NRES 497 Final Report

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Section 1: Introduction

For this project, we worked with the Wabash River Enhancement Corporation (WREC). Our project contact was Amy Krzton-Presson, the Watershed Coordinator for WREC. The goal of WREC is to protect the Wabash River as a resource and promote community engagement with the river. The Wabash Heritage Trail is a trail in the West Lafayette/Lafayette area that follows the Wabash River. This trail and information about the trail is not well documented. Without proper information about a trail, the public is less likely to use it. Properly mapping this trail and creating a webpage to educate people will encourage them to use this trail. For this project, our group will create a StoryMap in ArcGIS Pro that details the trail and its components including trailheads, parking lots, and ownership of land, among other informative features.

Section 2: Lit Review

Land use has a large impact on the sustainability of urban landscapes (Kyriakopoulos, 2023). As more research is done on sustainability, the more prevalent this idea becomes. For a city to be considered more sustainable, it should incorporate green spaces into the landscape. One way some cities are doing this is with trail paths. These trail paths are becoming a widespread solution to integrate green areas into cities. As more of these spaces appear, the public is more likely to use them (Brownson, 2000). Those who are passionate about finding these trails, if they exist already, may have trouble learning about them if they are not easily accessible. Using ArcGIS Pro to map these trails can help make that information accessible (Bovkir, 2021). This literature review discusses the use of Story Maps in ArcGIS Pro to map trails and provide information such as ecological features, useful locations, and historical sites to users.

Section 2: Developing StoryMaps for the Consumer

ArcGIS StoryMaps is a web-based program where developers can display maps made using ArcGIS Pro and related information about these maps (ESRI, n.d.). This way of organizing information allows authors to create stories out of different maps and their details. Using this display of quantitative and qualitative information, the maps created will allow more people to discover trails and learn about the area. Users can create a StoryMap by first creating a map of the area users would like to generate information about, in this case, it is a trail map. Regarding trail mapping, the stories can tell individuals along the lines of ecosystem development, historic landmarks, and notable features including parking lots, picnic areas, and much more. This type of trail mapping allows for in-depth explanations of elements of hiking trails not known by the average person. With this accessible resource, trail use increases (DiCarlo, 2023). Utilizing StoryMaps also accommodates many devices. Because of this, it is accessible to people of any age and can inform people about history and ecology that they did not know existed where they live (Cope, 2018). ArcGIS StoryMaps is a useful program that allows easily accessible information, trail maps, and educational resources.

Section 3: Trail Accessibility

As previously mentioned, a major component is using ArcGIS Pro and Story Maps to better communicate information regarding trails. Digital platforms, like Story Maps, have the ability to provide more detailed information on trails that can be updated in real time, thus making it easier to find and follow. Nonetheless, proper signage and printed maps are still useful for older and less tech-savvy hikers (Molokáč et al., 2022). Proper communication of trail information including difficulty level, elevation, terrain, environmental attractiveness, and presence of natural monuments, among other things, have all shown to be major decision-making factors for users when selecting a trail. Knowing specifics about these aspects also allows hikers to match trails with their skill level and preferences, increasing the likelihood of said trail selection (Molokáč et al., 2022). Moreover, the perceived accessibility of said trail information and other amenities, such as nearby amenities like restrooms plus parking and other transportation options, all influence the decision to visit specific trails (Choi & Kim, 2021). Additionally, proper mapping of trails to better indicate paths for visitors can better promote environmentally positive behaviors, such as trail path and ecological preservation. Further environmental educational resources regarding trails to users prior to their arrival is also more likely to foster conservation practices and responsible behavior by visitors during hikes (Choi & Kim, 2021).

Section 4: Education of Mappers

Informing the end user of the difficulty and describing a trail's environmental and historical aspects is at the heart of trail mapping. Informational inclusions aim to fill knowledge gaps within hikers and offer insight into the reasoning behind the trail's location. In the case of many Indiana paths, they provide ways to access the state's once sprawling contiguous forest, which now finds itself fragmented and surrounded by anthropogenic topographical modifications (Aby-Kruger, 2023). On top of the connectivity offered, they also often contain educational plaques and infographics alongside the trail bed. Topics range from the floral arrangement of the area, to the native populations that once called the area home. Trail developers determine the ideal placement and inclusion of data to foster intrigue in the hikers, which hopefully expands their interest in the local area, therefore increasing conservation practices and tourism. Story maps can provide a cursory glance at the local ecosystem and history, but much is required to apply them correctly. To do so, many educators utilize field mapping in conjunction with ArcGIS Pro to develop a proper understanding (Kerski, 2020). One crucial method in the education of mappers relates to the core of complete understanding and not simple memorization. This understanding is accomplished through the use of 5 basic geographical skills, asking geographical questions, collecting, organizing and analyzing geographical information, and answering geographical questions (Dündar, 2023).

Section 5: Community Benefits of Trails and Green Spaces

Nature trails and greenways are essential elements of a well-developed community that provide many benefits for its residents. Many studies have shown that prioritizing the development and management of natural areas in cities and growing urban centers are associated with resident's well-being and mental health (Davies, et al, 2012). Not only do they provide meaningful recreation experiences that impact people's emotional and physical well-being, but they also contribute to environmental protection and restoration (Keith, 2018). Additionally, nature trails and greenways are a great way to interconnect urban spaces with natural areas, promoting and creating opportunities for the population to have positive interactions with each other and nature in congested cities. (Keith, 2018). These benefits are multiplied when these trails provide residents with safe and environmentally friendly ways of commuting through the city, thus aiding in the effort of building a green community.

The economic development of cities and communities is another benefit of well-developed and managed nature trails. Ever since the COVID-19 pandemic, hiking trails and natural spaces have increased in popularity due to their social distancing nature (Lukoseviciute, et al, 2023). Many people became attracted to these spaces not only because of the perceived risk of human contact in closed spaces but also due to their health benefits and emotional well-being. In places where these spaces are well integrated in the urban environment, there seems to be an increase in economic activity and income for the communities surrounding it ((Lukoseviciute, et al, 2023). Many local businesses and entrepreneurs see business opportunities when trail visitors seek out certain services like safety information, visitor centers, food and drinks, and more.

Arguably, the most important benefit that such trails have in helping build communities is the ecological awareness that it brings to its residents. Studies have shown that participation in hiking activities and nature trails have helped in bringing environmental awareness and concern to different groups of people over certain environmental issues (Dirgantara, 2024). Not only that, but it inspired ecologically responsible behaviors like proper waste disposal and environmental conservation practices (Dirgantara, 2024). Engaging in outdoor activities and having the opportunity to interact with natural spaces helped people establish an emotional connection with nature and build feelings of concern, which then translated into active involvement in resolving environmental issues (Dirgantara, 2024). Even though there are many benefits of these trails to local communities and urban centers, lack of information and accessibility can easily discourage people from visiting these spaces (Davies, 2024). This is why the proper and detailed mapping of nature trails paired with educational and accessibility content to inform visitors of different amenities are essential for communities to reap all the benefits provided by these spaces.

Our sources span from those discussing ArcGIS Pro functions and how to use them to create an effective story map to sources discussing community involvement and how we can use trail mapping to get people outdoors and involved in their communities. Some of our sources even directly address using GIS to map trails for cities and towns. We also use ArcGIS Pro in great depth to map our trails, and we use some ecology and history apps to provide background information for our story map. Overall, we will use a wide variety of sources to complete our project, and most of these sources will be regarding either GIS usage, ecology, history, and community involvement.

Section 3: Goals and Objectives

Our background research paired with our community partner’s assessment of the local infrastructure and information on the Wabash Heritage Trail gave us a clear picture of the problem that needed to be addressed. It was identified that trails on public land were not well mapped and there was insufficient information available about the trail’s conditions, difficulty, length, surface material, and etc. Furthermore, our project partner highlighted the need for better and more accessible information to encourage hikers in our community to use local trails, which were reinforced by our background research on the benefits of trail accessibility and green spaces in the health and growth of local communities. With problems and needs clearly established, we were asked to map the length of the Wabash Heritage Trail using ArcGIS and create a story map that would include further information on the trail.

Based on our group’s past experience with ArgGIS and interest in history and ecology, we established the goal of developing a story map that would not only provide easy and accessible information for hikers but also include interesting educational material that could introduce the community to some historical and ecological elements of Lafayette and West Lafayette. In the first half of the semester, our goal was to map the Wabash Heritage Trail using field maps as well as ArcGIS feature layers from existing data sources in Tippecanoe County. Trail mapping was divided into sections that were then mapped and completed throughout the length of this project by different individuals within our group. Our main goal was to make this map interactive within our story map so that hikers could easily locate points of interest and navigate their way through the area using their phones. Points of interest included restroom facilities, public parking, scenic views, information signs, nearby bus stops, and more. During data collection and mapping we also gathered information on trail ownership, length, if the surface was paved or unpaved, and in which sections biking was permitted.

The second half of the semester was planned for conducting research and drafting educational content to be included in the storymap. Historical sites, plants, and animals that could be seen by hikers as they walked the Wabash Heritage Trail were the focus of our work. We created species lists for both plants and animals that can be found in Tippecanoe County, including a local bird watch list. As for historical content, Prophets Rock, Burnett's Creek, Fort Ouiatenon, and Davis Ferry Bridge are some of the examples included in our final story map.

Finally, our last goal was to design and display all the collected data and generated maps into an engaging and interactive story map. We created dashboards that included a main map with all the mapped sections of the Wabash Heritage Trail and its points of interest, as well as an ownership map that lists contact information for each section of the trail in case hikers run into any issues during their walks. Users can fully engage with these maps, filtering the sections and features that they are most interested in. Other trail information like length, surface material, public parking, and more were provided at the beginning of the story map so that it could be easily accessible to hikers. The educational content was provided right below for those interested in learning more about the history and ecology of the region. The historical content was displayed using the "map tour" function in ArcGIS story maps, which allows us to take our users through a guided tour of all the points added to our map, emphasizing their location and description. All information was divided into sections which are displayed on a header right at the beginning of the story map. This allows users to click on the section that they are most interested in without having to scroll through the entire content, thus making it easier and faster for people to find the information they need/want.

Section 4: Deliverables

Our project deliverables include the following:

- ArcGIS Pro Map of Trail
    - This map was produced on ArcGIS Pro and included important data from the Indiana DNR. It was edited to show the appropriate trail, as the original map was inaccurate at some points
- ArcGIS Pro Map of Trail with points of interest
    - This map was produced through field maps and transferred to ArcGIS Pro. Each group member hiked a portion of the trail and collected points.
- StoryMap of Trail (Web App)

        - This map was a culmination of the points of interest map and the general trail map, and it was turned into an online version that is easily accessible for trail hikers or general users.
    - StoryMap Dashboard (StoryMap)
        - This dashboard included the story map, as well as some ecological and historical features, as well as details about the trail, including bike access, trail type, elevation, parking access, and restrooms. The ecological and historical sections include the following;
            - The ecological section details the native wildlife in the area and provides a comprehensive list of birds that may be seen on the trail. This list is printable, so birders are able to take it with them!
            - The historical section includes the history behind each of the notable places along the trail. This section is also on a map, so it allows viewers to jump to different historical features they may be near
    - Transferrable Online Map
        - All of the components listed above were transferred to the Wabash River Enhancement Corporation so that they were able to put the map on their website. The link to this website and all other documents will be included in the appendix.

Section 5: Metadata and Technical Conclusions

Product or Original Content	Description/Use	Link(s)
ArcGIS Field Maps	ArcGIS Field Maps was used to survey the trail for various features and gather raw data points and trail shapes.	https://purdueuniversity.maps.arcgis.com/apps/mapviewer/index.html?webmap=9809369d4cc9436b86ca2beb64e77f68
ArcGIS Pro	The collected data from Field Maps was uploaded to ArcGIS Pro for data cleaning, analyzing, and visualizing. Layouts can be created here.	N/A - See project files
ArcGIS Online (Web Maps and Web Applications)	The completed mapping in ArcGIS Pro was uploaded to ArcGIS Web Maps for online use. Subsequently, an ArcGIS Web Application was made using Web Maps to create a more user-friendly interactive dashboard.	Wabash Heritage Trail https://tippecanoe.maps.arcgis.com/apps/webappviewer/index.html?id=1e54102a68e54915982f5f8bdfcc847a Wabash Heritage Trail Ownership. https://tippecanoe.maps.arcgis.com/apps/webappviewer/index.html?id=108d0da170184104877b5a2bca21aea9
ArcGIS StoryMaps	Social data and information	https://storymaps.arcgis.com/sto

	(descriptions, ecology, history, etc) were compiled into an ArcGIS StoryMap, in addition to the Web Applications. This is the completed 'website.'	ries/e7f4906b7bb24ca889e5bcd68c5a149b
Project Files	The project files include ArcGIS Pro projects labeled with different maps for their specific use, in addition to the collected data in the form of CSVs, and raw data gathered or downloaded. The bird watch list, in document format, is included for editing purposes.	Raw ArcGIS Pro Projects and Related files: https://purdue0-my.sharepoint.com/:u:/r/personal/mmereu_purdue_edu/Documents/Attachments/NRES%20497%20-%20GIS.zip?csf=1&web=1&e=ddehPy Bird Watch List Document: https://drive.google.com/file/d/1J3iSHH8MnbH8O6LmHJOhspRk3kBGiTjq/view?usp=drive_link
Other Data (Open Source)	The Indiana Department of Natural Resources has open-source shapefiles of all trails in Indiana, though out of date. This was a starting point for the overall trail mapping.	https://data-indnr.hub.arcgis.com/datasets/525e57b8acdd402181cb83af7d5f0122_0/explore?location=40.471944%2C-86.877145%2C11.93
Contact(s)	Daelen Ogas is the GIS specialist for Tippecanoe county in Indiana. As our Purdue files will be deleted upon graduation, they have graciously agreed to permanently host our StoryMaps and Web Apps. Only they have editing privileges to the StoryMap and Web Apps.	dogas@tippecanoe.in.gov

Section 6: Conclusion/Future work- Zach

Unlike many of our peers, our project is fully functional as of the end of this semester. Our team demonstrated their skills and forethought in our meetings with Amy, making sure we communicated all our concerns. We had concerns regarding the fate of our work following the deletion of our Purdue accounts but successfully transferred ownership to our community partner. One focus going forward is to hopefully publish the finalized website in a way that allows it to be near the top of Google results when querying "Wabash Heritage Trail". Although we no longer have control or access to make such changes, we are confident that both Tippecanoe County officials and the Wabash River Enhancement Corporation can work together to finalize our efforts. Another group concern is the usage of our data for the maps and signage provided on the Heritage Trail itself. The current signage is lacking over the 13-mile span of the trail. Although we did not produce a deliverable that directly mirrors the current signage, our web map can be used to craft a logical map using the provided legend. We collected points and took photos corresponding to all signage on the trails, and are curious as to how this data will be used by our community partners. One of our largest concerns related to the purpose of redoing this mapping project, which had been done before by students in this course. We were surprised to hear in our final community partner meeting that a past group had produced maps and other imagery. We hope that the fruits of our labor can be successfully implemented and remain publicly accessible and helpful in the future. Overall, the work process was extraordinarily smooth, and we are content with the culmination of our efforts.

Section 7: Appendices

1. Wabash River Enhancement Corporation Website:
https://wabashriver.net/wabash-heritage-trail/

2. StoryMap Dashboard (StoryMap)
https://storymaps.arcgis.com/stories/e7f4906b7bb24ca889e5bcd68c5a149b

3. ArcGIS Pro Map of Trail with points of interest
https://tippecanoe.maps.arcgis.com/apps/webappviewer/index.html?id=1e54102a68e54915982f5f8bdfcc847a

Section 8: References

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