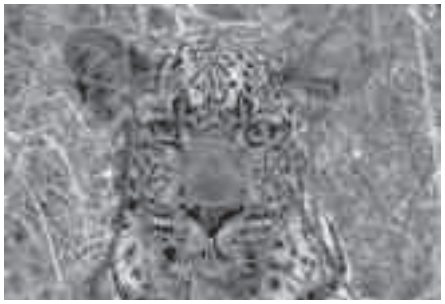
Detecting Patterns of Disturbance via Landscape-Level Vegetation Analysis within Southern Africa

ERIN BUNTING

For the past two summers, I have had the opportunity to work within the Okavango, Kwando, and Zambezi Catchments of southern Africa studying the impact of climate variability and other forms of disturbance on vegetation.

Environmental cues of phenology are well understood for temperate systems, however less so for dryland ecosystems. The savanna ecosystems of southern Africa are water limited and responsive to rainfall at varying temporal and spatial scales. While precipitation and associated soil moisture are most commonly associated with the variable vegetation pattern, many other biotic and abiotic factors also affect the ecosystem. Such factors include: fire, herbivory, soils, and anthropogenic activity. My research examines the impact of such factors on the vegetation of southern Africa, focusing mainly on the impact of climate variability.

My study region, located in tropical and subtropical southern Africa (the Okavango, Kwando, and upper Zambezi catchments) covers 683,000 km^2 across Angola, Botswana, Namibia, and Zambia. Average annual precipitation ranges from 400-2200 mm/yr. There is a steep north-south precipitation gradient characterized by low precipitation and high variability in the southern semi-arid regions and higher rainfall in the northern portions of the basin. The precipitation regime of the region has undergone great fluctuation, which has been documented in the rainfall data and within environmental histories obtained. Other variables influencing the land cover, while not as dominant as precipitation, still play a large role in the landscape dynamics. Soils are highly



variable across the basins, with differing levels of the key nutrients nitrogen and phosphorus. Additionally, many of the countries have differing policies in regard to burning, but savanna ecosystems are adapted to fire, the regularity of which varies depending on the environmental conditions.

It is my goal to utilize a time series of remotely sensed satellite imagery, precipitation data, livelihood surveys, and field-based vegetation sampling to classify the landscape. Specifically, I look to analyze the determinants of vegetation cover via spatial statistics, classify the vegetation using a rule-based approach that integrates spectral indices, and model the vegetation and climate at the landscape level. Such a study requires extensive field-based and satellite-based data. The satellite data utilized will consist of high and low resolution imagery, so that I can scale up the vegetation classifications and models to the entirety of the three basins. Field-based data is essential for the calibration and validation process, both the vegetation classification techniques and the models require ground truthing.

Two field seasons, which were partially funded by the Center for African Studies, have enabled me to collect sufficient vegetation data. Both training samples and transects were complete across the region, measuring percentage canopy closure, level of human influence, and discriminating between vegetation type. Research such as mine cannot be completed without ground truthing the satellite images. During summer 2011 in particular, vegetation sampling was concentrated in and around the Caprivi Strip of Namibia, Moremi National Park, and Chobe National Park.

The results of my research look to develop a detailed environmental history for the region. Utilizing a time series of satellite imagery the recent stability of the system, the impact of disturbance, and the overall shift in the vegetated state will be documented. Such information can assist in environmental management, and assess to some degree the impact that humans have had on the system. The overarching objective to my research is to contribute to a broader understanding of the dynamics of human environmental interactions in a semi-arid ecosystem.

Erin L. Bunting is a Ph.D. candidate in geography. *Funding for this research provided by: NSF SPICE Fellowship, NASA Land-Cover / Land-Use Change Program Grant, CAS pre-dissertation research award, CLAS travel award, and the UF Office of Research.*