Progress Report for Phase I

Coupling Land Use and Land Cover Changes, and Ecosystem Processes in Miombo Woodlands

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Introduction

This report covers the first phase of the NASA LCLUC Miombo project. The project is progressing very well and should start producing results by end of the year. We have acquired a Sun workstation for GIS/RS analysis for UVA and a PC-based system for Zimbabwe, both running Erdas Imagine GIS software. We have also acquired all major satellite data required for the project, and have started field work to collect validation data for the satellite mapping of land cover, as well data for ecological models. We have a conceptual model of land use change and ecological dynamics models, these will be implemented into a prototype integrated land use change model by end of the year. During this initial phase, we have published an IGBP Report that describes the science plan for the Miombo Network, a research program that is centered around questions of land use and land cover change in the miombo woodlands of Southern Africa. We have also released a CD-ROM of biophysical and socio-economic data for the miombo region.

Data Collection and Field Studies

Data collection efforts are concentrated on 10 sites scattered across the miombo region in five countries. We have acquired 1984/5 and 1995 TM data for each site, and are in the process of acquiring aerial photographs to assist in classification of the images and in validating tree cover products. MSS data are being acquired for the 1972/3 period. We have also collected topographic maps the areas concerned, both at 1:250,000 and 1:50,000 to assist in geo-coding.

Analysis of spectral and spatial characteristics of woodland and agricultural landscapes in the Kasungu and Sengwa sites (Malawi and Zimbabwe) revealed the best combination to of bands for TM in the dry season to be 4,7,1. (Most available TM scenes are from the dry season due to high cloud cover in the wet seasons and the patchiness in scenes captutred). Unsupervised classification was conducted and landscape indices computed using FRAGSTATS software. A manuscript is being prepared for submission.

From prints of the TM images, vegetation cover, land use and GPS locations are being recorded for sample sites. A year's measurements on ecological study sites (growth, stand development, recovery from fire and human clearing) will be completed by summer 1998 across the region in collaboration with Miombo Network scientists.

Detailed data from national archives and reports on socio-economic variables (population, prices, production rates, etc.) are being compiled at district (county) or higher resolution. These data will form integrated data bundles for analysis of the land use change model at multiple levels of resolution, and will be used to analyze special areas of rapid changes ("hot spots").

Model Design and Implementation

A conceptual land use change model that has multiple levels of resolution in a hierarchy (village, commercial center, national, regional commercial hub, and global levels) is being developed, and will be reviewed at the June 1998 Miombo meeting in Malawi. A paper is being prepared to describe material flows between the different levels, and decisions and influences of land use and associated land cover changes.

An improved vegetation dynamics model is under preparation, and is being implemented within the MUSE graphics modeling framework of Ian Noble (http://biology.anu.edu.au/research-groups/ecosys/muse.htm). The patch dynamics model will be converted into a spatially explicit model to simulate disturbance regimes (human and natural) at the landscape scale.

Impacts of land use change is being analyzed in relation to carbon fluxes, and will be linked to emissions/fire work. The June workshop in Malawi will compile a report on "land use and the causes of global change in the miombo region".

Network Impact

This project has served as an important initial project of the IGBP Miombo Network.

- This project led the design and implementation of a data cd-rom for Miombo in conjunction with the IGBP DIS, LUCC, and START. The Miombo CD contains existing geographic and tabular data for Southern Africa in a common gis format for easy viewing and extraction. The CD is being made available to African scientists (and global change scientists) who have very limited internet and web access currently, where most of the data resides. The Miombo CD can be accessed from the Miombo Web page at http://miombo.gecp.virginia.edu/miombocd.
- The satellite data being used as part of this study (SPOT XS and Landsat TM) are being shared with African scientists that are doing national studies. This has greatly increased access to satellite data and is stimulating discussions of best ways to map miombo ecosystems.
- This project has also been an important catalyst for discussions of land use in miombo, and two important meetings have been organized by the PI's in Southern Africa: One in Lusaka, Zambia in October, 1997; the second in June 1998 in Kasungu, Malawi. The outcome of the Lusaka meeting was a synthesis of case studies of land use in miombo, and the design of new

projects to better understand land cover of miombo, and how land use is driving land cover changes. A conceptual model of land use change in miombo will be reviewed at the Kasungu meeting in June, leading to the implementation of a prototype land use change model before end of the year.

- One PhD student is working on the project (Malanding Jaiteh) at Michigan Tech University, while another student will start work this May (Sarah Walker, at University of Virginia).
- IPCC - Africa chapter and the TAR - lead author.
- Miombo LCLUC will contribute to SAFARI 2000 - a Southern African Fire and Atmospheric Research Initiative.

Selected Presentations

Desanker, P.V., P.G.H. Frost, C.O. Justice, and M.S. Jaiteh. Process Study of Land Use Changes and Ecological Processes in Miombo. *Earth's Changing Land, GCTE-LUCC Open Science Conference on Global Change,* Barcelona, Spain, March14-18th, 1998.

Desanker, P.V., I.Auge, J. Maso, and P.G.H. Frost. Overview and Demonstration of the LUCC Miombo CD-ROM. *Earth's Changing Land, GCTE-LUCC Open Science Conference on Global Change,* Barcelona, Spain, March14-18th, 1998.

Frost, P.G.H., and P.V. Desanker. Integrated View of Land Use in Miombo Woodlands. Fifth Meeting of the IGBP Scientific Advisory Council (SAC-V), Nairobi, Kenya, September 1-7th, 1998.

Desanker, P.V. A Strategy to Model Land Use and Ecosystem Processes in Miombo Woodlands, IGBP Miombo Network Meeting, Lusaka, Zambia, October 27-31st, 1997.