

Quarterly Report for April to June 1998

Malawi Environmental Monitoring Programme Prototype Environmental Information System (EIS) Middle Shire Analysis

Contribution of the Arizona Remote Sensing Center (ARSC), University of Arizona, Tucson

Transition: PLUS to the Prototype EIS

ArcView project and MS Access metadata development were completed for PLUS – all data were transitioned into the format and standards required by the prototype EIS. The data were delivered to 10 agencies in Malawi participating in EIS development or directly involved in the land reform programme.

Participant Training

Four individuals central to EIS development efforts in Malawi participated in a Spatial and Temporal Modeling of Land Cover Conditions Course conducted in Tucson between 25 May and 30 June 1998. The training covered remote sensing and image processing fundamentals, metadata management, land cover change mapping, geographic information systems (GIS) spatial analysis, spatial modeling, data presentation, data interpretation, and report writing. The GIS portion focused primarily on vector analysis and included cartographic acquisition, topological construction, feature attribute tables, database theory and design, normalization, preprocessing, quality assurance and quality control (QA/QC), and vertical integration. The modeling included union of two layers, DEM design and creation, watershed delineation, agricultural suitability (LREP standard), erosion hazard (modified SLEMSA standard), and land cover change. The participants included:

Patrick S. Jambo, Department of Forestry
Geoffrey C. Mzembe, Department of Surveys
Mesheck L.M. Kapila, Department of Land Resources Conservation
Vincent A.L. Mkandawire, Department of Land Resources Conservation

They returned to Malawi with the final CD ROM dataset for PLUS (5 spatial and one metadata CD for each agency), all of the raw Landsat TM 1984 and 1994 imagery, and all the atmospherically and radiometrically corrected as well as georectified data noted in the second table below. The participants used actual Middle Shire prototype EIS data and wrote a report summarizing their activities and a number of findings critical to EIS development.

They also initiated several individual projects on areas outside those currently under focus in the Middle Shire Analysis. These efforts continued into July 1998 and will be reported in detail in the next quarterly report.

Middle Shire Analysis

ARSC has been working in conjunction with the Department of Surveys, the Land Resources Conservation Department, and Forestry to capture the spatial data necessary for analysis of

erosion hazard in the Middle Shire. For Blantyre and Machinga ADDs, these efforts progressed rapidly in anticipation of the participant training. During the training several critical issues concerning the base soils and land cover data layers were evaluated in detail. The primary result is that all completed work on these two critical layers must be reevaluated with respect to fundamental problems with original data. The participants agreed to discuss options with their respective agencies upon their return to Malawi.

Summary of Prototype EIS Spatial Data Development

Data Layer	Blantyre ADD			Machinga ADD			Rivi-Rivi		
	Capture	QA/QC	Metadata	Capture	QA/QC	Metadata	Capture	QA/QC	Metadata
<i>Base Data</i>									
<i>Survey Sheets (1:250,000)</i>									
Contours (100m)	√	√	√	√					
Streams	√	√	√	√	√	√	√		
Roads	√	√	√	√	√	√	√		
Boundary	√	√	√	√	√	√			
<i>LREP (1:250,000)</i>									
Agroclimate	√	√	√	√	√	√			√
Soils	√	*	*	√	*	*			
<i>Satellitbild (1:250,000)</i>									
1991 Land Cover	√	*	*	*	*	*			
<i>Analysis</i>									
DEM	√								
Shaded Relief	√								
Erosion Hazard	**								

*The completion of QA/QC of these data layers with the assistance of Malawian participants in the May-June training revealed fundamental problems in the original data. In the case of LREP soils, the soil categories along with edges of separate map sheets do not consistently match (and in many cases are dramatically different). In the case of Satellitbild's 1991 Land Cover map, there appears to be a registration or projection error that has resulted in a 1-3 km shift in where the land cover classes fall relative to the original images the classes were derived from. Experts from key Malawian EIS agencies are discussing options for addressing these problems.

** Erosion hazard modeling was conducted during the May-June training, however the discovery of fundamental problems in the original data (particularly land cover) led the participants to suggest a systematic review prior to issuing any modeling products for the Middle Shire Analysis.

Image processing activities for south central Malawi

All of Malawi is covered by 11 Landsat Thematic Images. The south-central region, including the Middle Shire, is captured by the four images covering territory physically north of Ngabu ADD. Using Landsat imagery nomenclature, these are named by satellite path/row as follows:

P168/R070 P167/R070
P168/R071 P167/R071

The raw imagery must undergo a series of preprocessing steps before it can be used in the development of products such as land cover maps. These were completed for these four scenes and the images were delivered by the participant trainees to Malawi.

Image Processing Step	P169/R067		P168/R071		P167/R070		P167/R171	
	84'	94'	84'	94'	84'	94'	84'	94'
Atmospheric /Radiometric Correction	√	√	√	√	√	√	√	√
Geometric Rectification	√	√	√	√	√	√	√	√
Corrected/Rectified Images added to EIS	√	√	√	√	√	√	√	√

The trainees also conducted unsupervised and supervised classification of a portion of these images as part of their training. They created land cover maps, conducted changed detection, and then reviewed their criteria selection process, both for classification and valuation of change.

Developments on Analysis Methods

The GIS model used to evaluate erosion hazard in PLUS was based on the modified SLEMSA model used in LREP. The GIS application of this model has been fine-tuned to improve its application in the Middle Shire Analysis. Algorithms have also been developed to facilitate the projection of point data such as the location of Department of Meteorology weather stations in Malawi.

National Data Updates

The development of the prototype EIS necessarily has impact on data layers that already exist at the national level. The national boundary has been revised to incorporate the greater detail resulting from the Middle Shire Analysis data capture. It was discovered that the FAO soils map had a vertical integration problem that has been corrected. The LREP agroclimatic zones also proved to have topological problems that have been corrected for the prototype EIS.