STATISTICS
TRENDS &
STRATEGY

FINAL REPORT

Welcome to the Future of GIS in Algonquin Provincial Park

Legacy Data Comparison & Visualization

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THE CLIENT

Algonquin Provincial Park
Senior GIS Database Technician at Algonquin Provincial Park - Josh DeClerck
GIS Technician at Algonquin Provincial Park - Steven Groulx

THE ADVISOR

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This final report is presented in partial fulfilment of the academic requirements for APST62, GIS Collaborative Project course, Fleming College.

ABSTRACT

Over the last few decades, Geographic Information Systems (GIS) technology has become a critical part of managing provincial protected areas. The collaborative project #2015 team worked with GIS staff at Algonquin Provincial Park to create a GIS solution that addresses the gap in keeping park spatial data updated. Our solution required our team to: go to the park to collect spatial data, load the data onto computers, process and assess the spatial data for accuracy, put the collected data into a file geodatabase, then visualize the new data in print and web cartographic products. By completing this project, we were able to give park staff (our client) a new data collection methodology, new feature data layers in a file geodatabase and custom visual tools displaying the data in two printed maps and two web applications.

Figure1. ?

Keywords:
data collection, trail data, field data collection methodology, GIS, park management, visuals tools, print map, web map, web app, Algonquin Provincial Park, Ontario Parks

> And into the forest I go. To lose my mind and find my Soul.
>
> John Muir - Scottish-American Naturalist

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1.0 Introduction of project context and purpose

1.1 Keeping up with natural resource management trends in a digital era

Algonquin Provincial Park was the first park established by the Provincial Park Service in 1893 as a wildlife sanctuary and is the third-largest park managed by Ontario Parks today (Friends of Algonquin Park, 2020). Ontario Parks, a provincial government organization, works to manage another 330+ provincial parks along with Algonquin Provincial Park. Since its establishment, the provincial park system has undergone many changes as natural resource management trends have come and gone.

Over the last few decades, Geographic Information Systems (GIS) technology has become a critical part of managing parks and protected areas (Kuyvenhoven, M., et al., 2003). GIS software allows for accurate data to be readily available for park managers to use in management decisions or reporting on asset management. More importantly, provincial park landscapes are better understood with the ability to accurately visualize the conservation opportunities or challenges in the park, from finding areas of declining Blanding's turtle populations to isolating a breakout of beech bark disease in the tree stands. Overall, the ability to quickly and accurately share spatial data helps make park management more effective and efficient decisions, meaning that GIS can help improve environmental conservation efforts by Ontario Parks.

INTRODUCTION

1.2 Status of Algonquin Provincial Park spatial data and project scope

Previously related work completed by park GIS staff includes establishing an authoritative database containing feature layers of park assets and resources over the last few decades. However, some of these datasets have not been updated since the 1990s, and others are as new as 2012. Regardless, this spatial data is beneficial because park staff can create custom visual tools that guide park staff and visitors in the park. These map products can be found in a large map format on a wall in the gatehouse as a tool for gate staff to use to answer questions asked by campers. As well as there are smaller format maps that can be seen in brochures or park tabloids for visitors to take with them. Further, Algonquin Provincial Park has a web map on the Ontario Parks website, suited for a potential visitor using a desktop device. All these tools are heavily relied upon for park navigation and management decisions, so with new features such as trails or buildings being added to the park, it's important to keep the park feature data layers up to date. Therefore, this project presents a GIS solution that focuses on building workflows for data collection and demonstrates a few different ways that the spatial data could be used to build visual tools for park staff and visitors.

This project focused on Algonquin Provincial Park which is located between Huntsville and Whitney in southeastern Ontario as seen in Figure 1. The scope of this project was restricted to the Highway 60 corridor in the park – refer to Figure 1, since these trails and campgrounds are most used in the park. Park staff manage about 14 campgrounds at the same time, along with over 20 hiking and portage trails.

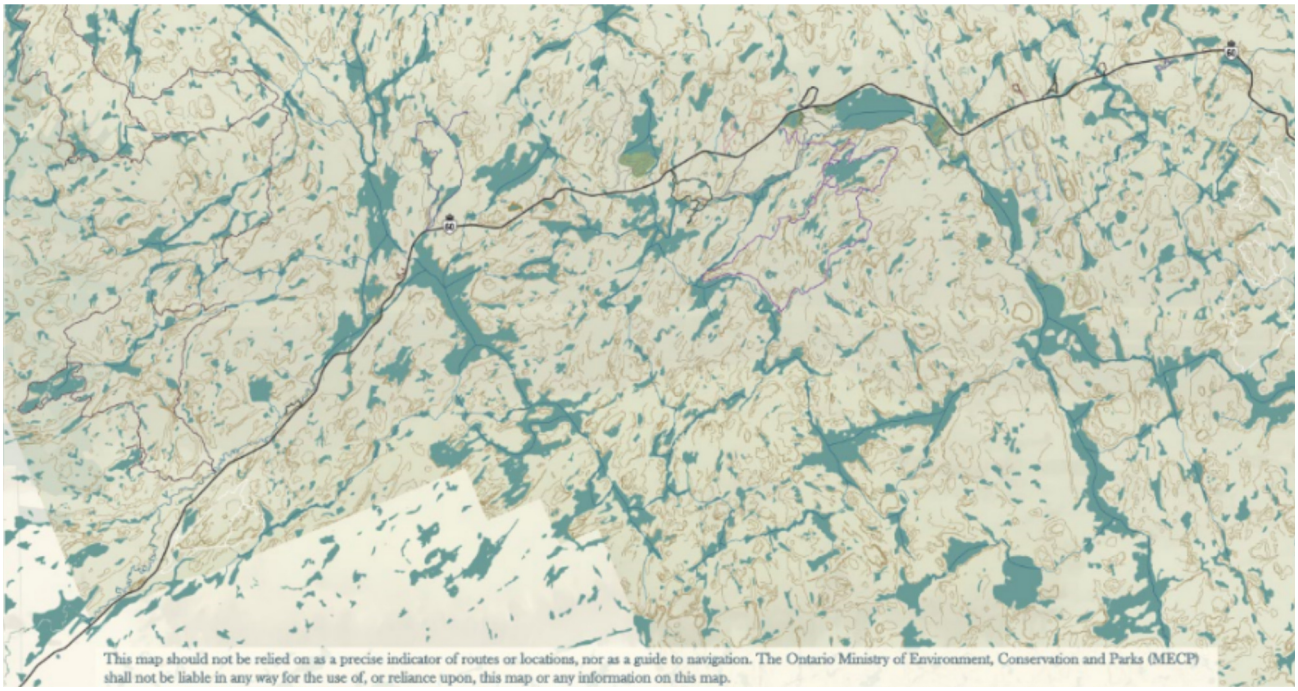


Figure 1: Highway 60 corridor in Algonquin Provincial Park, between Huntsville and Whitney, Ontario

1.3 Project expectations in terms of GIS staff from Algonquin Provincial Park

This GIS solution was developed with Algonquin GIS staff in mind, who support a variety of GIS projects across different departments in the park. Specifically, we worked with two GIS staff – our client – to define deliverables of this project, Josh DeClerck (josh.declerck@ontario.ca) and Steven Groulx (steven.groulx@ontario.ca). The client's needs from this project are summarized below:

1) New feature layer(s) to replace some legacy spatial data in the park's database;
2) Data visualization tools showcasing new spatial data in print and web format;
3) A repeatable methodology for data collection and visualization, with all tasks and methods described (in a manual)

INTRODUCTION

1.4 Project objectives as an academic project for APST 62 – Collaborative Project

The course is designed to provide GIS students with experience in planning, delivering and packing up a GIS project for a client who is currently working in a GIS-related field. Therefore, this project has four academic requirements that intersect with the needs of the client, to measure it in terms of academic success in addition to providing a GIS solution for an external organization. The academic requirements are listed below, along with a description of how they will be achieved:

1) 'Data acquisition/pre-processing' through collection of line and point data and pictures while hiking trails in Algonquin Provincial Park
2) 'Database design/processing' through creation of a file geodatabase containing new feature layers requested from client
3) 'Data visualization/presentation' through visualization of the new data in print and web cartographic products
4) 'Use of WebGIS technology/ArcGIS Enterprise' through creation of web applications using ESRI's Web App Builder and Map Tour Builder

Figure 2: Explore Algonquin Crest by Sarah Bencic, 2020

The details of these tasks and deliverables are described in the project methodology (section 2.0). This includes description of the processes and tools used to complete these objectives and the map products created to address these academic requirements.

OBJECTIVES

Data Acquisition	Database Design	Data Visualization	Web Technology
Collection of point & line data while hiking trails in the park	File geodatabase with newly created feature layers	New data in print & web cartographic products	Creation of web applications using ESRI software

METHODS

2.0 Project methodology for data collection and visualization

The methodology used to prepare for, collect, process, assess, and visualize the data are described in this section. All of the steps taken to complete these tasks and deliverables were created by our team, with knowledge learned from our past experiences as well as the course work from the Fleming College GIS – Cartographic Specialist Postgraduate Certificate, in which we are taking this collaborative project course (APST 62). During the project, processes changed slightly as other steps were seen as necessary or planned approaches did not work. These details can be found throughout this section, as well as described in the last section (section 4.0) and the separate configuration manual that was written specifically for the client.

2.1 Data acquisition while hiking trails in Algonquin Provincial Park at the end of May 2020

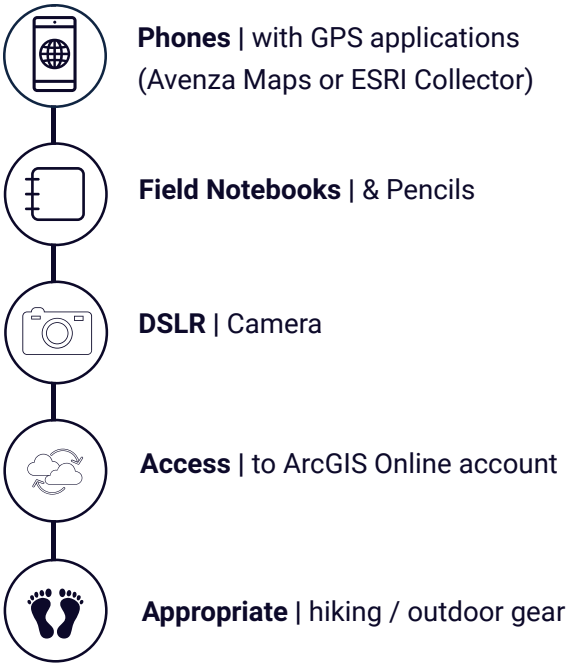
Our team travelled to Algonquin Provincial Park for a few days to conduct data collection for this project by hiking six different trails of various difficulty levels and lengths. Choosing to hike different kinds of trails helped test the software devices and prescribed processes in our methodology. Note: Original proposed plan (found in Final Proposal Group 2015 submission) to collect and visualize data in a campground was changed due to COVID19 restrictions.

ESRI's Collector application was set up for this project to be compared with Avenza Maps. Using Collector to set up a map and transferring it to a phone is easy for a GIS technician who is familiar with ArcGIS Online. This method would be helpful in setting up a project for field staff who are not familiar with GIS technology, because all they need to do is sign into ArcGIS Online on the Collector application on a phone and it is set up however the project manager wants. Although There were issues using Collector because we could not sign into our account while being in offline mode, which made using it to collect data on hiking trails difficult since there are spots where cell service is not available.

Therefore, the Avenza Maps application was used to collect all of the data, on a total of four iPhone/Android cellphones. Multiple devices were used to compare the data collection experience and output between Android and iPhone cellphones. In addition, having multiple collection devices is helpful if one stops working or one is forgotten or damaged. To collect the line data, GPS tracking was turned on in the application options, as well as the application recorded an elevation profile. To collect the point data, coordinates were saved using the 'add point' function at each interpretative marker found on the trail – marked with a number the corresponds to trail brochures available at the trail heads. In addition to collect both types of data on four phones, pictures were taken on phones at every interpretive marker and a DSLR camera was used to take pictures of exhibits and nice lookout spots along the trail.

After every trail, observation notes were recorded in notebooks describing weather conditions, anything interesting that was spotted on the trail, and the challenges of collecting trail data while hiking. By recording the challenges, it inspired improvements to our data collection methodology with is futher described in the last section of this report (section 4.4.2)

Tools for Success



METHODS

2.2 Database processing by compiling data and spatially comparing with legacy data

After collecting data in the field, the data was exported from the cellphones to a computer. All data files were compiled into one location and converted to appropriate feature layer file format using ESRI geoprocessing tools in ArcGIS Pro software. Once sorted, the data was examined to become more familiar with what was collected. To explore the accuracy of this new trail data, a spatial accuracy test was conducted by comparing the new trail data with the already existing (legacy) trail data. The test criteria were created from information gathered by consulting the client and finding some other datasets to compare our trail data and the legacy data with - see Figure 3. This information inspired the creation of four phases for comparing park trail data.

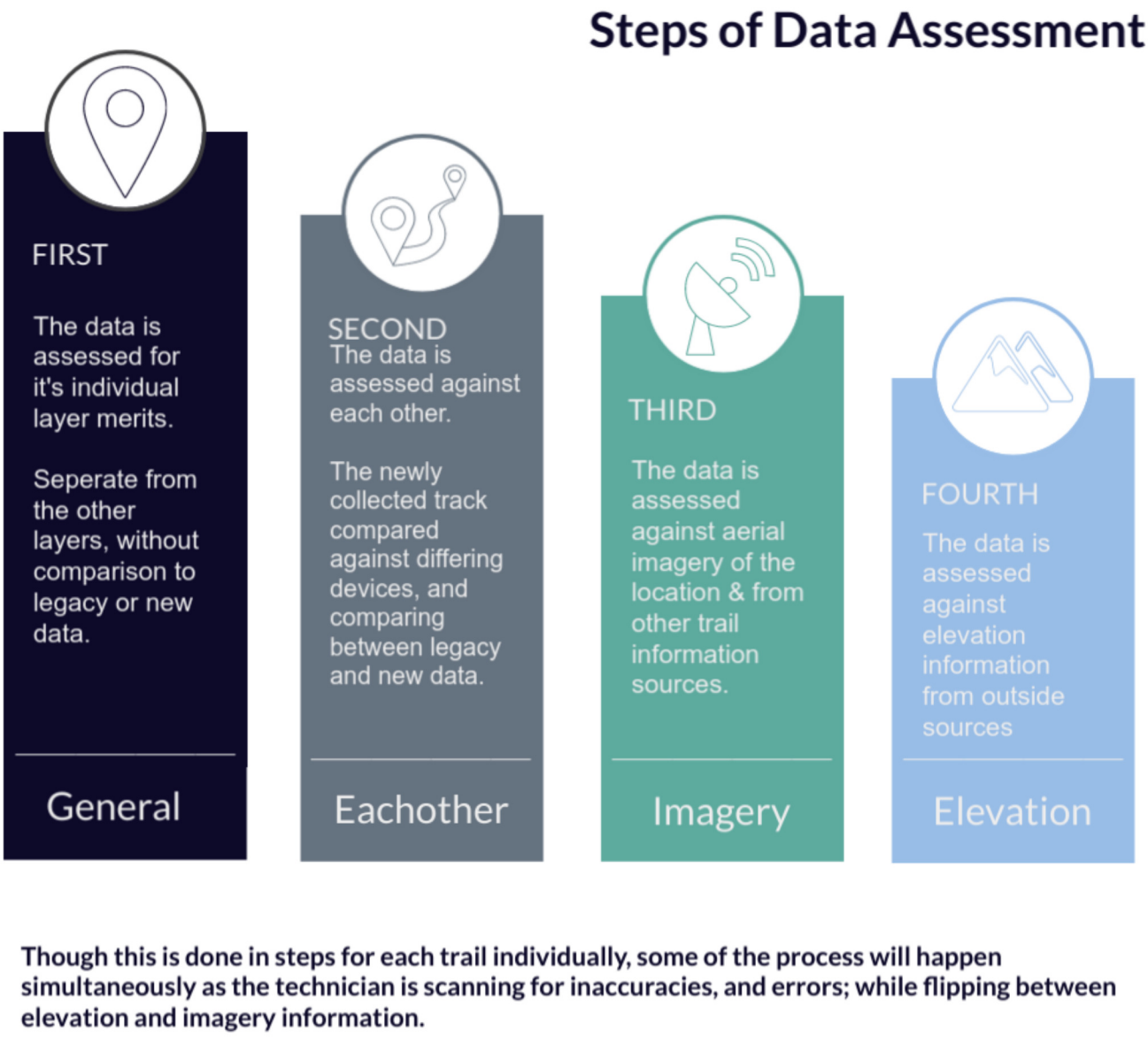


Figure 3: Steps of Data Assessment: Criteria Infographic describing steps used to assess spatial accuracy of collected trail data, Sarah Bencic (2020)

METHODS

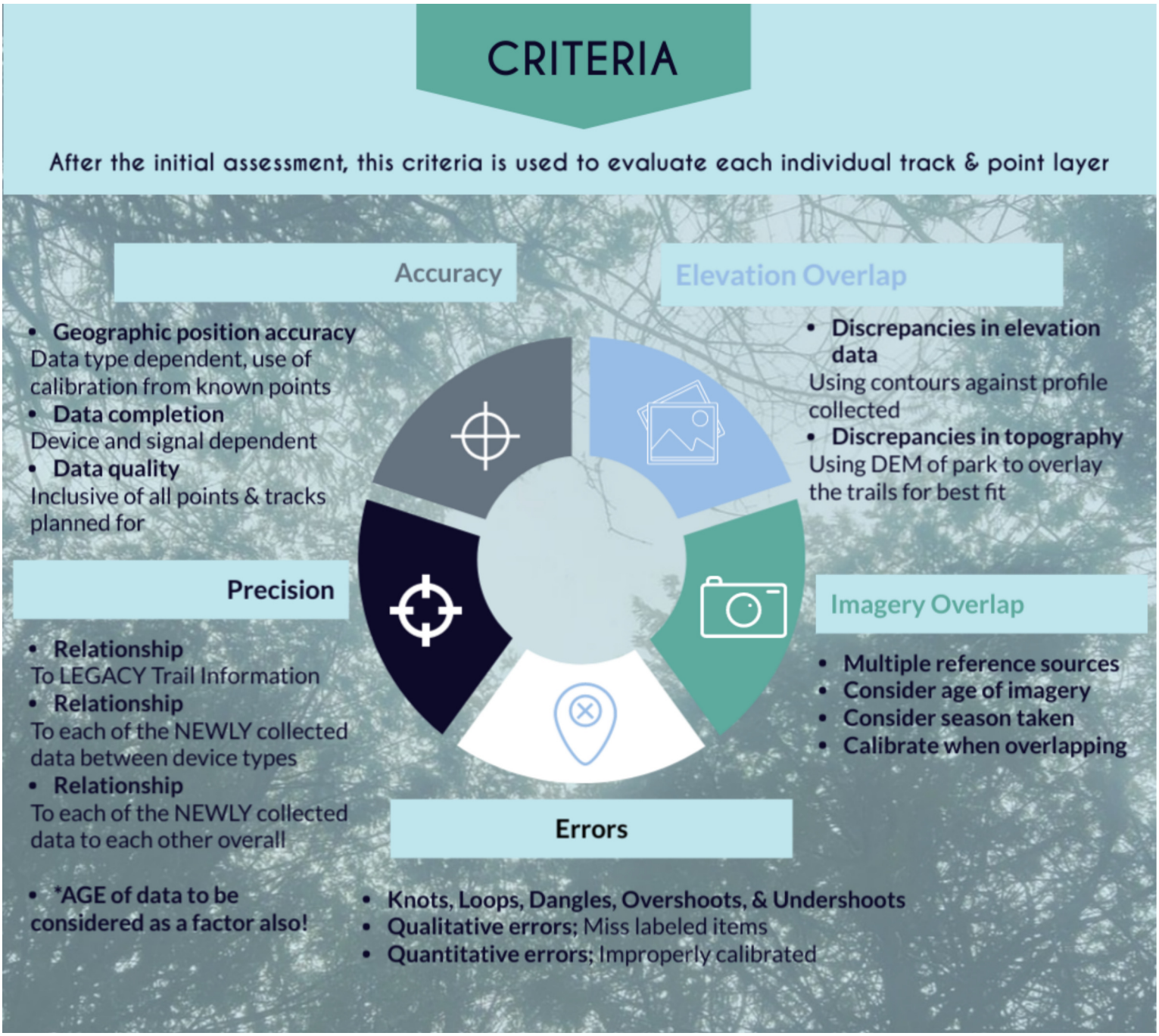


Figure 4 : Assessment Criteria Infographic made by Sarah Bencic (2020)

Once compared against other datasets the new trail data was rendered into cartographic feature layers (points and lines) using ESRI geoprocessing tools. Then, the feature layers were put together with base map layers, for context, into one file geodatabase.

Tools for success:

- Devices with the collected data
- ArcGIS Pro software

METHODS

2.3 Visualization of new trail data in multiple print and web cartographic products

In preparation for symbolizing the trail data and making the maps, a colour scheme was created to ensure the print maps, web maps, web applications, website, and other documents – like this report – were aesthetically pleasing and matching to provide a sense of unity to the project deliverables and documentation. Therefore, the colour accessibility standards outlined in the AODA, as well as the colour schemes of existing Ontario Parks maps, were consulted to create a custom colour palette for map symbology and accent colours for documents and infographics.

Then, the file geodatabase was added ArcGIS Pro to create the data layers for the print and web cartographic products. All layers were organized appropriately and then coloured with the custom colour palette. After, some layers were labelled to provide context for map readers. Then, the data layers were added in Adobe Illustrator into a custom Algonquin Provincial Park map layout using Avenza Map Publisher functions.

Tools for success:

- ArcGIS Pro
- Adobe Illustrator
- Avenza Map Publisher
- AODA web accessibility requirements
- Ontario Parks map documents

2.4 Using WebGIS technology to present trail data in a new way for Ontario Parks

The file geodatabase with symbolized data layers was added to a separate ArcGIS Pro document, where only the feature layers were displayed on top of the ESRI topographic base map because an ESRI Web App requires an ESRI base map to be used for georeferencing purposes. The trail line features were left with the same colours as the print map. However, the highway marker text symbology was changed to match the ESRI base map.

A web map was shared to an ArcGIS Online (AGOL) account with the trail and highway marker feature layers displayed. Once uploaded to AGOL, a few features were added to the web map such as custom pop-up displays and the transparency of the base map was increased so that all of the trail data is easier to see. The web map was used to make a custom web application made by using ESRI Web App Builder. Once loaded into the Web App Builder, a theme for the web application was selected and customized with the custom colour palette. Then, widgets were chosen, customized and added to the web application with potential hikers being the target audience for the web application's functionality. After, the web application was shared with everyone (the public) to be able to embed it in our team's showcase website by using a piece of iframe code.

In addition, Map Tour Builder was used to create a different web application for providing an interpretative trail experience online. For this Map Tour, coordinates of the trail's interpretative markers were added into the Map Tour Builder along with associated interpretative text from the trail brochure and images taken during the data collection trip. After, the web application was shared with everyone (the public) to be able to embed it in the showcase website.

Tools for success:

- Access to ArcGIS Online
- ArcGIS Pro
- Spatial data ready to be published
- Pictures and written content (for Map Tour)

RESULTS

3.0 Results from project tasks

The project objectives were created based on client needs. Then, they were translated into a project plan, task lists and desired deliverables to outline how our team would deliver on these objectives. Below are the results from our work:

3.1 Collected trail data in Algonquin Provincial Park

In order to provide the client with new feature layer(s) to replace some legacy spatial data in the park's database, we put together a spatial data collection methodology. The methodology was tested during our visit Algonquin Provincial Park to collect data over three days. During this data collection trip, we were able to collect line and point spatial data, and pictures, from six different trails in Algonquin Provincial Park.

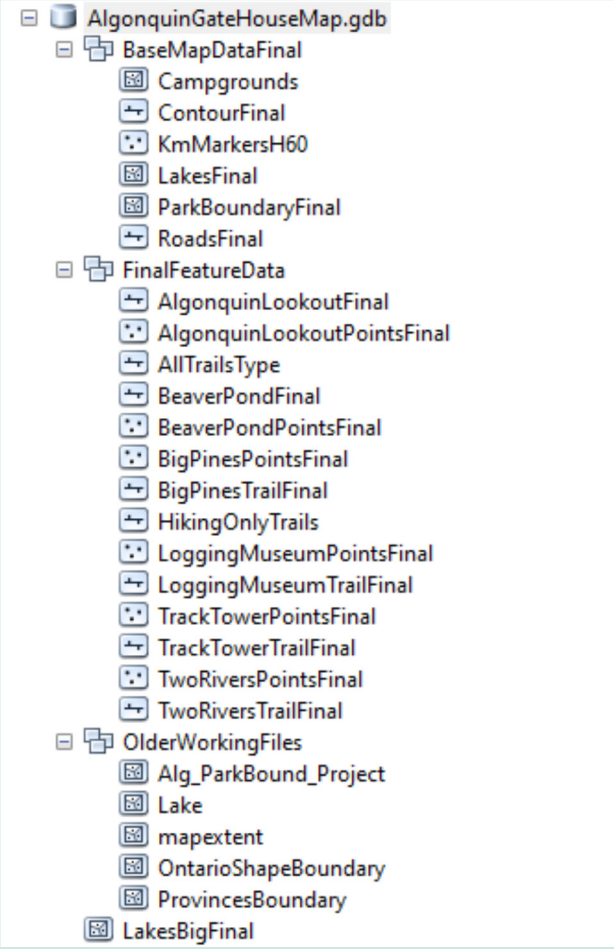


Figure 5: Data layers inside file geodatabase that was created by our team

3.2 Processed new trail data and created a file geodatabase with new feature layers and relevant base map layers

The data processing phase took over forty seven hours to complete. Each version of the newly collected data was compared with each other, the old data, the contour data, elevation profile data and satelite imagery. The best fit line was cleaned up manually and using ESRI's simplify line tool. This information was collected and reviewed in excel before finalizing and exporting the completed layers.

A file geodatabase (see Figure 5) filled with all feature layers and base map layers was produced after the data was compiled and assessed for spatial accuracy against legacy data. The geodatabase contains: point and line data layers collected by our team, already existing trail data for the park, and contextual data layers that include the Algonquin Provincial Park boundary, Highway 60 kilometer markers, roads, contours and lakes and streams.

RESULTS

3.3 Visualized new trail data in print and web cartographic products

Then, to provide the client with custom data visualization tools showcasing new spatial data in print and web format, a few cartographic products were created. One map product is a large format printed map for the gatehouse (see Figure 6), with a matching small format printed map (see Figure 7 on next page). Both maps include the necessary Ontario Parks logos, disclaimers and source information. The Print products make use of current and new park art work. Many of these graphics were created by our team for this project.

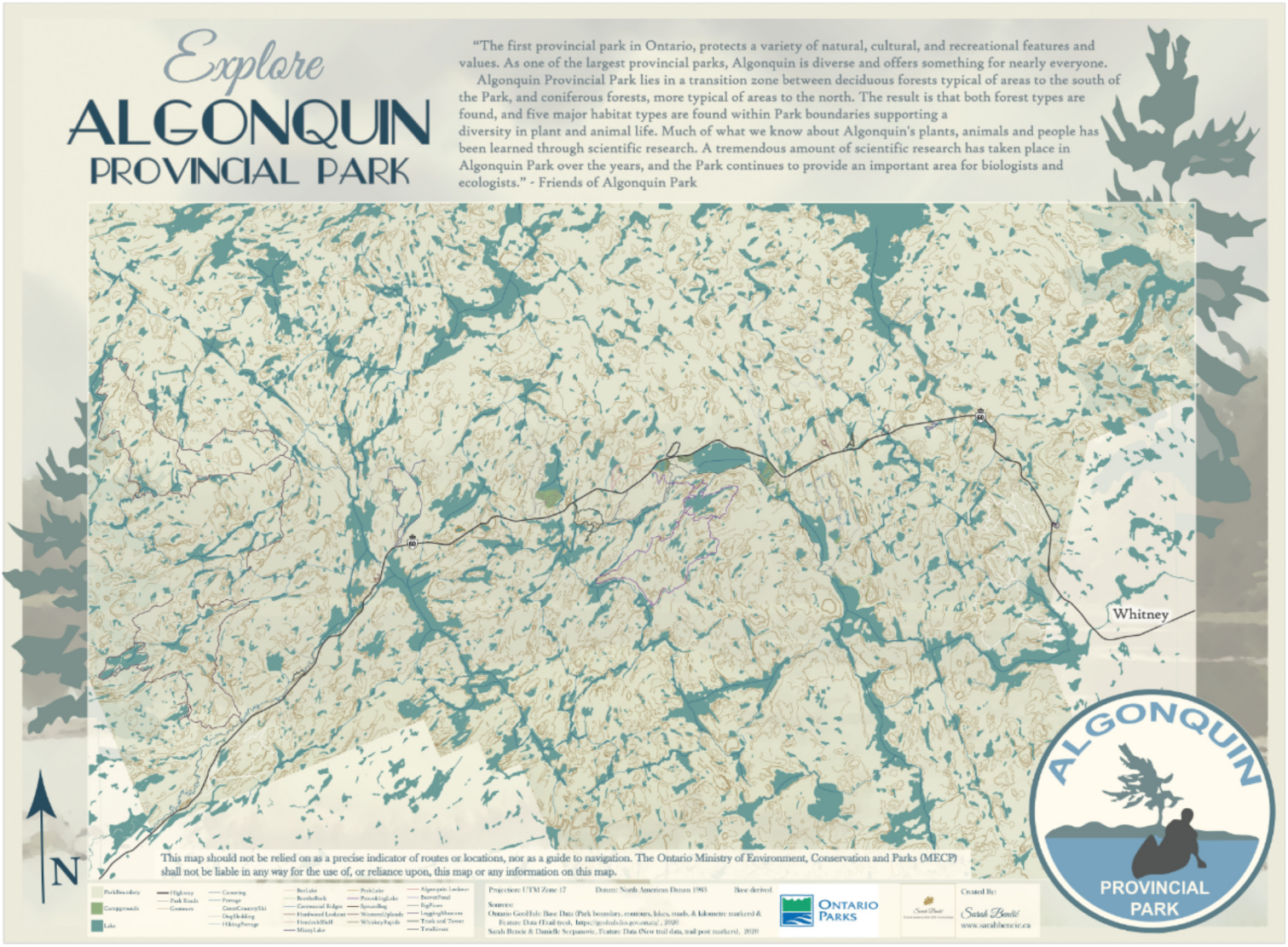
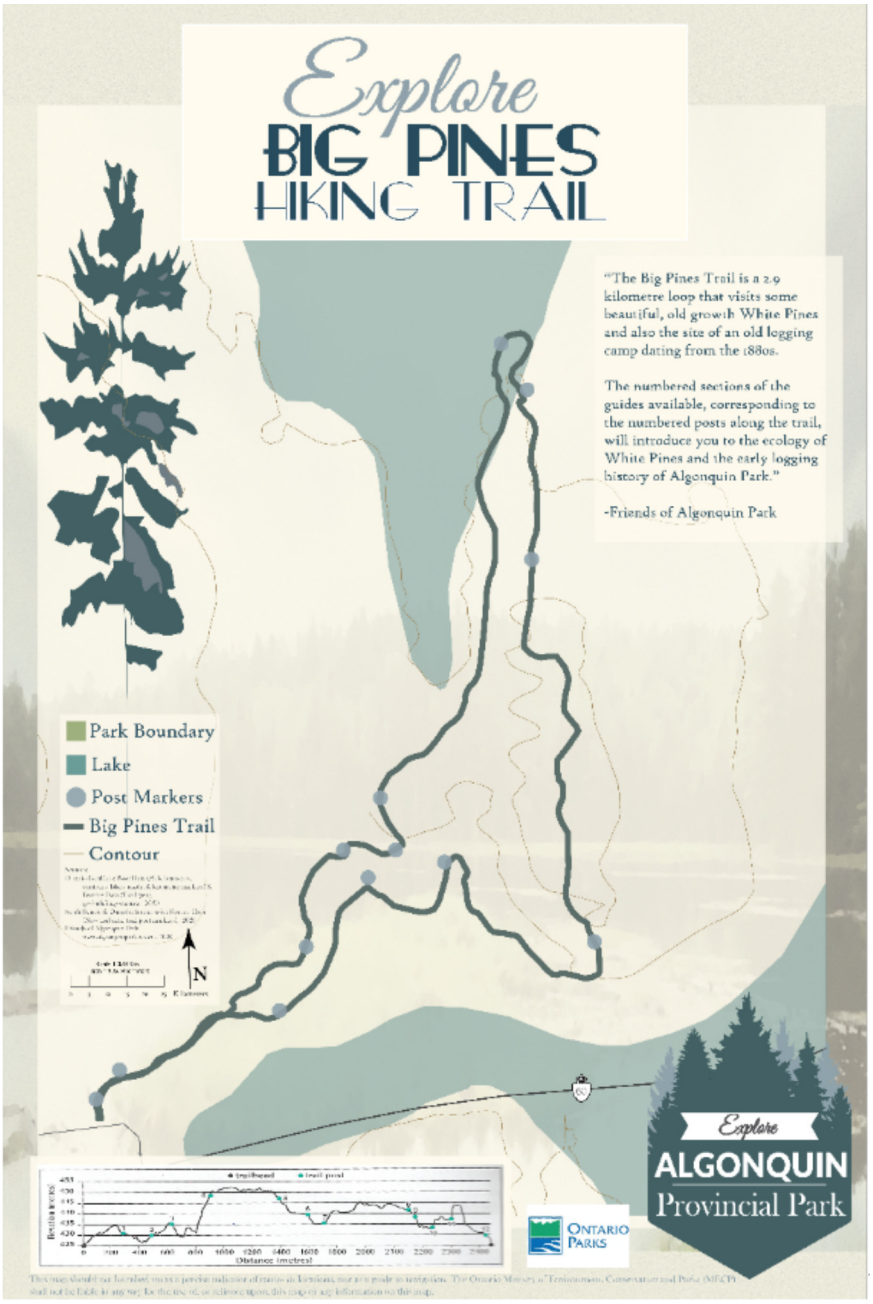


Figure 6: Gate House Print Map focusing on the highway 60 corridor, using ArcGIS Pro, Adobe Illustrator and Avenza Map Publisher. Visit this and the other print maps on our showcase website: https://algonquinopenhouse.webflow.io/

RESULTS



and Avenza's Map Publisher. Layout template for the remain trails on funding.

3.4 Using WebGIS technology to demonstrate how the trail data can be used in engaging web applications for the public

Further to meet the client's need for visual tools, two web applications with different purposes were created using ESRI Configurable Apps and Web App Builder, found on ArcGIS Online.
One web application (see Figure 8) focuses on the trails in Algonquin Provincial Park and provides information for the map user through pop-ups. In addition, the web application allows the map user to search for trails from a list, find directions to the trail or anywhere in the park, and print off the map or directions by saving it as a .pdf file. The other web application (see Figure 9) focuses on the Logging Museum Trail in the park, where it provides interpretive information and pictures of the trail for those who cannot access the trail or want to revisit the trail.

Finally, a configuration manual accompanies all of these deliverables to meet the last client need, where they asked for our methodology and project experience to be recorded so that they could repeat this project with their staff in the future. This will be found in a separate document in the project archive.

RESULTS

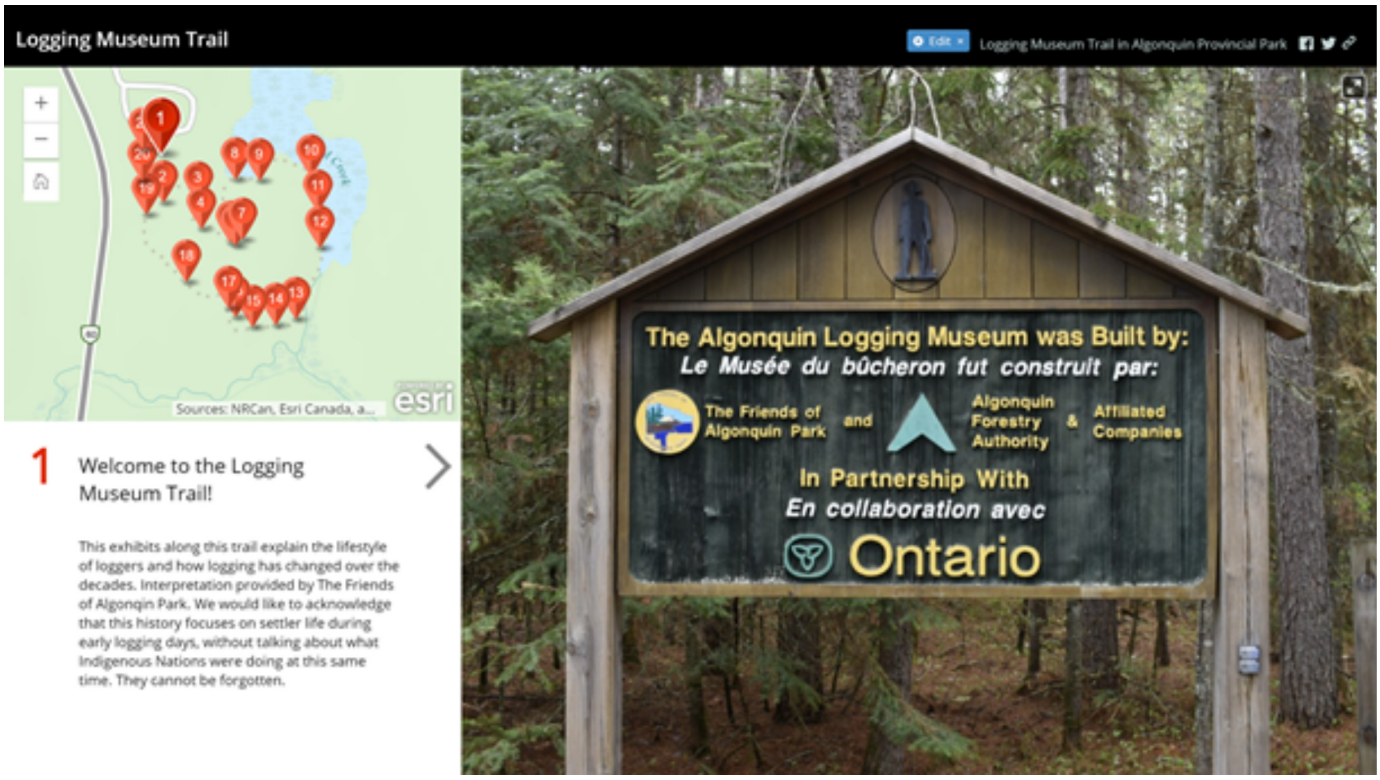


Figure 8: Logging Museum Trail web application created using ESRI Map Tour Builder. Visit this web application using this link: https://arcg.is/0qWT49

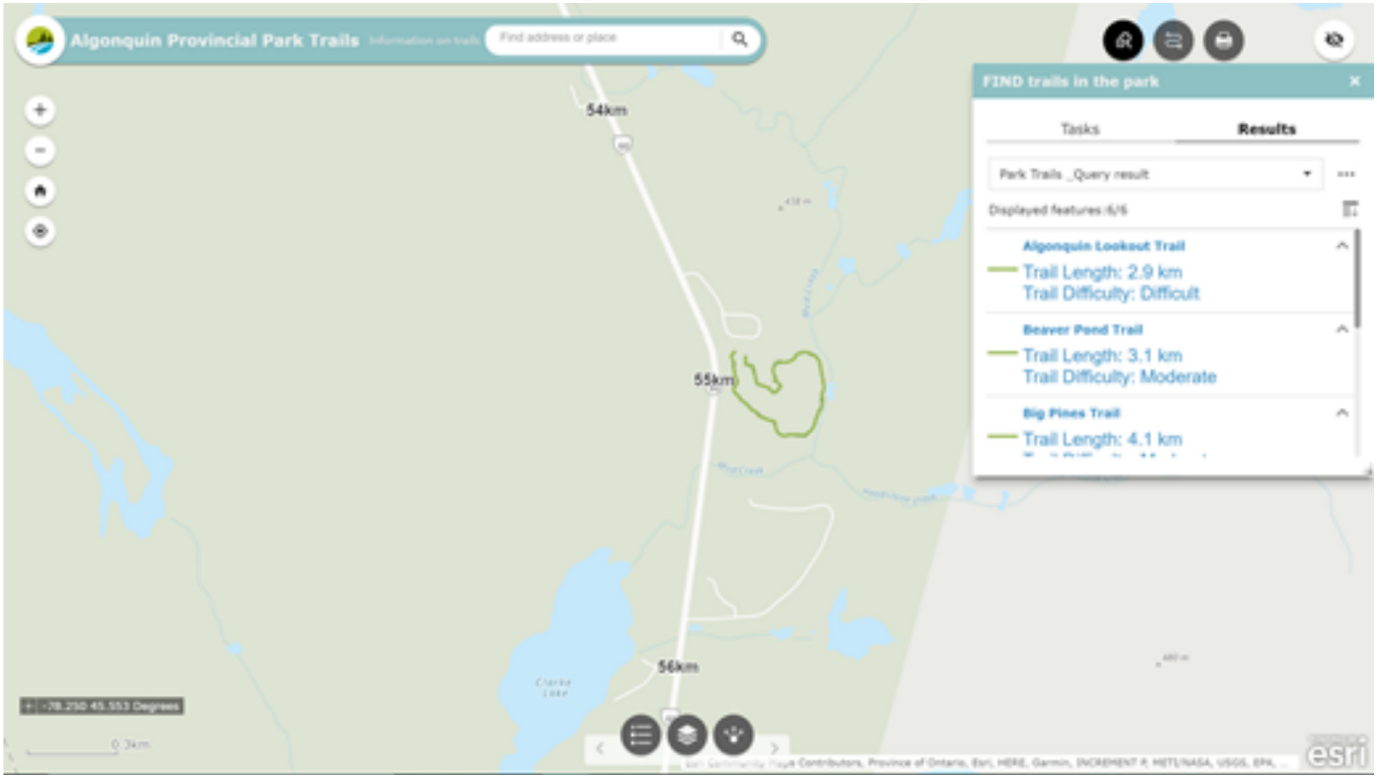


Figure 9: Logging Museum Trail web application created using ESRI Map Tour Builder. Visit this web application using this link: https://arcg.is/0qWT49

CONCLUSIONS & RECOMMENDATIONS

4.0 Discussion and recommendations for future park staff

4.1 Project summary

As stated in section 1.0, Geographic Information Systems (GIS) technology is a growing trend in the management of parks and protected areas because it helps with decision-making and asset management. The technology provides the ability to visualize and spatially store park features across the landscape, along with non-spatial information like installation dates. However, to have an effective GIS model of the park, it is necessary to have current data stored in a safe place with protocols for keeping the datasets updated.

Our GIS solution targets the need for having current data, as some of the park's data has not been updated since the 1990s and 2012 for a few other layers. This project met client needs by: collecting new trail data and creating new feature layers with it, visualizing the new trail data in different ways including print and web formats, as well as the client will be given a configuration manual that describes in detail the steps of this project so that it can be repeated in other areas of the park. Throughout this process, APST 62 academic requirements were met by collecting and pre-processing the trail data, creating a database of all relevant data layers, visualizing the collected data in print and web cartographic products, and using WebGIS technology to display the new trail data in a few ESRI-based web applications.

4.2 Discussion on print and web cartographic products

4.2.1 Print cartographic products

As a project deliverable to meet academic requirements and client needs, two print maps were created. There are two parts to this deliverable: (1) creating a custom colour palette and new map layout for Algonquin Provincial Park to continue using in future cartography projects, and (2) displaying the new trail data in a printed map product.

One of the print maps was designed as a large format map, seen in section 3.3, which displays all of the park's trails using the new trail data. This map will be printed and placed on a wall near the working space of the gate staff. Its purpose is to be a visual tool that gate staff can use to direct park visitors to the hiking trails, or other areas in the park. Another feature of this deliverable is that, as park trail data is updated in the future, the trail data layers on this map can be updated using Adobe Illustrator and Avenza Map Publisher, after the data is processed in ArcGIS Pro or ArcMap.
The other print map is designed as a small format map, seen in section 3.3, which focuses on one trail dataset with additional information such as an elevation profile. This map is intended to be a handout for park visitors who want to know more about specific trails. In addition, the small format map could fit on the signs at the trail heads where information about the trail and the shape of the trail is displayed for hikers. Similar to the large format map, the trail data layer on this map could be updated as new trail data is collected in future years.

4.2.2 Web cartographic products

As another project deliverable to meet academic requirements and client needs, two web applications were created using ESRI Web App Builder and Map Tour Builder. These web applications were designed to showcase how Ontario Parks could benefit from using ArcGIS Online, and to encourage them to take advantage of their ESRI software licensing that they already have. Further, the trail data collected by our team is displayed in these web applications to demonstrate how the same data can be visualized in various ways for different purposes, on desktop or mobile devices.

CONCLUSIONS & RECOMMENDATIONS

The Trail Info web application (see section 3.4) was created with potential hikers in mind, they may be planning their first visit to the park or avid hikers who want to double check the details about a trail. The web application displays only the new trail feature layer because the ESRI topographic base map has the park's existing trail data on it already. By looking closely at the map, the new trail data can be visually compared against legacy data. Also, the Highway 60 markers have been added for improved park navigation. For now, this web application serves as an example for park managers and GIS staff to see the potential of a trail web application that park staff could further develop.

The Logging Museum Trail web application (see section 3.4) was inspired by the popular interpretative experience that park visitors gain when they walk through the exhibits on the trail. In this online format, people who are not at the trail or are unable to hike the trail can still learn from its interpretative experience. For example, teachers could use this web application in their classroom to teach their students about the logging history of the park. The Map Tour Builder helps create an engaging story that flows through multiple point locations, with the ability to add supplementary text and an image. For this Map Tour of the Logging Museum Trail, the text was taken from the trail brochure written by the Friends of Algonquin Provincial Park (non-profit organization) and the images provided were taken with a wide-angle lens and a DLSR camera during our data collection trip. This specific Map Tour was created manually by entering coordinates, text, and an image for every point. There is an option to build a Map Tour using an existing feature layer. However, for this project, the web application looks better without the trail feature layer because there are discrepancies between the new trail data and the base map line data for the Logging Museum Trail. Although, the coordinates were taken from the new trail data, from the Avenza Maps application, so it is still being shown but in a different way.

4.3 Challenges during project timeline

4.3.1 Effect of COVID19 pandemic on this project

This project was completed from May 11th, 2020 to June 17th, 2020, during the time of the COVID19 pandemic. Luckily the transition from working on this project at school to working from home did not present many challenges. We were still able to access the software needed, and our client was still able to communicate with us regularly and help us when needed. However, due to COVID19 physical distancing restrictions, Ontario provincial park campgrounds were inaccessible for our team at this time. Therefore, the data collection goals changed from campground to trail data, which did not drastically change the project objectives or client's needs.

4.3.2 Team size decrease due to personal reasons

Due to personal reasons, our third team member left, meaning that we would work as a team of two. Luckily, this happened at the beginning of the project and we were able to change a few roles and shift tasks around to accommodate for the new team dynamic. Despite being a team of two, we are happy to report that we were able to produce all original deliverables for this project: two cartographic outputs for print (one large and one small format) and at least one web application.

4.3.3 Developing data collection methodology for future park staff

Since the data collection methodology was created by us, it was being tested the entire time from data collection to processing to visualization. This resulted in times when we had to change an approach or plan for completing the project deliverables. These moments were documented and are described in our recommendations (section 4.4), and configuration manual (section 2.0), for the future park staff repeating this project methodology.

CONCLUSIONS & RECOMMENDATIONS

4.4 Recommendations for future park staff

4.4.1 Maintenance of project deliverables by park staff

This project does not require us to maintain the dataset or map projects created, meaning that it is up to park staff to do so. We recommend that staff maintaining the project deliverables have GIS experience, specifically to: store the feature data layers in the park's dataset, use ArcGIS Pro, Adobe Illustrator and Avenza Map Publisher software to update the print cartographic projects, and use ArcGIS Online to upload the web applications to a government account and maintain these web cartographic products. Further, the custom colour palette should be stored in a place that is accessible for park cartographers to use in future cartographic projects. Additionally, the configuration manual, and this report if they wish, should be stored in a place that is accessible for future GIS staff to easily consult the project methodology when planning their project.

Finally, this entire project is displayed on a showcase website, which was made for the GIS Open House and with the intention to be used as a web-based resource to be consulted by park staff if they want to look at this project. The website was made using WebFlow, and our client will be given the credentials to the account with our website. This website is designed so that our client does not need to change any information when presenting this project to park managers and other GIS staff. However, if needed they can make minimal changes (it is a free account) with the user-friendly website builder function of WebFlow.

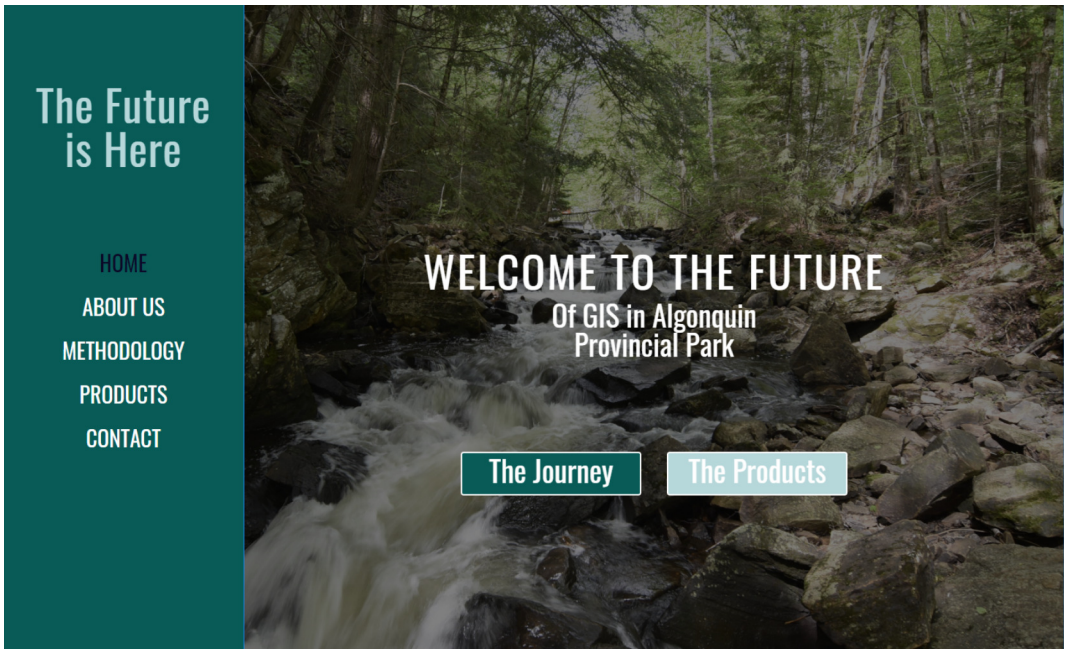


Figure 10: Welcome page for the showcase website, designed for the GIS Open House on June 26th, 2020

4.4.2 Suggestions for future trials of this project's methodology

Throughout this entire process, some of the approaches to completing project deliverables were changed after coming across a challenge. For example, using the Avenza Maps application to collect data instead of ESRI's Collector application since Collector does not have offline capabilities yet. The final processes of our methodology for this project can be found in the configuration manual. This manual is a separate document that describes, in great detail, how project tasks were completed and recommendations for future staff collecting trail data in the park during springtime – when we went to collect data.

These recommendations provide pro-tips (information we wish we knew at the beginning of this project) on using data collection devices/technology for the first time, how to plan hiking-related data collection trips, what gear is important to leave behind or take with you, and what to look for when looking at weather forecast.

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5.0 References

Citations
cited in body and listed in reference section consistent style (APA, CSE etc.)
References are cited in text, Bibliography is background reading

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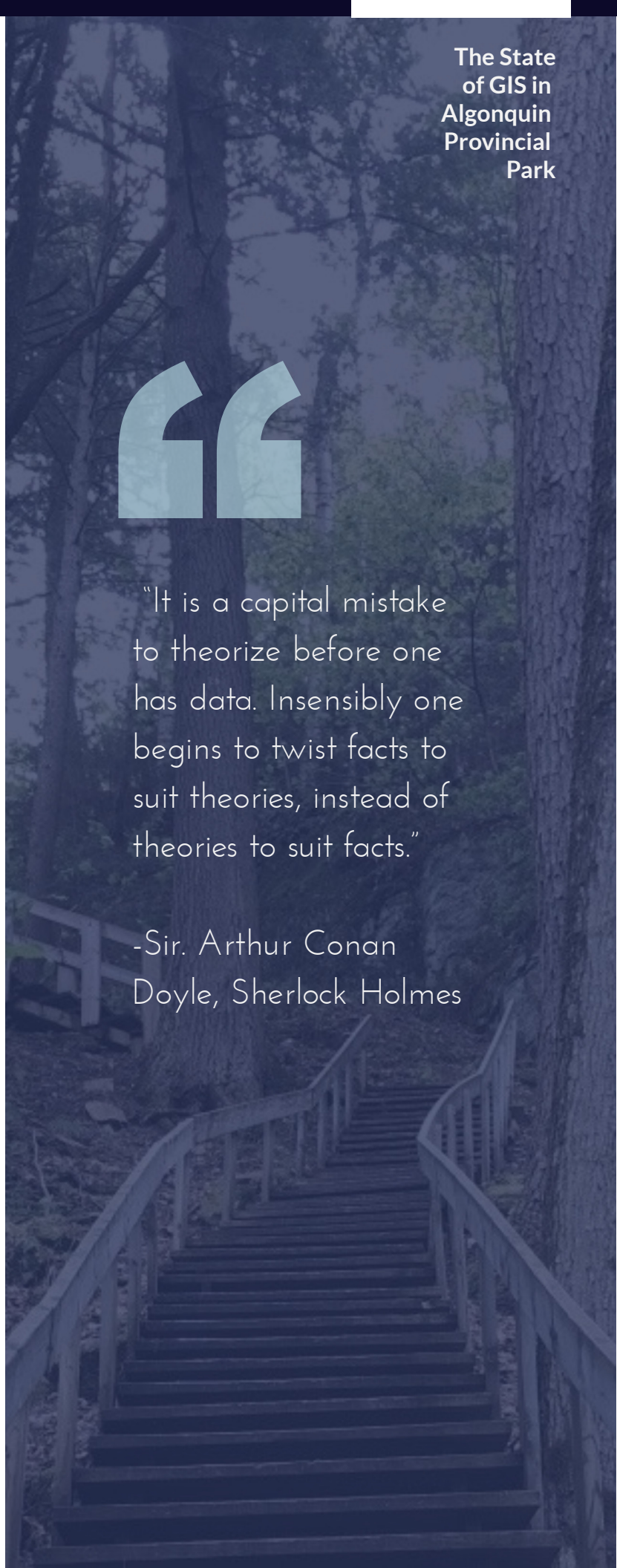


“It is a capital mistake to theorize before one has data. Insensibly one begins to twist facts to suit theories, instead of theories to suit facts.”

-Sir. Arthur Conan Doyle, Sherlock Holmes

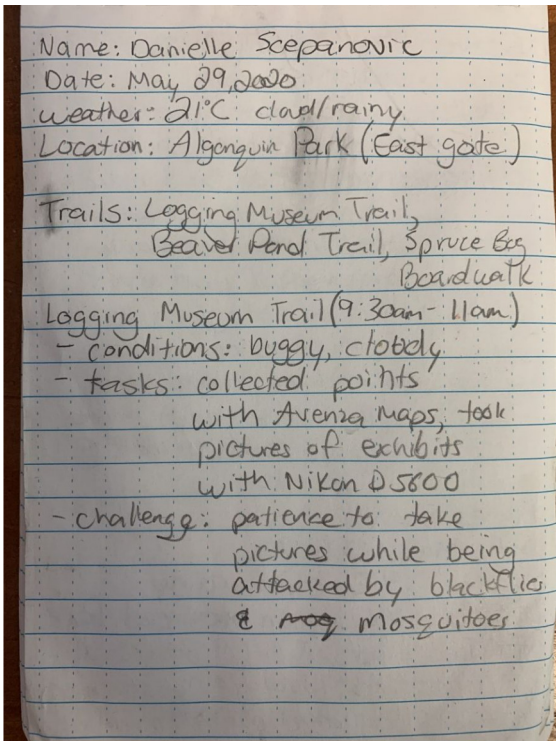
Apendicies

6.1 6.1 GIS LAYERS METADATA TABLE

Layer Type	Layer Name	Projection	Source	Year Created	Year Last Upd
Base Data	Province Boundary	NAD 1983 UTM Zone 17N	Projection: UTM Zone 17 Datum: North American Datum 1983 Base derived from: LIO (Land Information Ontario) Ontario GeoHub: https://geohub.lio.gov.on.ca/	1990-2000s	Early 2000
Base Data	Park Boundary	NAD 1983 UTM Zone 17N	Projection: UTM Zone 17 Datum: North American Datum 1983 Base derived from: LIO (Land Information Ontario) Ontario GeoHub: https://geohub.lio.gov.on.ca/	1990-2000s	Early 2000
Base Data	Campground Boundaries	NAD 1983 UTM Zone 17N	Projection: UTM Zone 17 Datum: North American Datum 1983 Base derived from: LIO (Land Information Ontario) Ontario GeoHub: https://geohub.lio.gov.on.ca/	1990-2000s	Early 2000
Base Data	Lakes	NAD 1983 UTM Zone 17N	Projection: UTM Zone 17 Datum: North American Datum 1983 Base derived from: LIO (Land Information Ontario) Ontario GeoHub: https://geohub.lio.gov.on.ca/	1990-2000s	Early 2000
Base Data	Roads	NAD 1983 UTM Zone 17N	Projection: UTM Zone 17 Datum: North American Datum 1983 Base derived from: LIO (Land Information Ontario) Ontario GeoHub: https://geohub.lio.gov.on.ca/	1990-2000s	Early 2000
Base Data	Contours	NAD 1983 UTM Zone 17N	Projection: UTM Zone 17 Datum: North American Datum 1983 Base derived from: LIO (Land Information Ontario) Ontario GeoHub: https://geohub.lio.gov.on.ca/	1990-2000s	Early 2000
Feature Data	Trail Types	NAD 1983 UTM Zone 17N	Projection: UTM Zone 17 Datum: North American Datum 1983 Base derived from: LIO (Land Information Ontario) Ontario GeoHub: https://geohub.lio.gov.on.ca/	1990-2000s	Early 2000
Feature Data	Trail Hiking	NAD 1983 UTM Zone 17N	Projection: UTM Zone 17 Datum: North American Datum 1983 Base derived from: LIO (Land Information Ontario) Ontario GeoHub: https://geohub.lio.gov.on.ca/	1990-2000s	Early 2000
Feature Data	New Trail Line	NAD 1983 UTM Zone 17N	Sarah Bencic & Danielle Spenovic: Avenza collection in Algonquin Provincial	2020	2020
Feature Data	New Trail Point	NAD 1983 UTM Zone 17N	Sarah Bencic & Danielle Spenovic: Avenza collection in Algonquin Provincial	2020	2020
Base Data	Kilometre Markers	NAD 1983 UTM Zone 17N			Early 2000
Reference Data	Elevation Profile		All Trails: https://www.alltrails.com/parks/canada/ontario/algonquin-provincial-park	Unknown	Unknown
Reference Data	USGS images		Landsat 8 Operational Land Imager (OLI)/ Thermal Infrared Sensor (TIRS) Tier 1, Images courtesy of USGS Earth Explorer Nine spectral bands, including a pan band: Band 1 Visible (0.43 - 0.45 µm) 30 m Band 2 Visible (0.450 - 0.51 µm) 30 m Band 3 Visible (0.53 - 0.59 µm) 30 m Band 4 Red (0.64 - 0.67 µm) 30 m Band 5 Near-Infrared (0.85 - 0.88 µm) 30 m Band 6 SWIR 1(1.57 - 1.65 µm) 30 m Band 7 SWIR 2 (2.11 - 2.29 µm) 30 m Band 8 Panchromatic (PAN) (0.50 - 0.68 µm) 15 m Band 9 Cirrus (1.36 - 1.38 µm) 30 m	2019	2019
Reference Data	LIO Orthophotography	The orthophotography has a pixel resolution of 20 centimetres and the horizontal positional accuracy of this data set is 50 cm at the 90% confidence level.	Time of Capture: May 6th to May 14th, 2015 Coverage: 4,536 sq km Canopy Coverage: Leaf-Off Ontario GeoHub: https://geohub.lio.gov.on.ca/ - Must Email to order imagery	2013-2017	2015

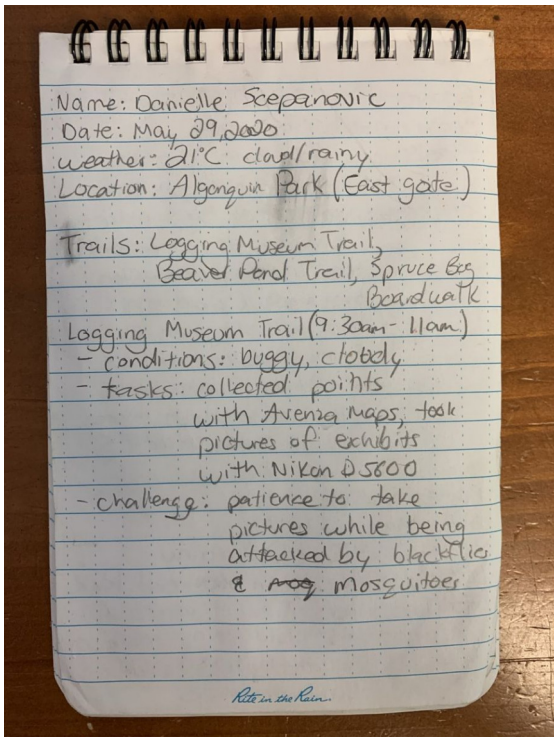
Apendicies

6.2 Example Field Notes


Name: Danielle Scepanovic
Date: May 29, 2020
weather: 21°C cloud/rainy
Location: Algonquin Park (East gate)

Trails: Logging Museum Trail, Beaver Pond Trail, Spruce Bog Boardwalk

Logging Museum Trail (9:30am - 11am)
- conditions: buggy, clobdy
- tasks: collected points with Avenza Maps, took pictures of exhibits with Nikon D5800
- challenge: patience to take pictures while being attacked by blackflie & ~~mog~~ Mosquitoes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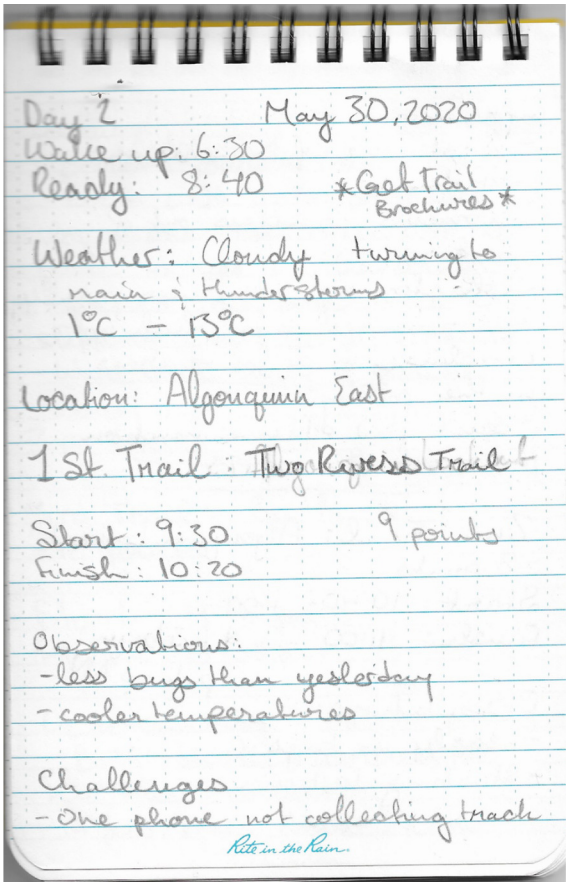
Rite in the Rain


Day 2 May 30, 2020
Wake up: 6:30
Ready: 8:40 *Got Trail Brochures*

Weather: Cloudy turning to rain & thunderstorms
1°C - 15°C

Location: Algonquin East

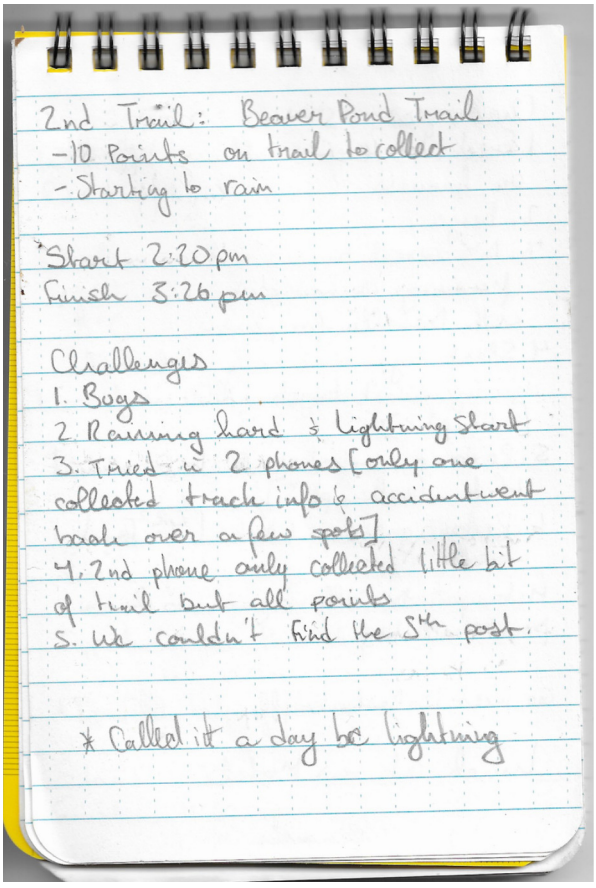
1st Trail: Two Rivers Trail

Start: 9:30 9 points
Finish: 10:20

Observations:
- less bugs than yesterday
- cooler temperatures

Challenges
- one phone not collecting track

Rite in the Rain


2nd Trail: Beaver Pond Trail
- 10 Points on trail to collect
- Starting to rain

Start 2:20 pm
Finish 3:26 pm

Challenges
1. Bugs
2. Raining hard & lightning start
3. Tried w 2 phones [only one collected track info & accidentwent back over a few spots]
4. 2nd phone only collected little bit of trail but all points
5. We couldn't find the 5th post.

* Called it a day bc lightning