WFSC/ENTO Study Abroad
Individual Research Project

"GIS Mapping of The Archbold Tropical Research and Education Center"

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Introduction

For my research, the Archbold Tropical Research and Education Center (ATREC) was chosen by Dr. Woolley and Dr. Wharton. It is the Current location of the Wildlife and Fisheries Sciences/Entomology study abroad. The ATREC is found on the island of Dominica, a commonwealth part of the Lesser Antilles of the Caribbean. It can be considered a tropical paradise even though it does not contain a single resort hotel. We arrived at the end of the dry season and did not see much rain until the start of the rainy season about a week later. The ATREC is located about four miles from the capitol city of Roseau and is nearly two-hundred acres in size. The ATREC consists of a main road and stream. Among and connecting the road and stream are many foot trails and individual points of interest. All of the foot trails lead to the compound of dormitories. Adjacent to the dormitories you will find a kitchen, a dining room, and staff quarters. As of yet, the ATREC does not have a map in either paper or electronic form. Because of the increase in technology, any map made of the research station many years ago could not have been near as accurate as the ones we are currently able to produce. The use of Global Positioning Systems is not only more accurate than measuring by hand, but it also saves a lot of time. It was my goal to carry out a project that would give the managers and future visitors to the station a reference map, and data that they can add to as the station grows. With this data they will be able to maintain the station by using the geographic information systems features associated with ArcGIS.

Materials

Earlier in the spring semester, I purchased a Garmin GPSMap 60 CSx handheld mapping Global Positioning System. This is the GPS receiver I used during my mapping project. The cost of the receiver was approximately $350 and was purchased through an online retailer. It is capable of taking points, tracks, and elevations. This model of Garmin is capable of being submersed in water a meter deep for up to thirty minutes and comes with a USB cable to connect it to a computer. Along with the receiver came a software program called Garmin Map Source. This software allowed me to download my points and tracks onto the computer and clean them up by deleting obvious errors. In order to get the GPS data from the receiver to the Geographic Information Systems (GIS) software, I had to download, from the internet, a piece of software from the Minnesota Department of Natural Resources titled “DNR Garmin”. The GIS software in which all the data ended up was ArcGIS, a product of Environmental Systems Research Institute (ESRI). In order to hike the many miles of GPS tracking I purchased a really comfortable pair of hiking shoes from Academy Sports and Outdoors. Also needed were clothes that could withstand getting wet while mapping the stream on the station.

Methods

Global Positioning System (GPS) is a system of orbiting satellites used for navigational purposes and capable of giving highly accurate geographic co-ordinates using hand-held receivers. (Heywood et. al., 2002) Waypoints are locations or landmarks you record and store in your GPS. They are locations you might want to return to later. Waypoints can be created using three methods. You can press the mark key while at a location, create a waypoint on the map page, or enter the co-ordinates for a waypoint manually. (Garmin, 2005) The tracks feature creates an electronic breadcrumb trail or “track log” on the map

page as you travel. The track log contains information about points along its path, including time, location, and elevation for each point. The track log starts recording as soon as the unit gets a location fix. (Garmin, 2005) The receiver is capable of storing up to twenty different tracks at any time.

GIS is a computer system that includes hardware, software, and appropriate procedures or techniques and orders for task implementation. (Heywood et. al., 2002) GIS can be used to add value to spatial data. Spatial data are characterized by information about position, connections with other features, and details of non-spatial characteristics. (Heywood et. al., 2002) All spatial data is broken down to points, lines, or areas. For the purposes of the ATREC mapping project, only points and lines where used. GIS technology is now well established and has been used since the 1960's. (Heywood et. al., 2002) The first two days after arriving in Dominica, were spent observing the ATREC and the landscape. I spent one day hiking downstream to make sure it was navigable before I attempted it with my gear. I was able to hike the full distance of the stream to the ocean without major problem. The first operation I performed once I had the GPS in hand was to calibrate it. To calibrate the GPS you must choose calibrate on the menu and follow the on screen instructions. This calibrated the compass only. To calibrate the altimeter I had to go to a know elevation and type it in to the receiver. I chose the ocean as the known point, because the elevation would make sense to be zero. With the GPS fully calibrated I was able to start mapping. I started mapping just the points of interest around the station and the trails that had to be used to reach said points. In order to maintain the best data for the points, I used the average point feature. This feature allows the GPS to sit in one location and take as many points there as you wish, then it averages them all together for a single accurate point. Back in the United States, and in other more developed countries there is a Wide Angle Augmentation System (WAAS) that allows the GPS to become more accurate from additional satellites on earth's surface. If used down in the Caribbean it has the potential to make the data even worse than without the WAAS so I was not able to take advantage of it. Once I was finished mapping the important points, I was able to map the other foot trails on the station that did not necessarily lead any where but to nature. I found it best to take GPS data when the climate was clear and the satellite reception was not effected by changes in the atmosphere. After taking all the field data, including seven mile hike to Middleham Falls and an eight mile hike to Boiling Lake, I downloaded the data to the Garmin Map Source software using the supplied USB cable. On the computer I was able to delete points on tracks that were obvious errors where for instance I stopped walking and the multiple satellites cause the track to make circles around itself. Once the data was cleaned and even more accurate than before, I uploaded it back into the handheld receiver. From there I was able to use the DNRGarmin software, obtained from the Minnesota Department of Natural Resource Department, to download the data into a file format, again using the USB cable supplied by garmin. I downloaded each waypoint and each track into a text file that will have a copy left behind for use by the research station. The data on the DNRGarmin software was also then saved as shape files. Once into the shape file format, the data was capable of being brought into the GIS software. Each waypoint and track was brought into ArcGIS and was the edited for color, size, and label. Next a title was added along with a north arrow and a scale bar. At this point the map was complete.

Results

Below is a list of every point feature I found, and the latitude and longitude of each one.

Type	Ident	Lat (N)	Long (W)
WAYPOINT	Barn	15.34647	61.3678
WAYPOINT	Bee House	15.34759	61.3678
WAYPOINT	Boiling Lake	15.31863	61.2947
WAYPOINT	Cabrits	15.58494	-61.477
WAYPOINT	Clearing	15.353	-61.365
WAYPOINT	Crossing	15.34606	-61.369
WAYPOINT	Green House	15.3474	61.3675
WAYPOINT	Market	15.29661	61.3872
WAYPOINT	Middleham Falls	15.34813	-61.336
WAYPOINT	Peak	15.31575	61.3041
WAYPOINT	Ruins	15.34792	61.3664
WAYPOINT	Shed	15.34623	61.3722
WAYPOINT	Springfield Station	15.34655	61.3689
WAYPOINT	Streamhouse	15.34618	61.3686
WAYPOINT	Syndicate	15.5238	61.4203
WAYPOINT	Water Tower	15.34807	-61.366

Below is a list of the beginning and ending of each track feature I found, along with the latitude, longitude, and altitude of each one.

Type	Ident	Lat (N)	Long (W)	Altitude
Begin TRACK	Bee House	15.35004	61.3638	511.5587
End TRACK	Bee House	15.34791	61.3669	426.0013
Begin TRACK	Boiling Lake	15.3289	61.3268	533.1884
End TRACK	Boiling Lake	15.31867	61.2948	783.1311

Begin TRACK	Dirt Road	15.34747	61.3669	400.0459
End TRACK	Dirt Road	15.34766	-61.368	387.068
Begin TRACK	Driveway	15.34788	61.3669	426.4821
End TRACK	Driveway	15.3473	61.3665	418.3108
Begin TRACK	Road	15.3473	61.3665	416.8689
End TRACK	Road	15.34484	61.3693	343.3279
Begin TRACK	Road To Middleham Falls	15.34477	61.3693	343.3279
End TRACK	Road To Middleham Falls	15.34774	61.3362	600.4807
Begin TRACK	Steps 1	15.34756	61.3683	392.8359
End TRACK	Steps 1	15.34722	61.3684	376.4935
Begin TRACK	Steps 2	15.34786	61.3673	392.8359
End TRACK	Steps 2	15.34789	61.3669	413.5043
Begin TRACK	Stream	15.34524	61.3668	340.9247
End TRACK	Stream	15.34524	61.3713	311.1238
Begin TRACK	Trail	15.34649	-61.369	354.3832
End TRACK	Trail	15.34563	-61.369	320.7371
Begin TRACK	Trail 2	15.34808	61.3676	418.3108
End TRACK	Trail 2	15.35014	-61.366	478.8739
Begin TRACK	Trail 3	15.34787	61.3673	405.333
End TRACK	Trail 3	15.34756	61.3683	392.8359

Begin TRACK	Trail To Massacre	15.34688	61.3689	344.77
End TRACK	Trail To Massacre	15.34626	61.3721	316.8917

Begin TRACK	Trail to Streamhouse	15.34623	61.3692	331.7921
End TRACK	Trail to Streamhouse	15.34612	61.3685	342.8473

A complete map of the ATREC can be found in figure 1. A map of the hiking trail to Boiling Lake is shown in figure 2. Finally, a map of the road/trail to Middleham Falls is shown in figure 3.

Data files can be found in attached folder.

Discussion

The only real problems I ran into during the project were the satellite reception and the file conversions for ArcGIS. When down in the river canyon, the walls block out any satellites that are not directly over head. I was able map a half mile stretch of the stream that flowed through the ATREC before reception was lost completely. After many hours of failing to convert my files to shape files that ArcGIS would read, I asked the advice of Kyle Wallace, who had some experience working with Arc. He was able to successfully transfer the data into Arc, allowing the project to move forward. Unfortunately this feat was accomplished with only a couple of days left in the trip so data manipulation and editing was minimal in the GIS software. We still managed to leave the ATREC with what we intended to do. We made maps of the features and saved data files for later use by the ATREC.

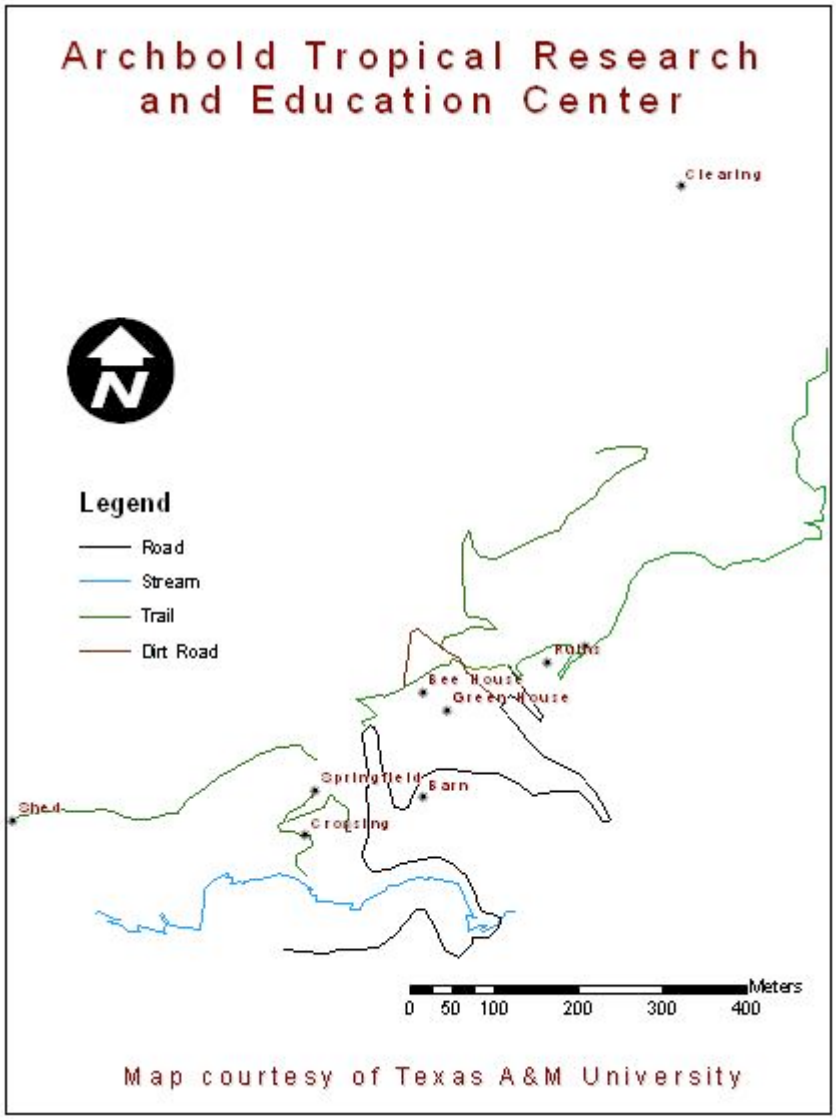
Archbold Tropical Research and Education Center
Clearing
N
Legend
Road
Stream
Trail
Dirt Road
Ruins
Bee House
Green House
Springfield
Barn
Shed
Crossing
Meters
0 50 100 200 300 400
Map courtesy of Texas A&M University

Figure 1

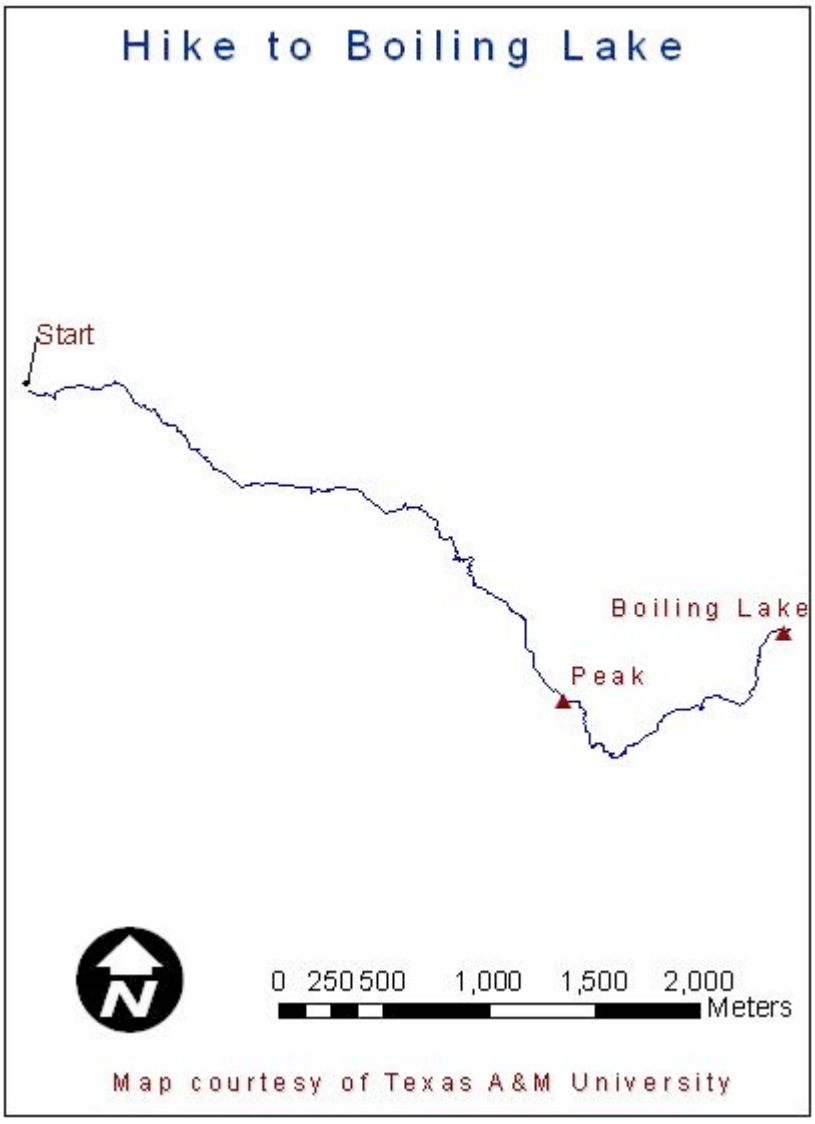
Hike to Boiling Lake
Start
Boiling Lake
Peak
N
0 250 500 1,000 1,500 2,000
Meters
Map courtesy of Texas A&M University

Figure 2

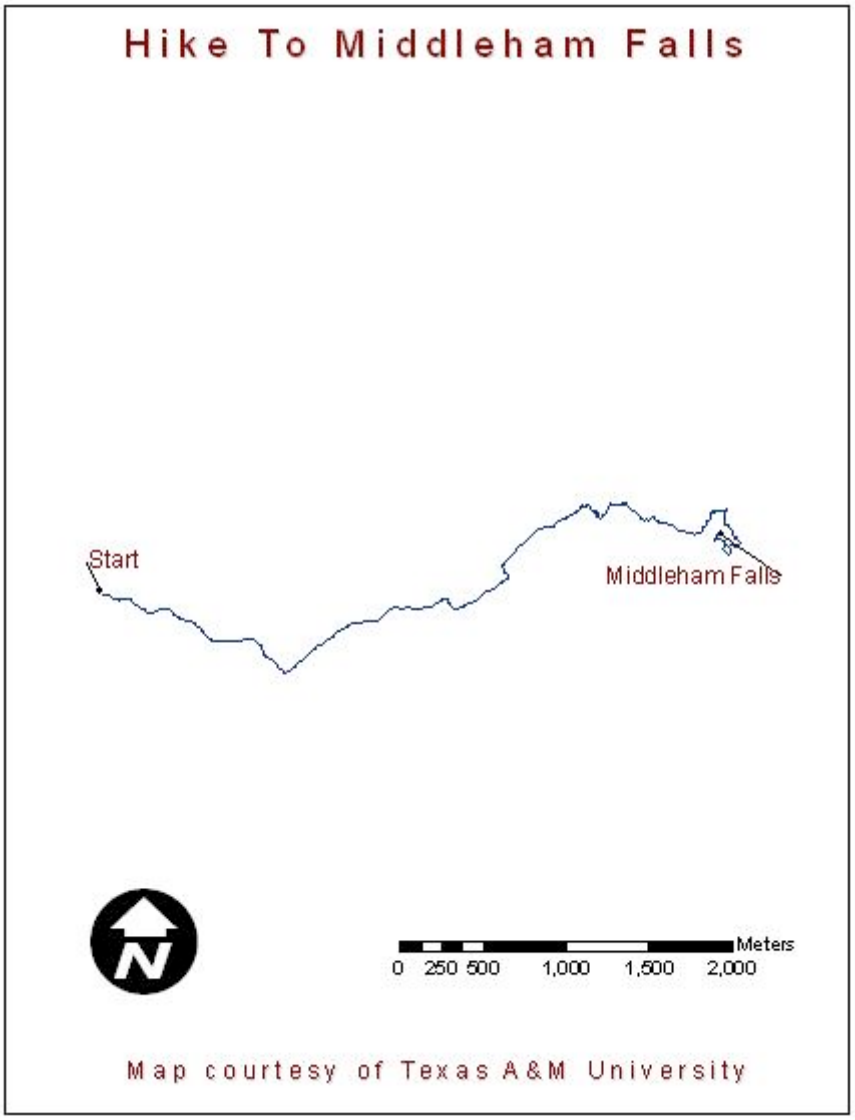
Hike To Middleham Falls
Start
Middleham Falls
N
Meters
0 250 500 1,000 1,500 2,000
Map courtesy of Texas A&M University

Figure 3

References

ArcGIS Desktop version 9.2. Environmental Systems Research Institute Inc. Redlands, California. 2007

DNRGarmin. Minnesota Department of Natural Resourses. Minnesota. 2007

Garmin Ltd. Garmin GPSMap 60 CSx With Sensors and Maps Owner's Manual. Olathe, Kansas. 2005

Heywood I., Cornelius S., and Carver S. An Introduction to Geographical Information Systems. Essex, England. 2002.