal.

Appendix C

Guide for Educational Programming Implementation at Sylvan Dell

By: Katie Wisotsky, Huthaifa Aladwan, and Brian Quinn

Table of Contents

Description of the Guide

The purpose of this guide is to provide an extensive summary of the research gathered regarding the role of outdoor, environmental programming at Sylvan Dell. As the site has only recently been purchased and there is a great deal of work to be done, this guide will provide much of the necessary information and background for implementing programming once that time has arrived. The main focuses will be on the role of nature-based learning and the benefits it can provide, various recommendations and considerations that have been accumulated from case studies and other nature preserves, and information on how to start organizing community gardens as a particularly important program that will hopefully occur on the future site. The guide is also connected to the spreadsheet of possible programs that can be implemented at Sylvan Dell in the future, as the recommendations and information provided in this guide are of critical importance in the development of any of those programs. The appendices in the guide will also provide a great deal of supplementary information, resources, and tools to use in planning and conducting the programs. This guide will provide the next group of individuals who are working on programming development with a helpful foundation of information upon which a great deal more research can be done (as is outlined in the Fieldwork Report and the eventual Project Report).

Importance of Nature-Based Learning

In order to understand the purpose for and necessity of implementing programming at Sylvan Dell down the road, it is first a critical step to understand why outdoor environmental education is such an important resource for learning, particularly for children and young adults. The research has outlined a variety of reasons for why nature-based learning and interaction with nature can be a critical tool in educating young minds, shaping development, and preparing children better for school. Some examples of these benefits include improving individuals' abilities to concentrate on particular tasks and development of motor skills (ECKLC). The combination of educational spaces with outdoor, natural spaces has been shown in many cases have been shown to leave important sensory imprints of smell, sound, texture, color, and taste that would not otherwise be learned (Nimmo & Hallett). Furthermore, outdoor and garden play can provide a place for children to simply be and explore their own imaginative capacities through drama and fantasy. It provides the opportunity to engage senses in ways that are different from classroom or indoor-oriented learning and through these different experiences expand their conceptions of the world both in and out of their imagination (Nimmo & Hallett). Another critical component of outdoor education is that fact that it provides safe conditions for children to engage in small risk-taking behaviors, such as interacting with various organisms, that peak curiosity, lead to development of autonomy, and provide learning that cannot be achieved in the confines of the classroom.

In addition to individualized learning and development that occurs in outdoor setting, nature-based learning can contribute significantly to individuals' development of social understanding in a variety of ways. For example, gardens and outdoor spaces can provide opportunities for children who maybe feel out of place or uncomfortable in formal educational settings the ability

to engage with learning tools and peers in different forms (Nimmo & Hallett). In addition, outdoor settings provide a place in which both adults and children are able to engage with other individuals that may not be in their typical circles, be that friends, family, or coworkers. There are several benefits to the ability or natural learning to bring together new people. Firstly, there are many possible benefits to children being able to interact with adults other than their parents and educators in safe, protected environments. The ability to learn and interact with nature alongside other older mentors who are passionate and knowledgeable about natural systems can supply many opportunities to learn new things and hear perspectives and experiences that they may not otherwise be able to have. Children may not have as much knowledge about topics such as sustainability, conservation, and biodiversity, but through outdoor learning with passionate adults they are able to gain these appreciations early on. A sustainable future depends on the education and engagement of the young generations, and through increasing outdoor learning this goal can be achieved (Western Pennsylvania Conservancy). This type of learning is also reciprocal, meaning it has benefits for the adults who are teaching and guiding as well. Children are often looked and talked down to as people because of their young age and lack of life experience, but children's play and their ideas have more value than they are given credit for. By working alongside children and young adults who are not in their families, adults can gain a greater respect for children and their consciousness, and give greater though to the rights and autonomy of children (Nimmo & Hallett). The second major benefit of interaction with new and different people in outdoor spaces is how it helps contribute to children's learning about human diversity and different perspectives and/or life experiences. The best way to build traits like empathy and understanding is through hearing from and talking to individuals of backgrounds different from one's own, and the opportunity for people of diverse backgrounds to meet and collaborate in outdoor spaces and programs is a highly valuable one. For example, working in community garden with other individuals can bring about conversation about food access and insecurity that some people may never have experienced or thought about on a deep level. These types of interactions and connections with people can help to internalize social knowledge and foster positive action. Confronting the complex contentions between sustainability and equity can help foster the development of moral dispositions of care, which make for stronger communities and healthy relationships throughout life.

Recommendations: Relevant Factors in Developing Programs

General

To start out the Recommendations section of the guide, there are a few general insights gained from various research studies and other nature preserves that will be helpful to keep in mind. One of the most fundamental things to keep in mind when planning programming for Sylvan Dell is to adapt programs, regardless of the type (see Program for Sylvan Dell spreadsheet), based on the specific ecosystems and organisms present on the site (Lehigh County). Sylvan Dell is a very special place given its history of conventional agriculture and the legacy of Robert Porter Allen, and these unique attributes will enhance the learning that can be achieved through educational, scientific, and recreational engagements. Tailoring programs to the attributes of the site, such as the presence of the beavers and dams, the wetland ecosystem, the geology of the

nearby ridge, and the histories of farming and Native American tribes will provide those who come to the sight with more tangible understandings of conservation and sustainability. On a more organizational note, the programming plans of other nature preserves in Pennsylvania, such as the Trexler Nature Preserve, suggest that the frequency of activities and programs is to some degree dependent on the time of year and seasonal changes. The majority of activities, unsurprisingly, should occur between the months of June-August, with May, September, and October also having a fairly high frequency of events. However, as will be discussed in the Diversity, Inclusion & Accessibility section, there are also other considerations to be taken into account when determining when to hold programs.

Another recommendation that arose from the research is that in order to stay true to the goals of the site and maintain consistency, it is an important step in strategic planning to outline a specific mission statement and accompanying core values for what exactly is to be gained out the programs that are run. This can come in several different forms. On one hand, it is important for the leadership of the nature preserve to establish core values for those who will be designing and running each particular program, such as partnership as a key to success, integrity, accountability, openness, and results-driven work (Western Pennsylvania Conservancy). In another sense, it is important to identify and outline the desired outcomes of the programs for both the community and those who participate in them. From the information available now, it is clear that Sylvan Dell has particular long-term goals that are steering the direction of the project, such as connecting the Williamsport area to the natural spaces in and around Sylvan Dell. Keeping these in mind throughout the process will help maintain continuity and the achievement of these goals and long-term regional impact.

Engaging with People of Different Ages

A second major theme that arose out of the various recommendations for program implementation was the idea that there are different ways to engage with people of different ages in terms of programs. In order to have the greatest impact on the surrounding community, the programs that are held must appeal to every age range, as outdoor engagement, recreation, and education are critical for people of all ages. In order to engage every generation, particular care must be taken to expand the programming list to include a variety of interests and dynamic communication is critical to ensure that the knowledge of the programs is actually reaching every age (Western Pennsylvania Conservancy). In other words, multi-faceted marketing and distribution of information will be absolutely necessary if this goal is to be achieved.

Specializing programs for different generational interests is extremely important, but it is also important to recognize the vast differences between children of all ages. Because development occurs so rapidly in younger years, the programming tailored towards children will have to be highly diversified as well. From the research, it seems that generally children's activities and educational programs are divided between pre-K ages (5 and under), ages ~6-8, ages ~8-11, and 12 and older. Some nature preserves and research studies also show programs being restricted to high school aged children only, but that is largely dependent on the content of the activities. Programs that are more educational and/or research-oriented are more divided simply

because of knowledge gaps that may exist, whereas recreational and work-oriented programs are less divided. Children under the age of 8 are typically more engaged with programs that are centered around structured play, art projects, reading, math connections, and general ecological concepts, while children who are older are more engaged with programs that involve gaining recreational skills, data collection, analysis, conducting special projects, and more complex ecological concepts (DCNR). Another helpful recommendation discovered throughout the research process was the idea of providing places for children to simply sit outside and be engaged with nature while reading or thinking. More specifically, creating naturally-immersed seating areas utilizing materials such as tree logs, log benches, or stone seats can be excellent places to allow children to sit and explore on their own, or to hold programs and educational sessions (ECLKC).

Diversity, Inclusion & Accessibility

The third major theme that is critical for programming implementation is to include concerns about whether or not the programs and general structure of the nature reserve are set up in a way that is as inclusive as possible for all community members. One major recommendation in this aspect is to have as many programs as possible be free to the public (Lehigh County). Obviously funding for programs will be a concern, but requiring payment for access to programs discriminates against people of lower socioeconomic status and prohibits their ability to enjoy and learn about nature. Pennsylvania Recreation Plans provide several other recommendations for providing opportunities for everyone to access outdoor spaces, such as improving park access for cultural events, improving marketing and messaging to reflect the diversity of outdoor recreation participants, and improving ADA accessibility in the trails and activities that are offered (DCNR). Furthermore, it is important to examine any displays in the reserve for cultural inconsistencies and biases. Another consideration to take into account is related to the varying ages of participants in programs. Some children cannot afford to partake in non-free programs, while others may need somewhere to go after school because their parent(s) work. There are a multitude of situations that people live with that may restrict their ability to engage in programs, so a good way to combat this is to offer many different schedules of programs for younger individuals. Holding multi-day summer camps, single-day summer camps, home-school summer programs, single-day camps throughout the year, and after-school programs would be a great was to combat this problem (DCNR).

Something incredibly important in being able to achieve inclusivity and accessibility in the future reserve is to incorporate community members in the planning, execution, and running of programs. Not only including people who that reserve will impact, but also making sure that those included in this process are from multiple backgrounds within the community and that they are able to represent a diversity of perspectives on how the programs are run (Western Pennsylvania Conservancy). The ultimate goal of Sylvan Dell should be to provide a safe and engaging place for people in the Williamsport area to learn about and spend time in nature. If this is only true for a small segment of the population, then that goal has not been achieved. A way to go about gaining multiple perspectives would be to create and send out surveys or conduct focus groups when programming development is beginning that are designed to reach

as many members of the community as possible. This does not mean to tokenize the responses and identities of people who participate, but to make sure that the insights gained are not all coming from the same groups of people.

Community Garden

Community Garden	Contact Information
Lewisburg Community Garden Ogren Alley, Lewisburg, PA 17837	Jen Schneidman Partica, garden coordinator jsp030@bucknell.edu 570-577-2212 https://lewisburgcommunitygarden.blogs.bucknell.edu/ https://www.facebook.com/lewisburggarden/
Bucknell University Farm	Jen Schneidman Partica, farm coordinator jsp030@bucknell.edu 570-577-2212 https://www.bucknell.edu/life-bucknell/sustainability/bucknell-farm https://www.facebook.com/pages/category/Farm/Bucknell-University-Farm-234761477245517/
East Snyder Community Garden 971 University Ave, Selinsgrove, PA 17870	(570) 374-1525 escgpa@gmail.com https://escg.shutterfly.com/
Union County Community Garden 480 Hafer Rd, Lewisburg, PA 17837	(570) 524-3894 https://www.unioncountypa.org/departments/community-garden/community-garden/page.aspx?id=1596

Included here is a list of comprehensive guides for establishing a community garden that will be of use when beginning to implement a garden on the Sylvan Dell property:
https://www.extension.iastate.edu/blackhawk/sites/www.extension.iastate.edu/files/blackhawk/community_garden_start-up_guide.pdf
http://celosangeles.ucdavis.edu/files/97080.pdf
https://anrcatalog.ucanr.edu/pdf/8499.pdf
https://search-proquest-com.ezproxy.bucknell.edu/docview/1668227157/abstract/4A0DD5E467694135PQ/1

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“State Outdoor Recreation Plan.” *Pennsylvania Department of Conservation & Natural Resources*, https://www.dcnr.pa.gov:443/Recreation/PAOutdoorRecPlan/Pages/default.aspx.

ECLKC. *Nature-Based Learning and Development | ECLKC*. https://eclkc.ohs.acf.hhs.gov/learning-environments/article/nature-based-learning-development.

Head Start Body Start. *Head Start Body Start Infant and Toddler Outdoor Play Space Assessment*. https://eclkc.ohs.acf.hhs.gov/sites/default/files/pdf/infant-toddler-play-space-assessment.pdf.

Lehigh County. *Environmental Education*. https://www.lehighcounty.org/Departments/Parks-And-Recreation/Environmental-Education.

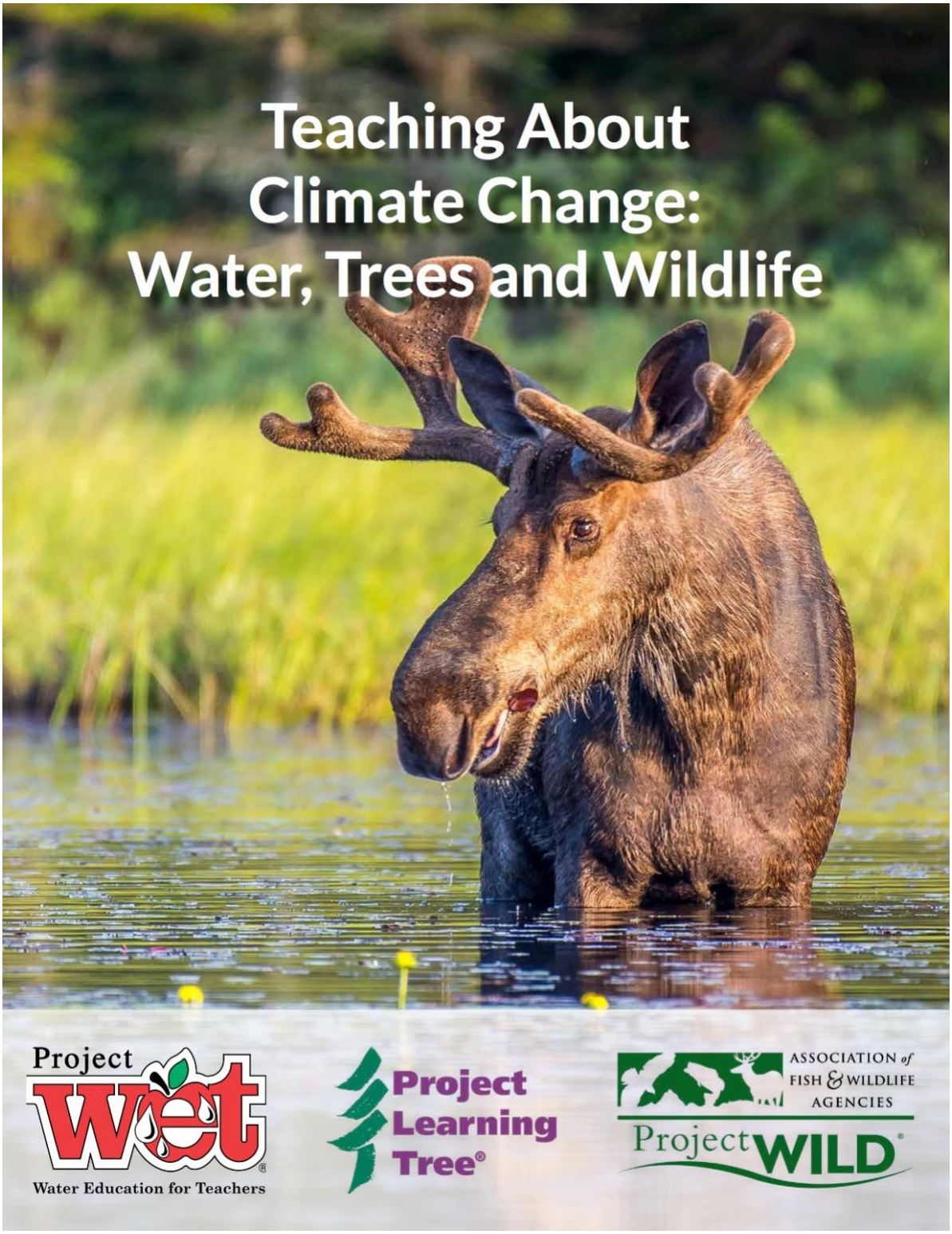
Nimmo, John, and Beth Hallett. *Childhood in the Garden: A Place to Encounter Natural and Social Diversity | ECLKC*. *eclkc.ohs.acf.hhs.gov*, https://eclkc.ohs.acf.hhs.gov/learning-environments/article/childhood-garden-place-encounter-natural-social-diversity.

The Natural Learning Initiative. *Affordable Settings and Elements: Ideas for Cost Effective Solutions | ECLKC*. *eclkc.ohs.acf.hhs.gov*, https://eclkc.ohs.acf.hhs.gov/learning-environments/article/affordable-settings-elements-ideas-cost-effective-solutions.

Western Pennsylvania Conservancy. *Western Pennsylvania Conservancy 2018-2020 Strategic Plan*. https://waterlandlife.org/wp-content/uploads/2018/02/WPC-2018-2020-Strategic-Plan.pdf.

Appendices

Appendix I



A note to educators

Climate change is a complex topic that can be intimidating to teach. However, understanding climate, including the ways it is changing and how that impacts the environment, is crucial to making informed decisions and building resilience. Environmental education is not isolated to water, forests or animals. It connects everything.

The resources listed in this document are meant to help you teach about climate change in a holistic way. They will provide your students with engaging educational experiences that will help them understand climate resiliences for communities and the environment.

As leaders in environmental education, Project Learning Tree, Project WET, and Project WILD provide hands-on activities that match each of our respective area of expertise. Each lesson is a stand-alone activity and can be taught modularly. We encourage you to form a lesson plan that fits in with your teaching plans, using lessons from all three of our organizations to teach about the impacts of climate change on water, forests and animals. We hope these lessons will inspire you and your students to develop innovative solutions to address challenges that are arising as a result of climate change.

We invite you to learn more about our organizations and the unique climate changes initiatives we are working on by visiting our websites:

Project WET
www.projectwet.org
www.projectwet.org/climate

Project Learning Tree
www.plt.org/
www.plt.org/news/teaching-climate-change/

Project WILD
www.projectwild.org
https://www.fishwildlife.org/afwa-inspires/project-wild/wildlife-climate

Project WET Activity	Publication	Summary for Use	K-2	3 - 5	6 - 8 (MS)	9 - 12 (HS)
9 custom WET activities about climate change	*Climate, Water and Resilience* Educators Guide	Project WET's newest Educator Guide, *Climate, Water and Resilience*, contains nine activities to teach students the fundamental of climate change and its impacts on the ocean, communities, aquatic species, plants, disease and more. This guide also contains background information in the front of the guide to help educators better understand climate change and resilience.			•	•
8-4-1, One for All	*Guide 2.0.* Adapted climate change version for *Guide 2.0* available in *Using Project WET to Teach Climate Resilience* Lesson Plan	Students will analyze eight water users and how climate change will impact these users and the community, coming up with a plan to help solve water challenges related to climate change. Create additional climate change obstacles for students as they move water through communities.		•	•	•
Blue River	*Project WET Curriculum and Activity Guide 2.0*	Find local streamflow data on USGS website to look at historical flow over time. https://waterdata.usgs.gov/nwis/sw (View the tutorial here.)		•	•	
Color Me a Watershed	*Project WET Curriculum and Activity Guide 2.0*	Through interpretation of maps, students observe how development can affect a watershed. This activity can be extended to look at how predicted vegetation changes due to changing climate may affect the hydrology of watersheds, as well as current mass changes in watershed land use types due to large wildfires.		•	•	•
Dirt to Dinner	Free to Download at store.projectwet.org. Also available in *Using Project WET to Teach Climate Resilience* Lesson Plan.	Students learn how water moves into, through and out of soil in a whole-body simulation to model water with soil, ground water, atmosphere and plants interactions taking into account changing precipitation and temperatures.			•	
Discover the Waters of Our National Parks	*Project WET Curriculum and Activity Guide 2.0*	Explore how a changing climate will affect our National Parks.		•		
Get the Groundwater Picture	*Project WET Curriculum and Activity Guide 2.0*	Students learn about basic ground water principles as they create their own geologic cross section or Earth window. Use ***Part III*** of this activity to address how a changing climate adds to the problem of use and recharge. Find local data from USGS to localize: https://waterdata.usgs.gov/nwis/sw			•	
High Water History	*Guide 2.0.* Adapted climate change version for *Guide 2.0* available in *Using Project WET to Teach Climate Resilience* Lesson Plan	The Annual Exceedance Probability (AEP), or the percent likelihood of a flood to occur, helps people to better understand 10-, 100- and 500-year floods, especially as the likelihood for major floods is expected to increase in many areas of the U.S.			•	

1

Project WET Activity	Publication	Summary for Use	K-2	3 - 5	6 - 8 (MS)	9 - 12 (HS)
Invaders!	Updated Version available on Water Education Portal (accessible with *Guide 2.0*). Also available on Project WET's store (store.Projectwet.org)	How do warming waters affect native species and the influx of invasive species? Will existing native or invasive species in your area thrive with warmer waters or will you see new invasive species entering local waterways?			•	•
Macroinvertebrate Mayhem	*Project WET Curriculum and Activity Guide 2.0*	Macroinvertebrates can help indicate the changes in stream conditions that result from climate change. What stressors may occur due to changing water temperatures or rising/ falling water levels?		•		
Nature Rules!	*Project WET Curriculum and Activity Guide 2.0*	With warming oceans and the increasing greenhouse effect, changes are triggered in the jet stream and precipitation patterns to bring more frequent weather extremes to areas across the globe. Students will simulate a TV newscast through role-play that is dominated by the extreme weather events and will communicate the underlying influence on those events.			•	
Ocean Habitats	*Project WET Curriculum and Activity Guide 2.0*	Look at rising ocean temperatures and changes in acidification of the oceans—how will these changes impact the different zones and organisms in them? Students may also look at how the ocean acts as a sink for CO_2, changes in pH and the effect on calcium uptake for shell development.			•	
Piece It Together	*Project WET Curriculum and Activity Guide 1.0*	Students analyze and plot global temperature and precipitation distributions to determine climate patterns and how they influence human lifestyles. Focus on how patterns are changing or are predicted to change. What effect will climate change have on lifestyles?		•	•	
Snow and Tell	*Project WET Curriculum and Activity Guide 2.0*	This activity looks factors that influence the rate of snow melt. Examine how these factors are impacted by a warming planet. What does this mean for seasonal and annual stream flow?		•	•	•
Stormwater (Storm Water)	*Guide 2.0.* Adapted climate change version for Guide 2.0 available in *Using Project WET to Teach Climate Resilience* Lesson Plan	Students can consider how climate change is impacting their city or town, and learn what other cities in the United States are doing to build community resilience.		•	•	
Super Sleuths	*Guide 2.0.* Adapted climate change version for Guide 2.0 available in *Using Project WET to Teach Climate Resilience* Lesson Plan	Use this activity to teach about waterborne diseases and water related vector diseases in a changing climate. How can a changing climate affect the spread of these diseases?			•	•

2

Project WET Activity	Publication	Summary for Use	K-2	3 - 5	6 - 8 (MS)	9 - 12 (HS)
The Breathing Boreal Forest	Free to Download at store.projectwet.org. Also available in *Using Project WET to Teach Climate Resilience* Lesson Plan.	In this activity students play the role of coniferous trees. First they learn about seasonal freeze/thaw cycles and dormancy through a game of tag. Students then juggle complex environmental factors to try to survive a growing season in a changing climate. Connections between freeze/thaw cycles, photosynthesis and the global carbon cycle are explored.			•	
Water Address	*Project WET Curriculum and Activity Guide 1.0*	Students identify plants and animals and their habitats by analyzing clues that describe water-related adaptations of aquatic and terrestrial organisms. Examine how climate change is affecting these organisms.		•	•	
Water Concentration	*Project WET Curriculum and Activity Guide 1.0*	Through the familiar game of Concentration, students make connections between modern and past water use practices and discuss how attitudes toward water changed as water use practices evolved. Use a basic engineering extension – What do students think the next generation of home water technology will be in a changing climate?		•	•	
Water Messages in Stone	*Project WET Curriculum and Activity Guide 1.0*	Students replicate rock paintings and carvings to learn about ancient cultures' relation to water and to create their own water-related expressions. What messages were past cultures trying to say, especially in relation to water? Try this with etching on sandpaper our current relationship with water. Imagine what human's relationship with water will be in the future.		•		
Wet Vacation!	*Project WET Curriculum and Activity Guide 1.0*	Analyze temperature and precipitation trends over the last 50-100 years locally and/or at vacation spots. Use USGS data to add evidence: https://waterdata.usgs.gov/nwis/sw. What will these vacation spots look like in the future?		•	•	

PLT Activity	Publication	Summary for Use	K-2	3 - 5	6 - 8 (MS)	9 - 12 (HS)
1: Stepping through Climate Science	*Southeastern Forests and Climate Change*	Students walk along a timeline of climate science and policy initiatives and then explore connections between forests and climate.				•
2: Clearing the Air	*Southeastern Forests and Climate Change*	After an introduction to the evidence of climate change, students explore common confusions and role-play a community discussion with the goal to reach consensus on strategies to reduce greenhouse gas emissions.				•
3: Atlas of Change	*Southeastern Forests and Climate Change*	Students are introduced to climate modeling to understand past changes and project future possibilities, and then use web resources to consider how forest ecosystems might change over the next 100 years.				•
4: The Changing Forests	*Southeastern Forests and Climate Change*	Students review how scientists are monitoring forest changes and exploring adaptive strategies to keep forests healthy.				•
5: Managing Forests for Change	*Southeastern Forests and Climate Change*	Students develop and use a systems diagram to model a forest so they can advise a forest landowner how to manage a pine plantation in light of climate projections.				•
6: Mapping Seed Sources	*Southeastern Forests and Climate Change*	Across the native range of loblolly pine, variations in genotype create trees that may do better under new climatic conditions. This activity helps students analyze data from three trials to determine the origin of the seeds.				•
7: Carbon on the Move	*Southeastern Forests and Climate Change*	Students become familiar with the carbon cycle and pathways that increase and decrease atmospheric carbon.				•
8: Counting Carbon	*Southeastern Forests and Climate Change*	Students measure trees near their schools and calculate the amount of carbon stored in individual trees. Students then compare the carbon sequestration potential for land-use types in their state, compare this to the estimated amount of carbon released by human activities, and discuss forests' ability to sequester atmospheric carbon.				•
9: The Real Cost	*Southeastern Forests and Climate Change*	Through a simulated shopping activity, students learn about the impact, or externalities, of consumer choices on the environment.				•
10: Adventures in Life Cycle Assessment	*Southeastern Forests and Climate Change*	Students investigate life cycle assessment data for three types of outdoor dining furniture to determine which type would generate the lowest amount of greenhouse gases. This detailed analysis of inputs and outputs is another tool for systems thinking.				•
11: Life Cycle Assessment Debate	*Southeastern Forests and Climate Change*	Students debate four pairs of similar products to develop their own sets of questions about product life cycles that can help guide consumer choices.				•
12: The Carbon Puzzle	*Southeastern Forests and Climate Change*	Students use a series of facts to realize how forest plantations, wood products, and wood substitution can reduce atmospheric carbon, and then interpret a graph published by the researchers who explored this concept.				•

PLT Activity	Publication	Summary for Use	K-2	3 - 5	6 - 8 (MS)	9 - 12 (HS)
13: Future of Our Forests	*Southeastern Forests and Climate Change*	Student teams review information from the module and share their knowledge with an appropriate audience.				•
14: Starting a Climate Service-Learning Project	*Southeastern Forests and Climate Change*	Students select and complete an action project to mitigate climate change or help their communities adapt to projected changes.				•
28: Air Plants	*PreK-8 Environmental Education Activity Guide*	This activity helps students understand the process of photosynthesis and how people and plants depends on this process for oxygen.		•	•	
39: Energy Sleuths	*PreK-8 Environmental Education Activity Guide*	Students learn about the different sources of energy, advantages and disadvantages to their use, and how energy is used in their daily lives, allowing them to access the relationship between their energy use and CO2 emissions.	•	•	•	
48: Field, Forest, and Stream	*PreK-8 Environmental Education Activity Guide*	In this field investigation, students compare three different environments to see how nonliving elements (sunlight, temperature, soil moisture, wind, and water flow) affect living elements in an ecosystem.	•	•	•	
73: Waste Watchers	*PreK-8 Environmental Education Activity Guide*	Students conduct an audit of the energy they use in their homes and create an action plan to reduce energy use.		•	•	
81: Living with Fire	*PreK-8 Environmental Education Activity Guide*	Students learn about the three elements a fire needs to burn and find out how an understanding of this "fire triangle" can be used to both prevent and manage wildland fires. They could also focus on the impact of climate change on the frequency of wildland fires.		•	•	
84: The Global Climate	*PreK-8 Environmental Education Activity Guide*	Using data collected from Mauna Loa, students graph changes in atmospheric CO2 over a 46-year period, and identify possible reasons for those changes. They also learn about the relationships between CO2 and the Earth's climate, and explore ways to reduce the amount of CO2 they generate.			•	
85: In the Driver's Seat	*PreK-8 Environmental Education Activity Guide*	Students keep a log of their family's transportation for a week, then explore fuel conservation and energy efficiency by modeling the distance they can travel using different vehicles.		•	•	
86: Our Changing World	*PreK-8 Environmental Education Activity Guide*	Students make a graphic organizer connecting natural resources, energy, and human activities. They also research a global issue, such as climate change, to gain an understanding of issues facing us today as a global society.		•	•	
88: Life on the Edge	*PreK-8 Environmental Education Activity Guide*	Students model what happens when habitat is altered either naturally or by humans, and create public relations campaigns on behalf of endangered plants or animals. They could focus their study on issues related to climate change.		•	•	
95: Did You Notice?	*PreK-8 Environmental Education Activity Guide*	Students study changes in their local environment over short and long time periods and identify patterns of change.	•	•	•	

5

PLT Activity	Publication	Summary for Use	K-2	3 - 5	6 - 8 (MS)	9 - 12 (HS)
1: What Is Climate?	Carbon & Climate E-Unit	Students explore the concept of climate as they examine global climate patterns and the relationship between temperature, precipitation, and the world's forests.			•	
2: The Carbon Cycle	Carbon & Climate E-Unit	Students model the movement of carbon atoms in the carbon cycle and explore the relationship between atmospheric carbon and plants.			•	
3: Is It Only Natural?	Carbon & Climate E-Unit	Students examine various factors that have caused climate change in the past, analyze carbon dioxide levels over time, and construct a claim, supported with evidence and reasoning.			•	
4: Climate Time Machine	Carbon & Climate E-Unit	In this project-based learning activity, students explore the geologic history of a particular region of the world to see how past climatic changes have altered the landscape. Students create museum exhibits to model what earlier climate patterns can reveal about current global temperature trends.			•	
5: Are You a Big Foot?	Carbon & Climate E-Unit	After examining projections for different forest regions in the United States, students use a carbon footprint calculator to analyze their personal contribution to carbon dioxide levels in the atmosphere and design a solution for reducing their carbon footprint.			•	
6: Seeking Sustainability: A Global Response	*Forests of the World*	Students consider possible indicators that a forest is sustainable and learn what is being done locally and in other countries to determine whether forests are managed in a sustainable way. They could focus their study on issues related to climate change.				•
3: Monitoring Forest Health	*Green Jobs*	Through a variety of health indicators, learners assess the health of a forested area, and see how soil scientists, wildlife biologists, arborists, and other forest professionals monitor forests. They could focus their assessment on climate change effects.			•	•
4: Seeking Sustainability	*Green Jobs*	Learners explore the concept of sustainability by examining the United Nations' 17 Sustainable Development Goals, while also taking a look at some jobs involved in ensuring forest sustainability. They could focus their examination on issues related to climate change.			•	•
1: Tree Benefits and Identification	Teaching with i-Tree	Using an online tool, students quantify the benefits that trees provide, including carbon storage.			•	•
3: Land Manager Role Play	Teaching with i-Tree	Students develop a plan for increasing the number of trees on school grounds based on identified goals. Students could base their plan around reducing carbon emissions.			•	•
Energy	GreenSchools Investigations	In this student-driven investigation, students investigate how much energy their school uses, the main sources of energy for the school, and ways to implement energy-saving strategies.		•	•	•

6

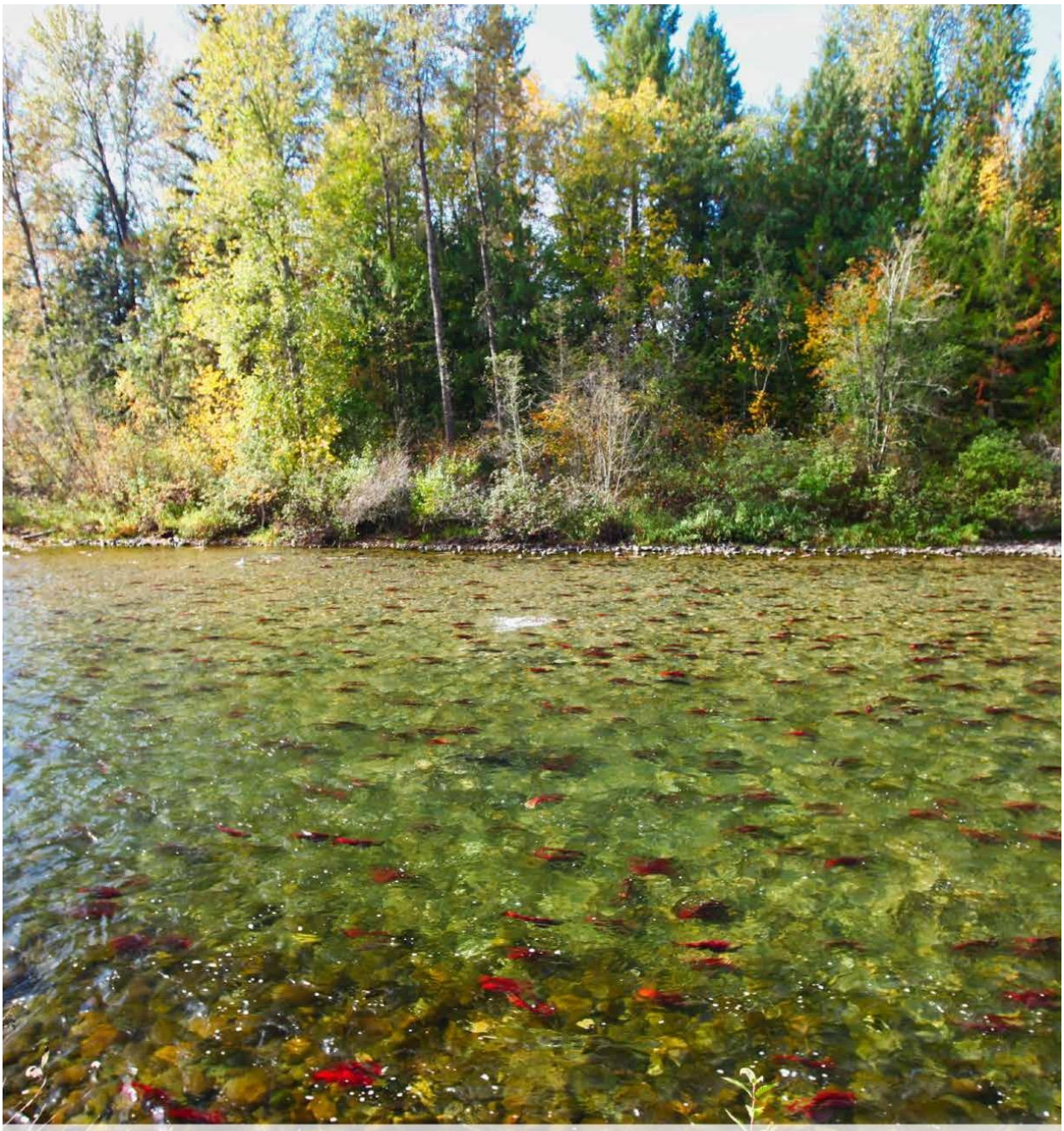
Project WILD Activity	Publication	Summary for Use	K-2	3 - 5	6 - 8 (MS)	9 - 12 (HS)
Note for review:	Activity already helps students draw direct connections between climate change and wildlife					
	Existing extension addresses climate change					
	Includes suggestion for adapting or extending the activity to address climate change					
Aquatic Times	*Aquatic WILD K-12 Curriculum & Activity Guide*	Create an aquatic themed newspaper by conducting research and writing articles on aquatic-related issues for a classroom newspaper. Students could focus on climate change and impacts to aquatic ecosystems.			•	•
Conservation Messaging	*Aquatic WILD K-12 Curriculum & Activity Guide*	Create public service announcements to educate the community about threats to aquatic wildlife and actions citizens can take to help address issues. Students could focus on climate change impacts, adaptation, and mitigation.			•	•
Hooks and Ladders	*Aquatic WILD K-12 Curriculum & Activity Guide*	Move through a migration obstacle course to simulate the limiting factors that salmon endure during their life cycle. Include an option to mimic climate change impacts, such as decreased habitat due to rising stream temperatures in some areas. Narrow the playing area where the predators are located.			•	
Migration Headache	*Aquatic WILD K-12 Curriculum & Activity Guide*	Simulate the migration of water birds by "flying" through an obstacle course to understand the limiting factors birds experience during their journey. Add a climate related-scenario, e.g.: Sea level rise means less freshwater wetland habitat is available to provide food. Remove one "habitat haven" from the wintering habitat.			•	
Pond Succession	*Aquatic WILD K-12 Curriculum & Activity Guide*	Create murals to illustrate the ecological succession of a pond over time. For a climate extension, discuss how warming temperatures will cause various habitats to change over time.			•	
Turtle Hurdles	*Aquatic WILD K-12 Curriculum & Activity Guide*	Simulate the migration of sea turtles by migrating through an obstacle course to understand the limiting factors sea turtles experience during their journey. For a climate extension, mark the nest zone clearly with a rope circle, or using paper plates that students must stand on. While the turtles are migrating, decrease the size of the nest zone to represent sea level rise reducing the area available for nesting sites. Turtles who return and cannot find space in the nest zone die without reproducing.		•	•	
Bird Hurdles	*Flying WILD: An Educator's Guide to Celebrating Birds*	Navigate your way through an obstacle course to understand the dangers wild birds face. After one round, in the "Hunt for Your Home" shrinking habitat part, remove a hoop and place the remaining hoops a bit further apart. Climate change has made some breeding and wintering areas no longer suitable. Can the birds adapt?		•	•	

Project WILD Activity	Publication	Summary for Use	K-2	3 - 5	6 - 8 (MS)	9 - 12 (HS)
A Dire Diet	*Project WILD K-12 Curriculum & Activity Guide*	Become wildlife and experience possible consequences of pesticide accumulation in the environment, then investigate the effectiveness of regulations to control pesticide use. See the In Step with STEM extension for a climate connection.			•	
A Home Away from Home*	*Project WILD K-12 Curriculum & Activity Guide*	Design a zoo habitat that provides all the necessary elements for a polar bear to survive in Phoenix. As habitats change due to global warming, animals will have to move or adapt in order to find food, water, shelter, and space. Are any animals in your state becoming more rare or more prevalent as their ranges shift? What habitat changes might be causing this? See the In Step with STEM extension for more climate connections.			•	
A Picture Is Worth a Thousand Words	*Project WILD K-12 Curriculum & Activity Guide*	Analyze pictures over time to explore how scientific knowledge and technological advancements change attitudes toward wildlife. Include pictures that relate to climate change (species impacted, technology used to study climate change) to discuss complexities of managing wildlife in a changing climate.			•	•
Back from the Brink	*Project WILD K-12 Curriculum & Activity Guide*	Read about the American alligator, black-footed ferret, and gray wolf and examine issues related to the decline and recovery of threatened and endangered species. See In Step with STEM for a climate connection.				•
Bat Blitz*	*Project WILD K-12 Curriculum & Activity Guide*	Simulate bats feeding on insects and perform calculations to learn about one of the roles bats play in an ecosystem. For a climate extension, perform variation 5. Discuss how temperature affects food availability. How might warmer winter temperatures impact the bat population and behavior?		•	•	
Birds of Prey**	*Project WILD K-12 Curriculum & Activity Guide*	Interpret data on wildlife populations and climate to recognize the interdependence of a healthy, functioning ecosystem.				•
Bottleneck Genes	*Project WILD K-12 Curriculum & Activity Guide*	Using a bottle, colored beads, and environmental scenario cards, investigate how genetic diversity within a population affects a species' ability to adapt and survive. See the In Step with STEM section for a climate connection.			•	•
Carrying Capacity	*Project WILD K-12 Curriculum & Activity Guide*	Participate in a relay to see how food abundance or scarcity affects the carrying capacity of an ecosystem. In step 7, discuss ways climate change has impacted or might impact the carrying capacity for various species in a given habitat.				•
Checks and Balances	*Project WILD K-12 Curriculum & Activity Guide*	Acting as wildlife managers, students play a card game and perform calculations to understand factors affecting a herd of animals. Encourage students to consider climate change impacts and mitigation strategies on their condition and management scenario cards.			•	

Project WILD Activity	Publication	Summary for Use	K-2	3 - 5	6 - 8 (MS)	9 - 12 (HS)
Eco-Enrichers	*Project WILD K-12 Curriculum & Activity Guide*	Design and conduct an experiment to investigate soil types and organisms found in soil. Soil is an important part of the carbon cycle. Taking good care of soil can increase the soil's capacity to absorb atmospheric carbon that contributes to global warming. See extension 3 to learn about composting and building up healthy soil. Does adding compost to a soil sample impact the results of the investigation? How so?			•	•
Ecosystem Architects	*Project WILD K-12 Curriculum & Activity Guide*	Design an ecosystem restoration project to improve habitat and biodiversity in a fictional scenario. See extension 4 for a climate connection.			•	•
Fire Ecologies*	*Project WILD K-12 Curriculum & Activity Guide*	Carry out an investigation of burned and unburned habitat areas to evaluate the positive and negative effects fire has on wildlife and habitat. See extension 3 for a climate connection.				•
Food Footprint*	*Project WILD K-12 Curriculum & Activity Guide*	Construct a flow diagram to trace the origins of food sources, consider impacts of production, and recommend improvements.			•	•
Forest in a Jar	*Project WILD K-12 Curriculum & Activity Guide*	Conduct a simple investigation using a jar, soil, water, seeds, and a plant to explain the process of ecological succession. See the second STEM bullet to explore how varying moisture impacts the plant communities. Look online for long-term precipitation trends in your area. How might changes in precipitation levels from year to year impact succession?			•	•
Graphananimal	*Project WILD K-12 Curriculum & Activity Guide*	Tally the diversity of animals on a nature walk to compare different environments. For young learners, this activity can help lay the groundwork for future understanding of climate change impacts on wildlife.	•			
Habitat Heroes	*Project WILD K-12 Curriculum & Activity Guide*	Take action in your community by designing and completing a habitat improvement project. See extension 1 for climate connections.		•	•	•
Here Today, Gone Tomorrow**	*Project WILD K-12 Curriculum & Activity Guide*	Identify reasons that wildlife become vulnerable to extinction and assess the vulnerability of various species.			•	•
Keeping Cool	*Project WILD K-12 Curriculum & Activity Guide*	Use thermometers in an investigation to explore how reptiles adapt to temperature changes. Look online for long-term temperature data in your area. Do you notice any trends? How might changes in average temperatures from year to year impact the reptiles in your area?		•		
Let's Talk Turkey	*Project WILD K-12 Curriculum & Activity Guide*	Using background information cards, construct a timeline chronicling societies' historical use of the wild turkey. See In Step with STEM for a climate extension.		•	•	
Limiting Factors: How Many Bears?	*Project WILD K-12 Curriculum & Activity Guide*	Simulate bears gathering habitat components to determine limiting factors for the given population. See extension 4 for a climate connection.		•	•	

Project WILD Activity	Publication	Summary for Use	K-2	3 - 5	6 - 8 (MS)	9 - 12 (HS)
Migration Barriers	*Project WILD K-12 Curriculum & Activity Guide*	Using a real-life example, make recommendations based on the consequences of developing a highway through a deer migration path. See extension 3 for a climate connection.			•	•
Monarch Marathon*	*Project WILD K-12 Curriculum & Activity Guide*	Students simulate the multi-generational monarch butterfly migration and experience the limiting factors affecting monarch survival. See extension 3 for a climate connection.		•	•	
Muskox Maneuvers	*Project WILD K-12 Curriculum & Activity Guide*	Simulate adaptations in predator and prey relationships in a game of "flag tag." See extension 1 for a climate connection.		•	•	
Natural Dilemmas	*Project WILD K-12 Curriculum & Activity Guide*	Read hypothetical dilemmas concerning wildlife and the environment, and discuss different courses of action based on one's values and beliefs. Be sure to include the cards connected to climate change and greenhouse gas emissions: pg. 300 bottom left and right, pg. 301 middle left and right and bottom left, pg. 302 top right, pg. 303 bottom right - create your own!			•	•
Oh Deer!	*Project WILD K-12 Curriculum & Activity Guide*	Students become deer and habitat components in a physical activity that demonstrates population fluctuations, carrying capacity, and limiting factors. Include a couple of rounds with examples of how carrying capacity is affected by climate change. For example, warmer winter temperatures may increase the carrying capacity of a habitat for white-tailed deer (longer growing season). The same warm winters may decrease the habitat's carrying capacity for moose as the warmer temperatures allow ticks to thrive (parasitism), to the detriment of the moose calves.		•	•	•
Phenology at Play**	*Project WILD K-12 Curriculum & Activity Guide*	Perform skits and graph data to understand effects of climate change on phenology and a migratory bird population.			•	•
Raindrops and Ranges*	*Project WILD K-12 Curriculum & Activity Guide*	Create digital maps to explore interrelationships among rainfall, vegetation, and wildlife species.			•	•
Smokey Bear Said What?	*Project WILD K-12 Curriculum & Activity Guide*	Create a mural to illustrate an ecosystem before, during, and after a fire. After students complete the murals, discuss where and when carbon is stored and released in the mural. See STEM bullet three to further discuss fire and carbon.		•	•	
Surprise Terrarium	*Project WILD K-12 Curriculum & Activity Guide*	Make observations of live animals to learn about camouflage and adaptations that help animals survive. For young learners, this activity can help lay the groundwork for future understanding of climate change impacts on wildlife.	•			
The Power of Planning*	*Project WILD K-12 Curriculum & Activity Guide*	Create a concept map to evaluate various energy sources, and then advocate for an assigned form of energy production during a simulated city council meeting.			•	•

Project WILD Activity	Publication	Summary for Use	K-2	3 - 5	6 - 8 (MS)	9 - 12 (HS)
Time Lapse*	*Project WILD K-12 Curriculum & Activity Guide*	Create a diagram that depicts changes in species diversity as an ecosystem undergoes succession. Include extension 3 for a climate connection.		•	•	
To Zone or Not to Zone	*Project WILD K-12 Curriculum & Activity Guide*	Simulate a county commission meeting to understand the complexities of land-use planning and decision making. See extension 1; have students research and create a scenario that deals with zoning and climate change.			•	•
Water Mileage**	*Project WILD K-12 Curriculum & Activity Guide*	Perform calculations to understand how adaptations enable animals to survive in harsh environments. Include extension 2 to focus on impacts of climate change.			•	•
What Bear Goes Where?	*Project WILD K-12 Curriculum & Activity Guide*	Create posters of three different bear habitats to illustrate that animals are adapted in order to live where they do. For young learners, this activity can help lay the groundwork for future understanding of climate change impacts on wildlife.	•			
World Travelers	*Project WILD K-12 Curriculum & Activity Guide*	Plan and carry out an investigation in your schoolyard to identify native and nonnative plant populations, examining the positive and negative effects of their presence. Select extension 1 or 2 to observe changes over time. What ecological factors may account for the increase or decrease in non-native species? How could students design an experiment to test those factors?			•	•
*Activities with more direct connections to climate change.						
**Activities with the most direct connections to climate change						



Project WET
Water Education for Teachers

Project Learning Tree®

Association of Fish & Wildlife Agencies
Project WILD®

Appendix II

HEAD START BODY START INFANT AND TODDLER OUTDOOR PLAY SPACE ASSESSMENT

The **Head Start Body Start Outdoor Play Space Assessment for Infants and Toddlers** has been developed to assist Early Head Start and other early childhood programs assess the quality of outdoor play spaces for infants, toddlers, and twos. Using this tool will help identify the strengths and needs of an existing outdoor play space, and serve as a basis for setting priorities and for planning enhancements and improvements. It can also be used as a tool to help plan and design a new outdoor play space.

Directions: This tool is best utilized during a walk-through of a play space. The assessment is divided into eight categories, listed in the left-hand column. **For each of the eight categories**, consider the extent to which a play space meets the given criteria. Score the play space using the rating scale, defined below and found in the center column. Circle the number that best reflects the present state of the play space based on the criteria and examples for that category. Use the right-hand column to make additional comments, such as strengths, areas for improvement, high or low priorities, ideas, donation prospects, etc. **Note:** If you are using this tool to help plan a new play space, simply ignore the Rating Scale column.

Rating Scale: 1 = Not at all 2 = Somewhat 3 = Partially 4 = Mostly 5 = Fully

Category	Rating Scale	Comments
A. WELCOMING ENVIRONMENT: ***The overall environment is welcoming, inviting, and comfortable for infants, toddlers, and adults.*** CRITERIA: 1) **Welcoming/Inviting**: *Several of the following are present*: Garden; fountain or water feature; statue; gazing ball; local cultural artifacts; whimsical signs; fence weaving; children's art; murals; non-toxic (preferably native) plants, trees, shrubs; house; flag; banner; chimes; wind sock; pergola; weather vane; deck; patio; umbrella; or other welcoming and inviting features or objects. 2) **Comfort and Routines**: *Several of the following are present*: Drinking fountain; diaper-changing	1 2 3 4 5	

area; balance of shade and sun (trees, pergola, manufactured shade structures, open and sunny areas); sleeping/resting accommodations (mats, cots, portable cribs, quilts); places to sit, relax, rejuvenate (garden bench, porch swing, glider, outdoor chairs, vine teepee, small tent, pergola); division of spaces by activity (quiet/noisy, restful/active, wet/dry, messy/orderly); or other features that offer comfort.		
B. KEY FEATURES: ***The overall play area has a variety of manufactured and natural materials that provide developmentally and age-appropriate opportunities for infants, toddlers, and twos to experience a sense of freedom, discovery, exploration, creativity, innovation, and sensory stimulation.*** CRITERIA: 1) **Sense of Freedom**: *Several of the following are present:* Multi-purpose space; open grassy area; ride-on toy track with a variety of ride-on/wheeled toys; stepping stone path; climbing structure; steps; balls of varying sizes; sand area; balance beam; or other features that provide a sense of freedom and independence. 2) **Discovery/Exploration**: *Several of the following are available:* Bird house; bird feeder; water features (*bird bath, wading pool, recirculating fountain, dry stream bed with water pump, hose, sprinkler, mister)*;* vegetable or flower gardens; playhouse; sunflower house; gentle hills; or other features that offer discovery/exploration experiences. **** All water features require appropriate supervision.*** 3) **Creativity/Innovation**: *Several of the following are available*: A variety of topographical surfaces; a variety of work surfaces; building blocks; tree cookies; loose parts for building; balls; writing/painting/drawing/sculpture materials; colorful scarves; or other materials to encourage creativity and innovation. 4) **Sensory Stimulation** (touch, smell, taste, sound, and sight): *Several of the following are available:* Items for music/noise/acoustical play; CD player; wind chimes; talking tubes; light/shade contrasts; color combinations and contrasts; leaves, bark, twigs, pine cones; grass; herbs; flowers; edible plants and/or fruit trees; colorful tiles; or other features that provide age-appropriate stimulation and exploration with supervision.	1 2 3 4 5	
C. INTENTIONAL DESIGN: ***The overall play space reflects planning, management, and resourcing for curriculum implementation and ongoing child assessment on par with indoor play environments.*** CRITERIA: 1) **Planning**: The play space supports *all* infant and toddler developmental domains related to school readiness:		

• *Physical Development & Health*: The play space supports opportunities to practice healthy and safe habits and personal care tasks such as dressing, toileting, washing hands, following safety rules and routines, and resting/napping. ***(See also Category E: Movement and Motor Development).*** • *Social & Emotional Development*: The play space provides: **a**) Opportunities to demonstrate self-regulation and relationships (cozy, quiet niches where individual children can be alone or with an adult; calm, uncluttered environment;) accommodations for large group/small group socialization, peer to peer interaction, adult/child interaction, and individualized/private spaces (such as garden benches, porch swings, gliders, stumps, outdoor chairs, raised platform, bean teepee, playhouse, or other features that support socialization); **b)** Opportunities for solitary, parallel, and cooperative play (e.g., balls, bats, dramatic play props, outdoor stage, playhouse**,** or other features that support different *stages* of play); **c**) Accommodations that support different *types* of play (symbolic, rough-and-tumble, socio-dramatic, fantasy, role play, or other different types of play). • *Approaches to Learning*: The play space provides opportunities to demonstrate attention, curiosity, persistence, and cooperation. Several of the following are available: Balls; dramatic play materials; colorful scarves; playhouse; tree cookies; building blocks; natural growth; natural and manufactured loose parts; containers for collecting and moving objects; water; large locks and keys; digging tools; or other materials and features that support a variety of approaches to learning. • *Language & Literacy*: Examples of each of the following are included: Books; inviting spaces to read; mats; quilts; easels; writing tools; directional signs; children's names in print; or other play materials that support language and literacy. • *Cognition & General Knowledge*: The play space provides opportunities to learn and demonstrate: **a)** Logic, reasoning, and problem solving (with puzzles, water flow, weather vane, rain gauge, gates with latches, loft, etc.); **b)** Mathematics knowledge and skills (with natural and manufactured loose parts (for counting, sorting, sequencing, and comparing), signs with numerals, loose parts with variation in shapes and colors, etc.); **c)** Science knowledge and skills (with magnifiers, wind chimes, weather vane, living things, containers, rain gauge, garden tools, etc.); and **d)** Social studies knowledge and skills (with miniature roads, buildings, people/families, local/community artifacts, recycling bin, etc.).	1 2 3 4 5	
2) **Management**: The outdoor space is managed similarly to the indoor classroom, including oversight, changing of toys/materials, monitoring, and continuous improvement and enhancement to support optimal learning and development.	1 2 3 4 5	
3) **Resourcing**: The outdoor space – including equipment, materials, natural and created features – has multiple, varied, defined, and multi-use learning and development areas.		

D. NATURAL FEATURES: ***The overall play space allows and encourages children to connect with nature.*** CRITERIA: *Several of the following are apparent:* Planters; raised planting beds; bird feeder; bird house; trees for shade and climbing; umbrella; water (stream, bird bath, water hose, misters, sprinklers, water containers); flowering plants, edible fruits, vegetables; climbing vines; stumps; logs; boulders; tree cookies; long grass; pine cones; *acorns, pebbles, and/or shells*;* frogs; earthworms; bugs/insects; animals (as allowed by regulations); sand; twigs; dirt and mud; topographic variations (mounds, terraces, slopes); or other naturalized materials and features that connect children with nature. **** Small, natural, loose objects require closer supervision.***	1 2 3 4 5	
E. MOVEMENT AND MOTOR DEVELOPMENT : ***The play space supports progress in children's locomotion and traveling skills, balancing and non-locomotor skills, manipulative and object control skills, and fine motor strength and coordination skills.*** CRITERIA: 1) **Locomotion and Traveling Skills** <u>Infants</u>: The play space provides opportunities for movement, rolling over, crawling, scooting, sitting propped up, sitting with support, pulling up, and moving with music. *The play space includes several of the following*: Walking path; pull-up bar; push/pull toys; tunnel; vine teepee on grassy area; A-frame on grassy area; smooth logs; quilts; mats; outdoor carpet square; or other features that support the emerging locomotion and traveling skills of infants. Adults bring blankets outside to sit on the ground with non-mobile infants. <u>Toddlers and Twos</u>: The play space provides opportunities for moving, walking, running, hopping, jumping, marching, tiptoeing, tumbling, sliding, leaping, skipping, galloping, following the leader, riding. *The play space includes several of the following:* Push/pull toys; tricycles; wagons; wheelbarrow*;* wheeled toy track (with bridge, tunnel, traffic gate, photo directional signs, or variations in surface material); tree with low limbs and low step ladder; walking path; embankment slide; A-frame; vine teepee; or other features that support the emerging locomotion and traveling skills of toddlers and twos. 2) **Balancing and Non-locomotor Skills** <u>Infants</u>: The play space provides opportunities for "tummy time", sitting propped up, sitting without support, rolling, stretching, rocking back and forth on hands and knees, and reaching. *The play space includes several of the following*: Quilts; mats; manipulatives; pull-up bar on grassy surface; walking/crawling path; or other features that support infants' emerging mobility and balancing skills.	1 2 3 4 5 1 2 3 4 5	

Toddlers and Twos: The play space provides opportunities for turning, swinging, swaying, squatting, standing on tiptoe, stretching, bending, balancing, reaching, wiggling, twisting, turning, jumping off, getting in and out. *The play space includes several of the following:* Swings; low ramp; walking path; balance beam; rope ladder; stairs/steps; hopscotch tiles; tent; or other features that support toddlers' and twos' emerging balancing skills. 3) **Manipulative and Object Control Skills** Infants: The play space provides opportunities for reaching, grasping, throwing, splashing, and releasing. *The play space includes several of the following:* Manipulatives/toys of different weights, textures, sizes, colors, and shapes; balls of varying sizes; small containers for water; or other materials that support infants' gross motor and manipulative skills. Toddlers and Twos: The play space provides opportunities for throwing, underhand tossing, striking with body and with implements, pushing, catching, kicking, rolling, carrying, collecting, pedaling, transferring objects, making movement in a variety of directions/speed/levels. *The play space includes several of the following:* Bean bags; scarves; pine cones; tires/wheels; balls of various sizes; bats; buckets and containers; tricycles and pedal toys; or other push toys and materials that support toddlers' and twos' manipulative and object control skills. 4) **Fine Motor, Strength and Coordination Skills** Infants: The play space provides opportunities for picking up, grasping, batting/swiping, releasing, banging, moving objects about. *The play space includes several of the following*: Natural loose parts (pine cones, leaves, sticks, etc.); musical toys; blocks; balls of various sizes; or other manipulatives, toys, or materials that support infants' emerging fine motor, strength, and coordination skills. Toddlers and Twos: The play space provides opportunities for drawing, painting, cutting, opening/closing, weaving, latching, locking/unlocking. *The play space includes several of the following:* Fence or grid for weaving; mail boxes; containers with lids; latches; gates; large keys and locks; crayons; paint brushes; scissors; spray bottles; musical instruments/toys; or other materials and features that support toddlers' and twos' emerging fine motor, strength, and coordination skills.	1 2 3 4 5 1 2 3 4 5	
F. FLEXIBILITY AND INDIVIDUALIZATION. CRITERIA: 1) The play space provides features that allow for adaptations, scaffolding, and learning and development activities that meet the changing, individualized needs of all children, including children with disabilities and special needs (e.g., wheelchair access, raised sand table, tricycle without pedals, both flat and varied walking surfaces, etc.). 2) The play space changes and evolves over time to reflect children's needs and their created	1 2 3 4 5	

products/projects. 3) The play space supports both child- and teacher-initiated learning and development activities. 4) The play space supports solitary, parallel, and cooperative play.		
G. SAFETY, MAINTENANCE, SHADE AND STORAGE: ***The overall play space meets all relevant safety codes and regulations; receives planned, ongoing maintenance; and provides adequate and convenient storage.*** CRITERIA: 1) **Safety Codes and Regulations**: The play space meets all *required* local, state, and federal safety codes and regulations, and uses the following for guidance and enhanced safety: **a**) *ASTM (American Society for Testing and Materials);* **b**) *CPSC (Consumer Product Safety Commission);* **c**) *Head Start Program Performance Standards;* **d)** *NAEYC (National Association for the Education of Young Children) Academy for Early Childhood Program Accreditation; and* **e)** *state licensure regulations.* ****Infant and Toddler play space is separate from preschool play space per OHS regulations.*** *2)* **Shade:** 25% – 50% of the play space is shaded (by trees, tall shrubs, and/or man-made shade structures). 3) **Maintenance**: The play space reflects a sense of organization, is free of debris, can be easily supervised, and is well-maintained (including surfacing and sand areas) on a planned and ongoing schedule. 4) **Storage**: Adequate storage such as sheds or small outdoor buildings are used to store and organize loose parts, toys, wheeled toys, creative arts materials, child assessment materials and files, and other outdoor play materials that need protection from weather.	1 2 3 4 5	

H. REASONABLE RISK AND CHALLENGE: ***The overall play space provides both risk and challenge appropriate to children's emerging skills.*** CRITERIA: 1) The play space provides a sense of freedom with open areas for running, big body movements, and rough-and-tumble play. 2) The play space includes areas that provide a sense of comfort, coziness, and solitude while also being easily supervised by adults (e.g., pergola, small chairs, small tents, nooks, hideaways, low hedges, quilts/mats for infants, etc.). 3) The play space provides areas and equipment that promote reasonable risk and challenge to support emerging skills and development (such as trees to climb, low step ladders, lofts, uneven walking path, pergola, shrubs, dirt, etc.). 4) The play space provides safe but stimulating features for children to self-assess their capabilities and skills (such as climbers, steps, topographical variations, garden tools, musical/acoustical feature). 5) The play space provides materials, equipment, and features that promote independence, self-regulation, and a sense of confidence (such as water hose, gate with latch, wheeled toys for pushing and riding, bird feeder, etc.).	1 2 3 4 5	

References:

Heroman C, Burts DC, Berke K, Bickart T, Tabors P, Dodge DT. The Creative Curriculum for Infants, Toddlers, & Twos. Washington, DC: Teaching Strategies, Inc., 2011.

Bilton H. Outdoor Learning in the Early Years: Management and Innovation. New York: Routledge, 2010.

Lewin-Benham A. Infants & Toddlers at Work. New York: Teachers College Press, 2010.

Appendix III

Sample Community Garden CONTRACT
(Information in parentheses is to be determined by individual garden)

Common Ground Garden Program, University of California Cooperative Extension, Los Angeles County
P.O. Box 22255, 4800 E. Cesar E. Chavez Avenue, Los Angeles CA 90022
Phone (323) 260-3407, Fax (323) 881-0067, Email <ydsavio@ucdavis.edu>

Rules, Terms, and Conditions for Participation

Introduction

A. The (organization/garden manager) is the highest governing authority at the (Name) Community Garden.
B. Breaking any rules, terms, and conditions is cause for exclusion from the garden and loss of your plot.
   1. You will receive one verbal warning from the garden manager.
   2. If no response or correction has been made, you will receive written notice two weeks later.
   3. In another two weeks, if no response or correction has been made, you will receive written final notification that you have forfeited your gardening privileges and plot.
   4. You will be allowed to reapply for another garden plot only after one year, and only at the discretion of the garden manager.

Rules, Terms, and Condition for Participation

If accepted as a gardener, I will abide by the following rules, terms, and conditions.

1. I use this garden at the sole discretion of (Watts Family) Community Garden. I agree to abide by its policies and practices.
2. The fee for the use of the garden is ($32.00) per plot, per year (January 1 – December 31), due on or before January 1). Fee for half a year after (beginning July 1 or later) is ($16.00). There are no refunds.
3. Once I have been assigned a plot, I will cultivate and plant it within two weeks. I will garden year round. My plot cannot be left fallow or unused for any period of three weeks or longer, more than one time a year.
4. My plot is (20 x 20) feet. I will not expand my plot beyond this measurement or into paths or other plots. I will keep all my plants within the limits of my garden plot and will not allow any plants to grow more than six feet high. I must keep my plot free of weeds, pests and diseases.
5. I will keep my plot, paths, and surrounding areas clean and neat. I will completely separate my trash into three groups: 1) dead plants, leaves, and other green waste plant parts; 2) rocks, stones, and asphalt; and 3) paper, plastic, cardboard, wood, metal, etc. I will put each type of trash only in the areas designated specifically for each. Anything I bring from my home I will take back home. I will not bring household trash and leave it at the (Watts Family) Community Garden.
6. If I now have more than one plot, I will give up my additional plots by the end of this gardening year (December 31).
7. I will not plant any illegal plant. I will not smoke, drink alcoholic beverages, use illegal drugs, or gamble in the garden. I will not come to the garden while under the influence of alcohol or illegal drugs. I will not bring weapons or pets or other animals to the garden.
8. Guests and visitors, including children, may enter the garden only if I accompany them. They must follow all rules, terms, and conditions stated here. I will supervise my children at all times when they are in the garden. I am solely responsible for the behavior of my guests.
9. The garden manager will assign me general garden maintenance tasks each month, and I must complete them by the end of the month that I am assigned them
10. I will water my plot according to water-wise guidelines. (If I use more than the recommended amount of water, I will pay a fee each month to cover the cost of this additional water.
11. I will attend the regular (bi-monthly) garden club meetings. If workshops are offered, I will attend at least one of each of the following topics: soil preparation and maintenance, watering the vegetable garden, and pest and disease control.
12. I will not apply any pesticides in the garden without the approval of the garden manager.
13. I will not make duplicate keys of any locks at the garden or give my key or lock combination to another person.
14. I will not take food or plants from other gardeners' plots. I will not take anything from the garden that is not rightfully mine.
15. I will respect other gardeners, and I will not use abusive or profane language or discriminate against others.
16. I will work to keep the garden a happy, secure, and enjoyable place where all participants can garden and socialize peacefully in a neighborly manner.
17. I forfeit my right to sue the owner of the property

Commitment

I have read and understand the application and accept these rules, terms, and conditions stated above for the participation in the (Name) Community Garden

Signed _____ Date:_____
Gardener
Approved:_____ Date:_____
Garden Manager

Appendix D
Educational Programs for Sylvan Dell

Category/Topic	Program	Description and Information
Environmental Education	Construction of Outdoor Classrooms	
	Camps and After-School Programs	
	Science and Research Programs	bringing out people interested in scientific aspects of natural study to learn about testing and collection of data
		test things like water quality, biodiversity, and numbers of species populations to learn practical skills
	Active Living Seminars	
	Teacher Education Sessions	seminars to help educators who are looking to incorporate more environmental education into classroom
	Land Use Seminars	
	Geology of Pennsylvania and Sylvan Dell	programs to educate students/youth about the history of PA geology and the particular geological formations in and around the site
		collecting and identifying rock/mineral/fossil samples, walks around preserve while discussing nearby geology (ridges)
		https://www.dcnr.pa.gov/Education/GeologyEducation/Pages/default.aspx
	Project WET Program Examples	see Guide for Educational Programming Implementation at Sylvan Dell Appendix I for resources
	DiscoverE Program Examples	https://www.dcnr.pa.gov/Education/DiscoverE/Pages/default.aspx
	Envirothon Program Example	teams of 5 high school students compete in field testing and environmental knowledge
		5 different categories: soil and land use, aquatic ecology, forestry, wildlife, and environmental issues
		additional "hot topic" each year based on news or modern developments
		utilize this event as model for Sylvan Dell/make topics more specific to Sylvan Dell ecosystems
		examples: beavers and dams, wetlands, particular organisms on site, regenerative agriculture, etc.
Regenerative Farming and Local Food Systems	Community Garden	see Guide for Educational Programming Implementation at Sylvan Dell pg. 7 for details
	Tours of Community Garden	walk through with groups to educate about food access, food insecurity, environmental justice, etc.
Sustainable Design and Restoration	Creative Reuse of Site Materials	
	Constructing Outdoor Play Areas	utilization of fallen trees, sticks, stumps, etc. to build outdoor play areas
Active Recreation	Trail Running & Walking	plan out specific trails and routes for people coming to preserve
	Mountain Biking	
	Canoe and Kayak River Access	
	"Green" Gym	
	Yoga and/or Meditation Classes	
	Outdoor Art Events	various events and programs for these groups
	Partnering with Local Boy and Girl Scout Troops	

Appendix E

Informational Guide: Relationship Between Native American History and Sylvan Dell

By: Katie Wisotsky, Huthaifa Aladwan, and Brian Quinn

Table of Contents

Purpose of the Informational Guide

This guide was not originally included in our plans for this project or the ideas we had about program development. However, after some conversations with our community partners and a visit to the Sylvan Dell site, we became aware that there had been Native American artifacts previously discovered on the site and that it is very likely that there are more still there. We were unable to let this information slip through the cracks of our project, and after some discussion with Professor Wooden we found a way to incorporate this history and the meaning behind it into our research and hopefully into the future of Sylvan Dell. Ultimately, the purpose of this informational guide is to provide our community partners with some context of the Native American history of the site and to emphasize why it is so critically important to recognize. This guide provides a brief history of the Native American groups that lived on the land and what happened, some details about the legal obligations of a site in which there may be Native American artifacts, how and why this history should be included in programming planning, a list of potentially helpful contacts, and some additional resources in the appendix.

Brief History of Native Americans at Sylvan Dell

This portion of the guide was compiled from a combination of the research done by the previous group that worked on a Sylvan Dell project and from an email received from Jim Dunn. While the community partners already have this information, it is important for this guide to provide a brief overview of the history of Native Americans at the Sylvan Dell site and in the Williamsport area in order to put the following sections into some context. The tribes that lived on the land that is now Sylvan Dell were the Susquehannock and the Iroquois. From 1600-1675 the Indian Wars took place in this area between the Susquehannock and the Iroquois, and in 1675 the Susquehannock were defeated and forced to relocate to the Mississippi area while the Iroquois took over most of the land. From this period to the late 1700s there was a great deal of conflict between the Iroquois and European colonizers over issue of trade and occupation, and ultimately the land came under European control. In 1768, land was given to soldiers that fought in the French and Indian War as a way to pay for their service, effectively giving away the land that was stolen from the Iroquois. The land that is now known as the Sylvan Dell property eventually came into the possession of both Isaac Allen (Western area) and George Porter (Eastern area), which brings us to the present day of the site. The history of Sylvan Dell, like all of the United States, is deeply embedded in the stealing of lands and colonial legacies.

Possibility of Artifacts on the Site

Although there are no federally or state recognized tribes currently within the State of Pennsylvania, we were able to identify some legislature and standards that may be relevant to the possible artifacts on the Sylvan Dell site (National Conference of State Legislatures). The first is known as Section 106 of the National Historic Preservation Act which is concerned with federal undertakings, meaning any project, activity, or program that is funded, approved, permitted, or licensed by the federal government. This includes projects that take place either on or off of federally-owned property. Essentially, Section 106 requires federal agencies to take into account the impacts of their undertakings on historic preservation and to consult with the Advisory Council on Historic Preservation. It also requires consultation with several other actors: Tribal Historic Preservation Offices, Indian Tribes, and Native Hawaiian Organizations (Advisory Council on Historic Preservation). It is required that these consultations occur if it is believed that there are artifacts, records, or religious or cultural significance for the historic property to the Tribes or NHOs (National Park Service). In the appendix you will see a flow chart that will be helpful in determining Section 106 compliance.

The second major piece of legislation that is important to include here is Title 37 of the Pennsylvania History Code. In particular, the relevant aspects of this regulation regards the specific powers and duties of the Pennsylvania Historical and Museum Commission, which generally are to protect the historically and culturally significant relics for the state. Particularly, they have the power to examine, research, and/or excavate areas with cultural material remains of Native American groups. This title gives the commission the power to oversee such archaeological investigations, although they are also able to collaborate with other experts and historical/archaeological societies.

A final major document that is relevant to the Sylvan Dell site is the Secretary of the Interior's Standards and Guidelines on Archaeology and Historic Preservation. The purpose of these standards are to organize information about preservation activities, describe results to be achieved in the planning for the identification, evaluation, registration, and treatment of historic properties, and to integrate different bodies working on preservation systematically in order to preserve cultural heritage (Nation Park Service). While this document is not regulatory, it does provide some guidelines that are highly relevant to Sylvan Dell and should be utilized if/when archaeological research is to be conducted:
https://www.nps.gov/history/local-law/arch_stnds_0.htm

Relevance to Sylvan Dell Programming

Ultimately, the most important takeaway from this informational guide is the absolute necessity of engaging with the Native American history of Sylvan Dell in the right way. While it is easier to pretend the previously found artifact and the possible other do not exist and continue ahead with plans for the reserve as-is, it would be a grave injustice to the Susquehannock and Iroquois tribes that once lived on this land and their descendants now. The history of all United States land is one of robbery, racism, and colonial conquest that cannot be erased. However, to continue the cycle of colonization by deliberately ignoring the artifacts that remain is no better. Therefore, it is crucial to approach this issue directly, by ensuring compliance with state and federal regulations and conducting an archaeological study of the Sylvan Dell site. In addition, it is equally-if-not-more important to include actual tribal leaders and representatives in this process. Their wishes and needs should be at the forefront of this type of endeavor.

While the colonial history cannot be erased, what can be done is take the history and the stories of what happening in Williamsport and in Sylvan Dell and utilize them as an educational opportunity in programs. What is not meant here is to take a diluted and easy-to-swallow history of the Susquehannock and the Iroquois like so many are taught in schools, but to actually do the work to provide programs that teach about what has happened in order to show the evils of European colonization. This involves the input and guidance of the tribes themselves in the design and implementation, if they choose to have involvement, and taking the time to really convey the truth.

Contact List

Onondaga Nation Contacts	**Local Professor Contacts**
Sidney Hill, Chief Dyohdihwasne'ha - Administration Building 4040 Route 11 Nedrow, NY 13120 (315) 469-0302 Fax: 315.469.4717 admin@onondaganation.org	**Timothy Baylor** Professor of Sociology at Lock Haven University Research in Native American Studies & Native American Activism (570) 484-2333 tbaylor@lockhaven.edu
Tony Gonyea, Faithkeeper Section 106 [paper submissions] Dyohdihwasne'ha - Administration Building 4040 Route 11 Nedrow, NY 13120 (315) 469-0302	**Katherine Faull** Professor of German and Comparative Studies at Bucknell University Research in Native American Studies katherine.faull@bucknell.edu

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Appendix

Appendix I

U.S. Department of the Interior
National Park Service
American Indian Liason Office

What is the process for Section 106 compliance?

Section 106 process initiated by Federal Agency: establish undertaking, determine responsible Federal agency, identify appropriate SHPO, THPO, Tribe, NHO and other consulting parties to include the public, also notify and plan to involve the public. *[see 36 CFR Part 800.3]*

Undertaking is type that might affect historic properties? **NO** → If undertaking is a type of acivity that does not affect historic properties then responsible Federal agency has no further obligations under Section 106. *[see 36 CFR Part 800.3(b)]*

YES

Identify historic properties: determine scope of efforts, identify historic properties, evaluate historic significance and effects, consult with SHPO/THPO/ Tribe/NHO. *[see 36 CFR Part 800.4(b)]*

Historic properties have been identified or are affected? **NO** → If no historic properties have been identified or are affected, Federal agency provides documentation to SHPO/THPO and notifies consulting parties. Documentation is also made available to the public. SHPO/THPO and the Advisory Council on Historic Preservation have 30 days to object. Lack of objection within 30 days means Federal agency has completed its Section 106 responsibilities. *[see 36 CFR Part 800.4(d)(1)]*

YES

Assess adverse effects: apply criteria of adverse effect. *[see 36 CFR Part 800.5]*

Historic properties are adversely affected? **NO** → If Federal agency finds historic properties are not adversely affected, they notify and provide documentation to SHPO/THPO and consulting parties. SHPO/THPO have 30 days to review. Lack of objection by SHPO/THPO or consulting parties within 30 days means Federal agency may carry out the undertaking. Federal agency retains records of findings of "no adverse effect" and makes them available to the public. Failure of Federal agency to carry out the undertaking in accordance with the findings requires reopening of Section 106 process. *[see 36 CFR Part 800.5(d)(1)]*

YES

Resolve adverse effects: continue consultation among Federal agency, SHPO/THPO/Tribe/NHO, and consulting parties, avoid or mitigate adverse effects. *[see 36 CFR Part 800.6]*

Failure to resolve adverse effects? **NO** → Memorandum of Agreement (MOA), project moves forward. An MOA is evidence of a Federal agency's compliance with Section 106. The agency is obligated to follow the terms of the MOA. Failure to do so requires the agency to reopen the Section 106 process. *[see 36 CFR Part 800.6(c)]*

YES

Advisory Council on Historic Preservation (ACHP) provides comments to head of Federal agency. ACHP comments must be considered when final agency decision on the undertaking is made. *[see 36 CFR Part 800.7]* → After reviewing ACHP comments the Federal agency head decides if project: moves forward, stops persuant to mitigation, or steps back through the Section 106 process.