Using Landsat Imagery to Analyse Land Cover Change in the Njoro Watershed, Kenya

T. J. Baldyga[1], S. N. Miller[1], K. L. Driese[1], C. Maina-Gichaba[2]

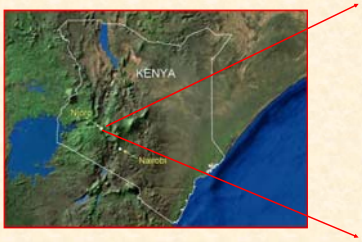
1. University of Wyoming, Department of Renewable Resources, P.O. Box 3354, Laramie, Wyoming, 82071, USA

2. Egerton University, Department of Geography, PO BOX 536, Njoro, Kenya

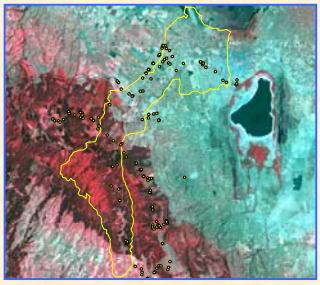
Introduction

In developing nations where resources are scarce and increased population pressures create stress on available resources, methods are needed to examine effects of human migration and resultant changes in land cover. Widespread availability and low cost of remotely sensed imagery and Geographic Information Systems (GIS) are making such methods a reality to develop quantitative resource mapping and land cover change detection in developing nations.

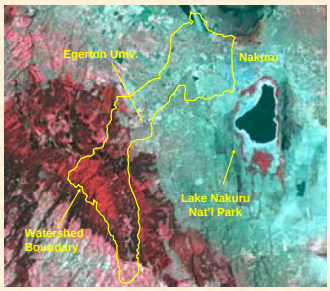
The River Njoro Watershed

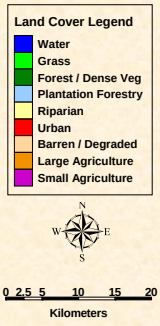


Location of the Study Area

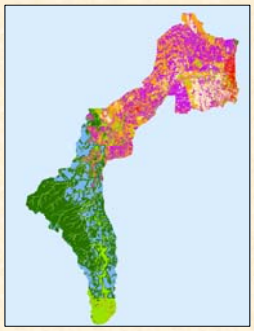


GPS locations of validation sites





Raw Landsat Image (1995) of Region Around Study Area



Classified Landsat Image of Study Area

Land Cover Class	1986 (ha)	1995 (ha)	2003 (ha)	Change 1986 – 2003 (ha)
Open Water	0	0	1	1
Urban	275	438	502	227
Agriculture	10208	9902	11504	1296
Barren	2146	2162	1518	-628
Forest	11243	10110	7676	-3567
Grassland	4538	3017	4437	-101

Methods

- Baldyga et al. (2004) showed that vegetation and temporal variability resulted in large classification errors in an unsupervised classification – this effort had ***41% accuracy***
- Band separability for 9 informational classes was measured for a Landsat 7 image acquired in Kenya's Rift Valley (Path 169, Row 60) on 4 February 2003.
- This analysis indicates that in this region the nine identified spectral classes are best distinguished using a four-dimensional image consisting of bands 4, 5 and 6 and the tasselled cap transformation for brightness (TC1).
- Informational classes (land cover) were identified for this project and a combination of unsupervised and supervised classification methods were used to classify the 4-dimensional image.

Results

- The current classification (see Table) is ***76% accurate*** (unsupervised / supervised)
- The greatest error is in classifying ***Barren areas***, which change seasonally and annually, so the error is not surprising given that ground truth data collection was impossible on the acquisition date of the Landsat image.
- Other error: Shrublands and Riparian were classified as Agriculture and Forest respectively
- In all cases of misclassification, at least ***one adjacent cell*** was classified as the accuracy assessment point.
- All misclassified Grasslands cells were classified as Agriculture or Forest and ***located near transitional areas.***

Land Cover Class	Map Total	Number Correct	Producer's Accuracy	User's Accuracy
Open Water	5	5	100%	100%
Urban	3	2	67%	67%
Agriculture	33	21	64%	81%
Barren	10	1	10%	10%
Forest	25	15	60%	79%
Grassland	95	86	91%	78%
Total:	**171**	**130**		
Overall Accuracy:		**76%**		

Summary

We believe the classification accuracy using the bands and enhancements above is much higher than indicated. Results are limited due to low numbers of field visits (400). Future work towards refining the classification process by incorporating ancillary data will improve results, especially in Riparian and Agricultural areas. These classified land cover scenes serve as input to GIS-based models as part of a systems approach to understanding watershed dynamics. Therefore, developing accurate classification methods in rapidly changing tropical landscapes is critical to understanding dynamic systems.

References

Baldyga, T. J., S. N. Miller, W. Shivoga & C. Maina-Gichaba (2004). Assessing the impact of land cover change in Kenya using remote sensing and hydrologic modelling. Proceedings of the American Society for Photogrammetry and Remote Sensing Annual Meeting, Denver, Colorado, May 23-28, 2004.

Collaborating Institutions of the SUMAWA Project – Visit us at www.sumawa.org

University of Wyoming, USA

Egerton University, Kenya

Moi University, Kenya

Kenya Department of Fisheries

Kenya Wildlife Service

University of California-Davis, USA

Funding for this research was provided by the **Global Livestock Collaborative Research Support Program (GL CRSP)**

The GL-CRSP is funded in part by USAID and by participating institutions.