Regional integration of long term data for environmental management in the United States

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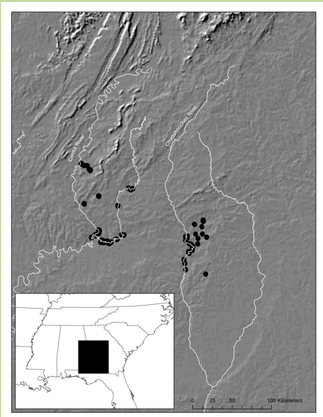
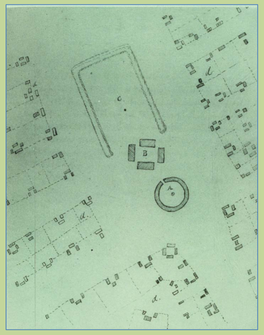
Introduction

Anthropogenic effects on biodiversity are one of the largest challenges facing humans today. The United Nations Convention on Biological Diversity notes that understanding the effects on biodiversity as either natural phenomena or as anthropogenic events is important for global environmental management, economic development, and elucidating climatic change. Humans have had a profound effect on the local and global environment, species diversity, and climate. Our ability to mitigate or manage these effects depends on our ability to understand the specific human behaviors and their long term effects on biodiversity and ecological processes.

Willis and Birks (2006) recently argued that ecological processes occur over long time periods and that a thorough understanding of biodiversity requires understanding ecosystems over equally long time periods. Environmental conservationists concerned with invasive species, wildfire, climate variability, and thresholds of natural variability should be using long-term datasets such as those used by archaeologists and geologists. Particularly for ecosystems formed during the Holocene, those long-term processes include the actions of humans. This poster describes how data from historic documents, archaeology, and palynology can be combined over large regions to metrics of change for environmental management. The research has been applied to the southeastern United States where the Muscogee Creek people lived.

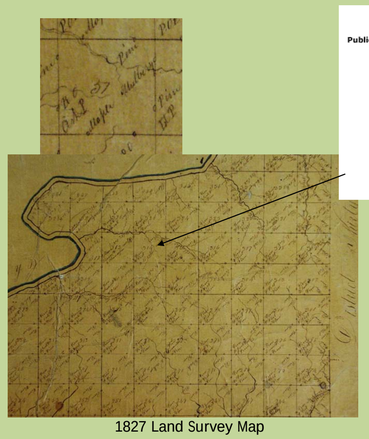




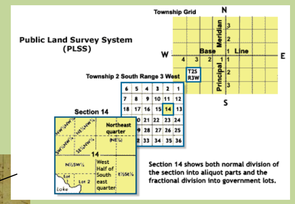
Muscogee town according to William Bartram, 1777

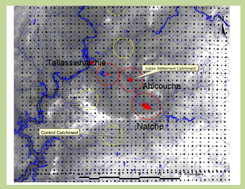
The Muscogee Creek people were a Native American population that lived in the southeastern region of the United States between, at least 1600-1800. They were a horticultural society depending on domesticated maize, squashes, sunflower, beans, and foraged foods such as fish, hickory nuts, and deer. Their villages were located near major river valleys. Their horticultural fields were usually adjacent to their villages and were cleared with manual labor and fire. Forest products were gathered for food, medicine, and construction materials.

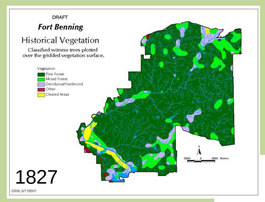
During the nineteenth century, some of the Creek people began to experiment with Eur-Asian crops such as cotton, peas, and rice. The Creek people hunted deer and other animal resources from the forest. Deerskins were used for clothing and were traded during the early eighteenth century to European settlers in Georgia, Florida, and South Carolina to be shipped to Europe. Deer were hunted with broadcast forest fires as well as solitary hunting parties.

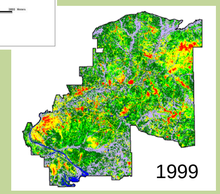


1827 Land Survey Map

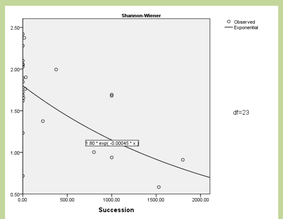








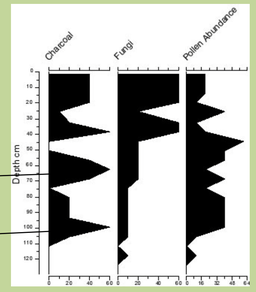
Environmental data in the form of point loci of trees by species are extracted from historic documents and maps to create GIS models of the forest composition. The point data can be used to model forest composition and compared to modern satellite imagery to measure change. Statistically significant samples of experimental catchments compared to control catchments to measure the effects of human activity on forest composition.



An analysis of 25 chronosequence sites indicates that Native American activities such as horticulture, use of fire, and central place foraging increase biodiversity. The relationship between biodiversity and years of succession since human occupation is statistically significant (p=.001) and strong (-.625).

Palynology informs about human use of fire during the eighteenth century deerskin trade

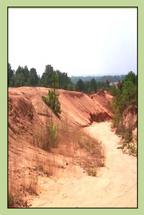
Charcoal in sediment cores shows peaks in forest fires that correlate with the historically documented deerskin trade. The magnitude of the forest fires from deer hunting were similar to those from western agriculture.



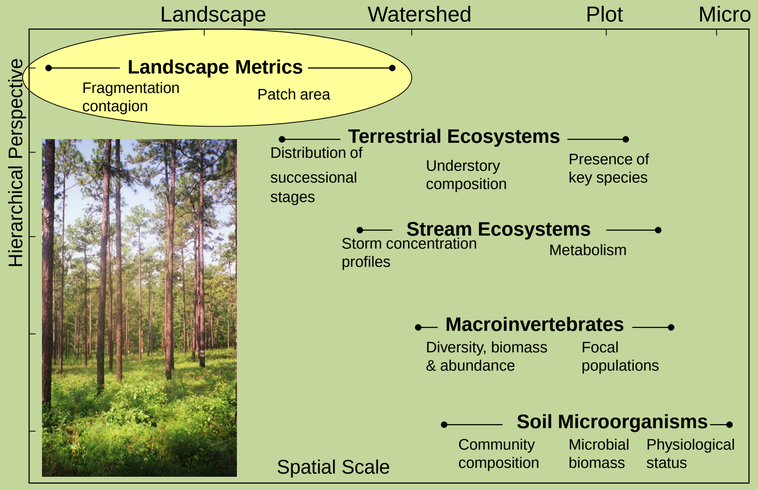
The results of these studies are combined to identify the effects of humans on the present and past environment. Metrics of change were identified at varying scales to be used for modern environmental management on United States owned land.

Archaeological and Historic data used for Department of Defense Environmental Management

- Land degradation and habitat fragmentation resulting from military land use may compromise the ability of a base to fulfill its mission
- Environmental responsibilities: endangered species and cultural resources



Suite of Ecological Indicators derived for environmental management



References

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International Science Workshop: Regional Integration of Past Records for Management of Modern Resources and Landscapes

International Geosphere-Biosphere Programme: Past Global Changes
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