Digital Mapping as a Student and Staff Communication Tool

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by

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Satellite and computer technology developed over the last thirty years can be used to create new tools for communication between students and instructors in the plant materials classes. Maps have been a crucial communication tool for millennia. Once the domain of cartographers, new digital tools developed over the past few decades have made mapmaking accessible to anyone with access to a computer. As the same time, these advances have made maps themselves more interactive and versatile. One example of this versatility is the ability to quickly update a map to reflect changing circumstances via a few keystrokes. This project aims to demonstrate just one small way in which Geographic Information Systems (GIS) and Global Positioning Systems (GPS) technology can help aid communication between students and staff at California Polytechnic State University.

The Global Positioning System is a constellation of Positioning, Navigation and Timing (PNT) Satellites maintained by the U.S. Department of Defense. Composed of at least 24 satellites1 on four orbital planes these are used to determine the location of a point on the earth by plotting the location of an earth based receiver relative to at least four satellites (United States Air Force). Originally planned as a military application, President Reagan issued a directive that the GPS signal would be freely available worldwide when operational after a Korean Air Jetliner carrying 269 passengers was shot down after mistakenly entering Soviet Airspace in 1983 (Pellerin). Due to this universal availability, the utility of GPS has evolved far beyond the navigation and fire control system envisioned by military planners. GIS is the use of a computer system to view, manipulate and analyze geographically referenced data (USGS).

[1] Because it is impractical to maintain the orbit of GPS satellites indefinitely (and because available technology is constantly evolving) satellites are lost and added on an ongoing basis. For full coverage, a minimum of 24 satellites are necessary, but there are usually more than this in stable orbit at any given time.

As the plant material labs are currently conducted, students are led on a campus tour covering about 20 new plants every week and may have only one opportunity during the quarter to see some of the less common specimens. It can be difficult to find that or another plant of the same variety should a student wish to look at it again. This is particularly true for relatively new students who don't know their way around campus. The goal of this project is to produce an easily updated digital map that will provide staff with a new tool for coordinating their plant material labs and students with a way to quickly and easily locate the plants they wish to review. An easily updated map showing the locations of plants covered in plant materials would be very useful to students who wished to obtain new samples of the plants to study prior to a quiz or for a student to conduct a self-led tour in the event that they missed their primary lab and were unable to attend one of the alternate labs. In addition, this demonstrates how GIS and GPS may be integrated in a way to benefit teachers, students and staff involved in the Plant Materials classes offered by the Horticulture and Crop Science Department at CalPoly. The original goal was to create a map documenting the location of at least one sample of every plant taught in Plant Materials I and II. This proved to be impractical due to the fact that plants taught to students within the class are rotated through several quarters. Some plants are virtually always present while others are substituted from time to time through a process not elucidated to this author. This limitation has changed this into a demonstration project open to continual refinement and development by future students. Currently the map has approximately 180 specimens mapped, a little under half of the almost 400 species taught in both quarters of Plant Materials.

The equipment required for this project were: 1.) A GPS unit from the Bio-Resource and Agricultural Engineering (BRAE) department; 2.) Access to ArcGIS software; 3.) A list of plants

taught in both quarters of Plant Materials and 4.) A geo-referenced[2] image of the CalPoly campus.

The task was to create a digital map showing the location of the plants taught to students in Plant Materials I and II. This involved procuring a portable GPS unit from Bio Resource and Agricultural Engineering. The GPS unit was taken to each plant in question and used to reference it to a specific geographic location. Once all of the data points were collected (the location of each plant) the information was uploaded to ESRI ArcGIS on the campus computers. Using ArcMap, I then loaded a geographically referenced image of the campus. The points representing the plants were then superimposed over the campus image showing their approximate location in relation to various hardscape campus features (roads, paths, buildings). Because the GPS unit I was using was only accurate to within a few meters, I then had to adjust the location of all points representing the plants by comparing the point on the map to where I knew the plant actually was (usually determined by hand sketches of nearby physical features). Finally, I had to associate data points with a database describing the plant's family, genus, specific epithet and common name.

When I started the project, I didn't foresee the emergence of smartphones and their utility as low-end gps units and the versatility of open source GIS programs. By utilizing a smartphone and an open source GIS program such as Google Earth, I could have simplified my project considerably as the data must be ported over to that platform anyway if it is to be of any use to students. As a demonstration of the utility of GIS technology to the Horticulture and Crop Science department, this project has met my expectations, and I hope to see other students carry on with the project in the future as the map must be continually updated and refined to reflect changes in the layout of the campus (Observe that the map is now obsolete with respect to the plant materials located around what is affectionately known as the spider building due to recent construction activity in the area). If other students elect to carry on with the development of this tool, I would highly recommend a group effort as the work may be

[2] Georeference: referenced to a physical location. (Harvard University Graduate School of Design)

daunting and I strongly suggest at least one of them take at least the introductory GIS class offered by the NRM department. One possible partnership would be between a horticulture student a Crop Science student and a Biology student who, in addition to completing the Plant Materials map, could update Dr. Ritter's Tree Project (Ritter) and map out the crop growing areas on campus.

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