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Ideas at Work

Using Geographic Information System Technology to Identify Environmental Education Field Sites

Abstract

Natural resources Extension educators use outdoor environmental education sites to increase public knowledge of environmental issues, but locating appropriate sites can be time-consuming. Geographic information system (GIS) software and geospatial data can help Extension professionals choose such sites more efficiently. We describe our use of GIS technology to select a natural resources field day site in Tuskegee National Forest in Alabama. We used site characteristics such as forest type, road access, and slope to narrow potential sites from 94 possibilities to the two best options. Sources of free and low-cost geospatial data also are discussed.

Keywords: ArcGIS, geospatial data, natural resources, workshop planning

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Introduction

Natural resources Extension programs educate the public about forest ecosystems and related benefits (Peden, Hall, Westcot, & Police, 2016). Research has suggested that experiential learning outside the classroom greatly affects knowledge and values, making local outdoor environmental education workshops and other such events a priority for natural resources professionals. But determining the best locations for these outdoor activities, which may occur in remote locations, can be time-consuming. Geographic information system (GIS) technology can improve a natural resources Extension professional's ability to evaluate forest sites for hosting workshops, field days, field tour stops, and so on (Harman, 2014). Although not all Extension professionals may be proficient with or have access to a GIS (Merry, Bettinger, & Hubbard, 2008), many are interested in this technology. Herein we outline how one can use GIS technology to determine the best location for a natural resources outdoor education event, using our exploration of Tuskegee National Forest (TNF) in Alabama as an example.

TNF was established in 1959 and is located in Macon County, Alabama (U.S. Forest Service [USFS], 2014). The region in which TNF is located was once covered by approximately 90 million ac of longleaf pine (*Pinus palustris*) forests. This ecosystem is of interest because it provides habitat for many threatened and endangered wildlife species (USFS, 2014). Today longleaf pine forests cover an estimated 2–3 million ac. This situation makes determining a suitable location for a longleaf pine restoration and education site within TNF a real-world, relevant example for Extension professionals to follow when trying to determine locations for their own natural resources outdoor education field sites.

Selecting Potential Field Sites Using a GIS

For our project, we first identified criteria for usable field sites in TNF. We determined that field sites in TNF must have the necessary biological component (longleaf pine forests), must be accessible by vehicle, and must be physically accessible to all participants (i.e., have a slope of less than 4.8 degrees [U.S. Department of Justice, 2010]). We used ArcGIS Desktop (Release 10.3.1) (Esri, 2015) and data sets that included forest types in TNF to locate longleaf pine forests in the area. Additionally, we used National Agriculture Imagery Program aerial imagery and digital elevation model (DEM) data (U.S. Department of Agriculture Natural Resources Conservation Service, 2018) to estimate site elevation, site proximity to roads, and site slope percentage. Following the steps below, we determined the optimal locations for potential forestry field tour stops.

1. Using the TNF GIS data and ArcGIS, we queried the number of longleaf pine stands in TNF using the formula Cisc.FORTYPE='Longleaf Pine'. We found 94 stands meeting this criterion.

2. Using the "select by location" tool in ArcGIS, we selected longleaf pine stands adjacent to roads from the 94 stands identified in Step 1. We determined that 77 longleaf pine stands were adjacent to roads.

3. Using the DEM data, we calculated the slopes of the longleaf pine stands that were adjacent to roads. We found three stands having slopes of less than 4.8 degrees.

4. In an effort to rank the stands for suitability, we obtained 10 random measurements of slope from within each of the three stands identified in Step 3 to calculate each site's average slope.

5. Of the three sites, we determined that the site with an average slope of 2.33 degrees was potentially the most suitable location, followed by the site with an average slope of 2.46 degrees. We deemed the third site unsuitable as it had an average slope of 5.48 degrees.

Additional Technology Options

Extension educators can choose from a variety of technologies to accomplish timely and budget-efficient selection of candidates for outdoor education sites. Beyond the technologies we applied, other sources of low-cost geospatial data and programs Extension educators can use include the following options:

- EarthExplorer (https://earthexplorer.usgs.gov/) is a service of the U.S. Department of the Interior and the U.S. Geological Survey. It provides access to aerial imagery, elevation data, and land cover data from across the United States.

- Google Earth (https://www.google.com/earth/) is not a GIS but instead provides free or low-cost access to aerial imagery of the world. Google Earth Pro allows users to save images and import shapefiles.

- Geospatial Data Gateway (https://datagateway.nrcs.usda.gov/) is a free service of the U.S. Department of Agriculture Natural Resources Conservation Service. Users can download geospatial data, such as aerial imagery, topographic maps, and precipitation data, by state or county.

- 3DEP seamless DEMs (https://viewer.nationalmap.gov/basic/) represent the topographic surface of the earth and are available for free download.

- SoilWeb is a GPS-based app for iPhone and Android systems. It allows users to retrieve real-time soil information based on geographic location. It is also compatible with Google Earth.

- Web Soil Survey (https://websoilsurvey.nrcs.usda.gov/app/HomePage.htm), developed and managed by the U.S. Department of Agriculture Natural Resources Conservation Service, provides soil information for most counties in the United States.

Conclusion

Using the process outlined in this article, we were able to select an outdoor education site that could be used for an upcoming natural resources Extension event. Although a site visit is still necessary, implementation of a GIS assessment potentially decreases time spent searching for appropriate field sites. By applying techniques outlined herein, Extension educators familiar with this technology can supplement traditional assessment methods to achieve a more holistic planning process.

References

Esri. (2015). ArcGIS Desktop: Release 10.3.1 [Computer software]. Redlands, CA: Environmental Systems Research Institute. Retrieved from www.arcgis.com

Harman, M. B. (2014). Identifying locally important farmland: A novel approach to cooperative GIS analysis. *Journal of Extension*, *52*(2), Article 2TOT5. Available at: https://www.joe.org/joe/2014april/tt5.php

Merry, K. L., Bettinger, P., & Hubbard, W. G. (2008). Back to the future part II: Surveying geospatial technology needs of agriculture and natural resources Extension professionals. *Journal of Extension*, *46*(4), Article 4RIB1. Available at: http://www.joe.org/joe/2008august/rb1.php

Peden, J. G., Hall, A., Westcot, G., & Police, S. (2016). A walk in the forest: Elementary students' perceptions and knowledge of forestry principles. *Journal of Park & Recreation Administration*, *34*(2), 62–73.

U.S. Department of Agriculture Natural Resources Conservation Service. (2018). Geospatial data gateway. Retrieved from https://gdg.sc.egov.usda.gov

U.S. Department of Justice. (2010). ADA standards for accessible design [PDF file]. Retrieved from https://www.ada.gov/regs2010/2010ADAStandards/2010ADAstandards.htm

U.S. Forest Service. (2014). *Environmental assessment for Tuskegee Upland Pine Restoration* [PDF file]. Retrieved from http://a123.g.akamai.net/7/123/11558/abc123/forestservic.download.akamai.com/11558/www/nepa/90842_FSPLT3_1631204.pdf

