

# THE INFLUENCE OF RAINFALL, VEGETATION, ELEPHANTS AND PEOPLE ON FIRE FREQUENCY OF MIOMBO WOODLANDS, NORTHERN MOZAMBIQUE

*Natasha S. Ribeiro<sup>1,2,4</sup>, Gregory S. Okin<sup>3</sup>, Herman H. Shugart<sup>1</sup>, Robert J. Swap<sup>1</sup>*

<sup>1</sup>Department of Environmental Sciences, University of Virginia, Clark Hall, 291 McCormick Road, Charlottesville, VA 22904, USA

<sup>2</sup>Departamento de Engenharia Florestal, Faculdade de Agronomia e Engenharia Florestal, Universidade Eduardo Mondlane, P.O.Box 257, Maputo, Mozambique

<sup>3</sup>Department of Geography, University of California, 1255 Bunche Hall, Los Angeles, CA 90095-1524

<sup>4</sup>Corresponding author. Email: [nribeiro@uem.mz](mailto:nribeiro@uem.mz); [nsr8s@virginia.edu](mailto:nsr8s@virginia.edu); ph #: 258-21492177; Fax #: 258-21492176

## ABSTRACT

Miombo woodlands are important in southern Africa as they occupy over 50% of the land and, their goods and services support a large proportion of people in the region [1]. Anthropogenic fires occur in miombo every year especially in the dry season (from May to October). This study explores the influence of annual rainfall, elephant density, human density and corridors, and vegetation on the fire frequency. Our hypothesis are: 1) At the landscape level, there are significant intra-annual differences in biomass (measured by remote sensing) between areas with high fire frequency and low fire frequency; 2) The fire frequency within Niassa National Reserve is influenced by the prevailing environmental conditions such as mean annual precipitation, human population, vegetation density and elephant density. The study was carried out in Niassa National Reserve located in northern Mozambique, the largest and more pristine conservation area of miombo woodlands in the world. We used a time series analysis and statistical *t*-test of MODIS-derived Normalized Difference Vegetation Index (NDVI) and Enhanced Vegetation Index (EVI) to explore the relationship between biomass and fire frequency. The influence of rainfall, elephants, human movements and density and vegetation on fire return was explored using a stepwise logistic regression analysis. The results of this study indicate that fire frequency is higher in places

with high biomass at beginning of the dry season. In these areas fire seems to be more intense and to strongly reduce biomass in the late dry season. We infer that there is a varied tree:grass dynamics in this area that strongly influenced by fire. Land cover is the strongest predictor of fire frequency, but elephant density, annual rainfall and human corridors are also important. The hypothesized interaction between the fire predictors is that higher elephant density in the east causes modification in the tree:grass ratio, with a decrease in tree cover and an increase in grass biomass. Since grass is the main component of the fuel load it causes higher frequency in the eastern than the western Niassa National Reserve. Human population is also concentrated (both settlements and corridors) in the east portion of the reserve and even though it is not the most important predictor it is the main initiator of fire and thus, cause the observed higher fire frequency in eastern Niassa National Reserve.

## **References**

- [1] P. V. F Desanker, P.G.H. Frost, C.O. Justice and R.J. Scholes, "The miombo Network: framework for a terrestrial transect study of land use and land cover change in miombo ecosystems of central Africa," International Geosphere - Biosphere Program (IGBP) Report 41 (IGBP: Stockholm), 1997.