Diversity and Carbon Content of University of Richmond Campus Trees

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Abstract

Located in Richmond VA, the university offers two campuses divided by the Westhampton Lake. The goal was to create a high-resolution map of the distribution of trees and forest patches of the Westhampton Campus using Global Positioning System (GPS) and Geographic Information Systems (GIS) for web-based applications. The data were also used to quantify measures of species diversity and the amount of carbon stored in the trees and forests on campus. These metrics were then compared between the cultivated and less managed parts of campus.

Methods

Data Collection:
- Cultivated Tree Logging – Individual trees were logged in the cultivated areas of campus using a Trimble Nomad GPS unit attached to a Trimble GEX-G2 antenna which achieved sub-meter accuracy in most areas. The main attributes recorded were species1, diameter at breast height (DBH), and height. If a tree was found to be unhealthy or have abnormal attributes, those features were recorded. Only trees with a DBH greater than 5 cm were recorded.
- Unmanaged Forest Patches – Parcel data were obtained from the City of Richmond in order to have an accurate polygon of the forest area. For Westhampton forest, a dot density map was used to identify thirteen random points to be the corners of a 13 meter by 13 meter sample transects. Within each transect all trees with a DBH greater than 2.5 cm were recorded using the GIS unit.

Data Analysis:
- Diversity – Dominance-diversity curves were generated for campus as a whole as well as separately for the Westhampton forest and the cultivated areas of campus.
- Carbon – Allometric equations were used to calculate the biomass of the trees based on DBH and tree species. For 88% of the trees collected11. Then carbon content and CO2 estimations were made using calculations from the Alabama Forestry Commission9. The carbon content and CO2 estimations were made using calculations from the Alabama Forestry Commission9.

Online Map:
The data were uploaded to ArcGIS Explorer Online to increase access by the University of Richmond community and to serve as a resource for other universities looking to create a similar database.

Results and Discussion

Species Diversity

- 63 species total were observed in the mapped area of campus (845 individual trees)
  - 61 species in cultivated section (694 individuals)
  - 16 species in forest section (151 individuals)
- Forest area showed greater dominance by a few species
  - Forest Trees – 88.6%
  - Cultivated Trees – 56.3%

Carbon Content

- Mean CO2 Equivalent
  - Cultivated trees – 256.0 kg
  - Forest trees – 95.5 kg
- Top 5 Species Account for What Percent of CO2
  - Forest Trees – 88.6%
  - Cultivated Trees – 56.3%
- CO2 per Square Meter
  - Cultivated Area – 4.6 kg/m²
  - Forest Area – 38.3 kg/m²
  - Total Campus Area – 11.8 kg/m²
- CO2 Estimate Whole Campus
  - Cultivated Area – 4,729,661 kg
  - Forest Area – 10,643,815 kg
  - Total Campus Area – 15,373,476 kg

Works Cited and Acknowledgments

1. Hayden, John, Dr. "Key to Conifers on UR Campus." Print.
2. Hayden, John, Dr. "Key to Some Common Trees on UR Campus." Print.

Special thanks to John Remmes for his work on the project. Thanks to Todd Lookingbill and Tihomir Kostadinov for their guidance. Also thanks to Kim Klinker, John Hayden, Peter Smallwood, and the Spatial Analysis Lab for all their support.