Operationalizing GOFC in the Miombo Region and Questions of Carbon

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Outline

- Objectives of project
- Tour of activities and some early results
- Next steps

- Miombo Region: Tanzania, Malawi, Mozambique, Zimbabwe, Zambia (using Mozambique for mapping pilot)

Objectives

1) Mapping the miombo region using Landsat 5 and 7 data by working in conjunction with Southern African national mapping agencies;

2) Measurement of carbon densities in representative land cover/forest cover types;

3) Development of a carbon accounting model for 1990 and 2000 and links to dynamic land use change

4) Development of a regional spatial database for site characterization; and

5) Development of an information management system that will will distribute satellite data for the miombo region

Main Activities 1

Year 1: team building activities

GIS/RS Training Workshop in collaboration with START (NORAD funding) in Maputo, July 13-18, 2000

Miombo GOFC Coordination Workshop - 20-22 July 2000, Maputo, Mozambique,

- Special issue coming up in *Forest Ecology and Management*

Forest Ecology and Management **Special Issue**

Papers in following categories

- Reviews of Remote Sensing Applications (mostly Landsat and SPOT) and Methods for Southern Africa (woodlands/savannas)
- Case studies of mapping and use of Landsat in miombo
- Carbon and Biomass assessments and modeling
- Case studies of land use and change
- *(see Miombo Folder for list of papers – expected early next year)*

Miombo GOFC Workshop, Maputo 2000 - National Reps selected

(Paulos Mwale (SADC); Pius Yanda; Dominick Kwesha; Manuel Ferrao)

National GOFC Representatives for Miombo

Tanzania

Pius Yanda, Institute of Environ Studies, Univ of Dar es Salaam (pyanda@hotmail.com)

Malawi

Leo Zulu, SADC Forestry Sector Technical Coordination Unit (lzulu@hotmail.com)

Zimbabwe

Dominick Kwesha, Zimbabwe Forestry Commission (dkwesha@frchigh.co.zw)

Mozambique

Manuel Ferrao, CENACARTA (manuel@carvalho.uem.mz)

Zambia

Allan Mulondo, Zambia Met Services

George Kasali, Kafue MA Project

Selected Needs for the Region

(Based on recommendations from GOFC meeting in July 2000)

1. Need Landsat 7 coverage for the whole region (access to data sooner than later)

2. Data distribution through national nodes using **CD-ROMs** most effective means versus online data servers owing to very limited Internet availability in region

3. Need to rescue (formally archive) forest biomass data and other field data from national studies to support carbon budget studies and validation

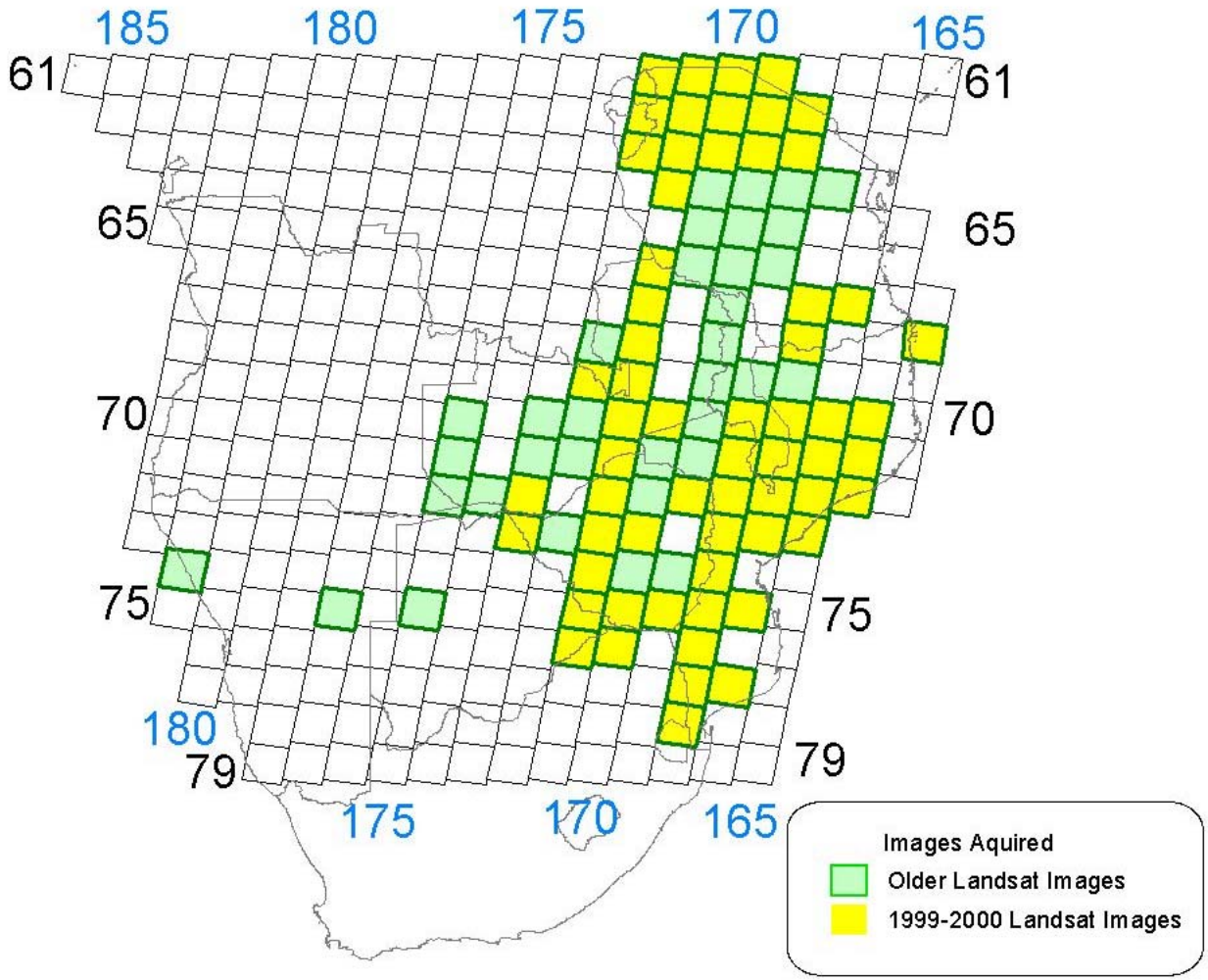
Mozambique Workshop July 2000 – fire scars

Data Distribution to Stakeholders:

Distribution of Landsat data on CD to national reps
– each country has copies of **ALL** data available in the Miombo Network archive for their region(total of >300 scenes, mostly older data)

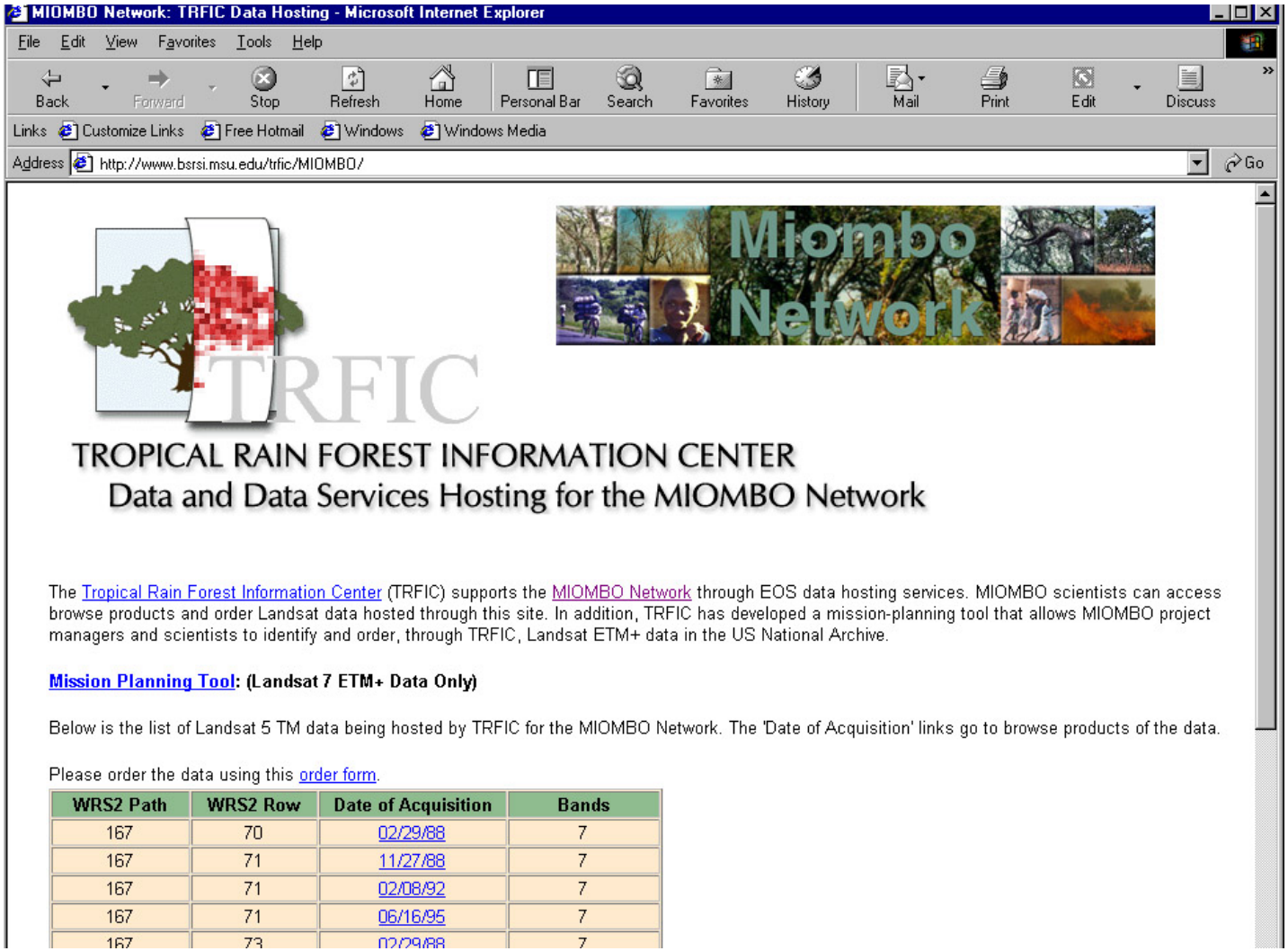
Acquisition of Landsat 5 and 7 (see map) continued.

Miombo Landsat 5 and 7 Data Archive from Acquisitions

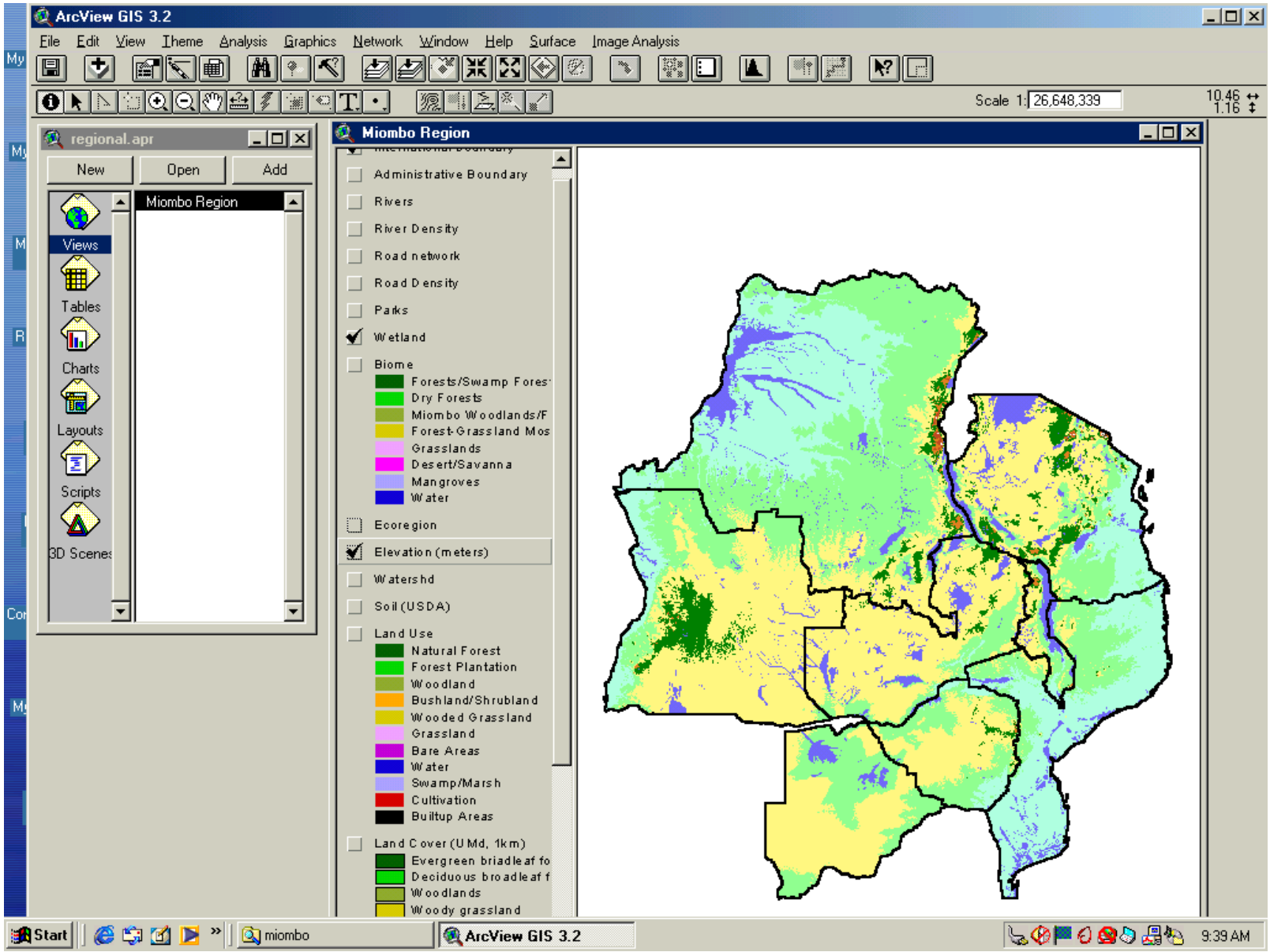


**(Also have ~1990 Landsat 5 data for area boxed from Earthsat)

Miombo Data Server set up in collaboration with MSU-TRFIC. More data upload in progress (http://www.bsrsi.msu.edu/trfic/MIOMBO/)



New Spatial Data Bundle – for Miombo Region, to be available online and CD-ROM



Data Collection and Modeling

Field work to measure carbon densities under different land uses in Regrowth Miombo

Mapping – Sites and whole country

Modeling: Land Use Change and Carbon Changes

The Regrowth Dynamics of The Miombo Woodlands

- Shifting cultivation (slash and burn) common method for agric land use in rural areas
- Expansion of clearing (and shortened fallow periods with increasing demands for land within limited arable land)
- Regrowth woodland increasingly dominant cover.
- The dynamics of these secondary forests have not been examined closely

Issues to be Addressed

- Rate of Biomass Accumulation within regrowth areas under different LU regimes
- Limitations on biomass accumulation, such as soil nutrient status and precipitation
- Possible positive feedback on biomass accumulation due to disturbance (coppice more vigorous)
- Human impact on remnant species composition due to selected use/removal

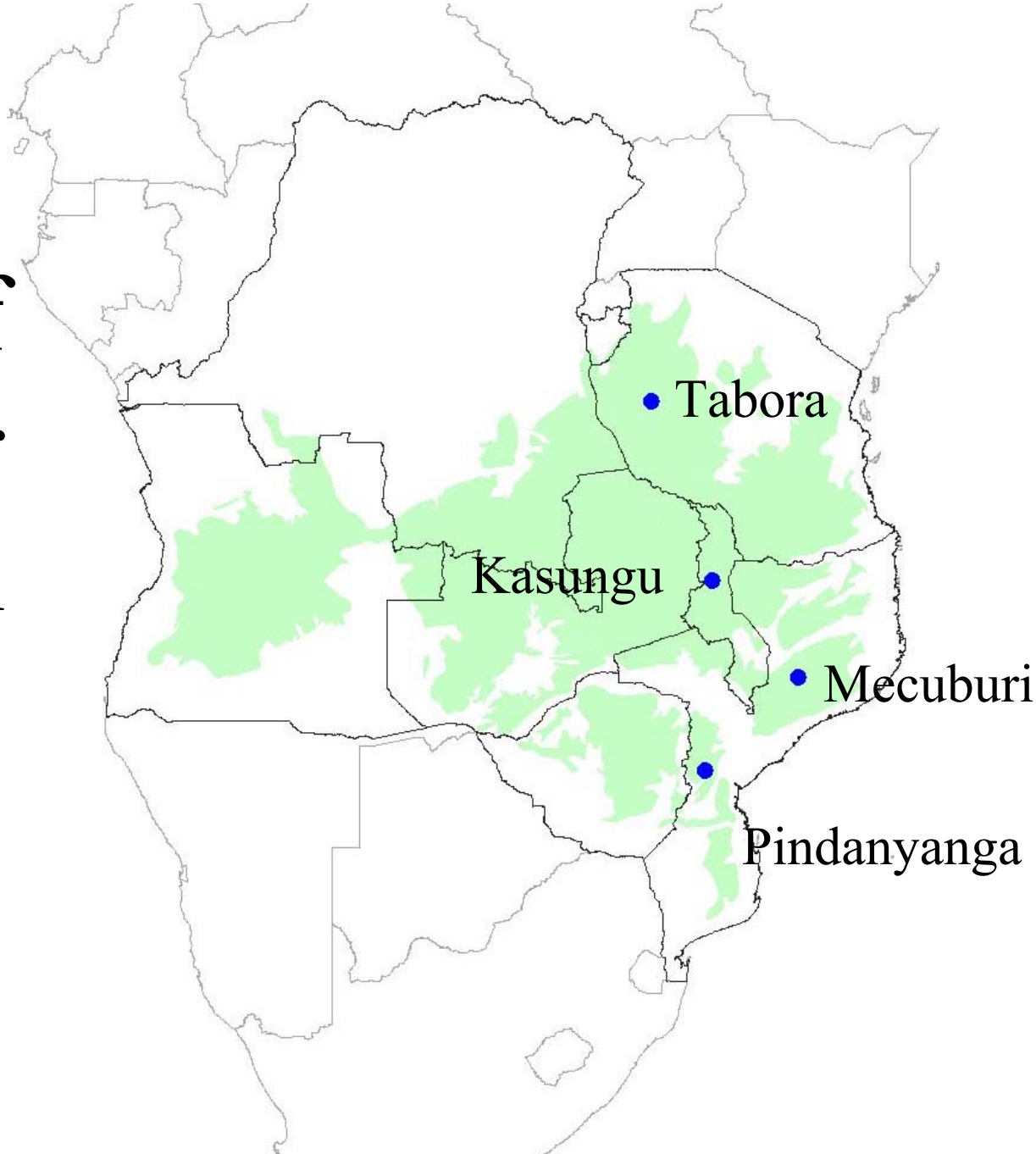
Methodology

- Areas with different aged woodland were selected.
- Plots were destructively sampled in order to estimate total biomass within a plot.
- Aboveground biomass components measured
- Soil samples were also taken to a depth of 50 cm.

Fieldwork October 2001

- During this field campaign, three sites were sampled destructively at Mecuburi, Northern Mozambique:
  - 5 yr. old regrowth
  - 15 yr. old regrowth
  - 20 yr. old regrowth
- Non-destructive sampling also took place at a wetter site, Pindanyanga Central Mozambique.
- Contacts were made to possibly return to this location for further research.

Location of Sites for Carbon Studies:

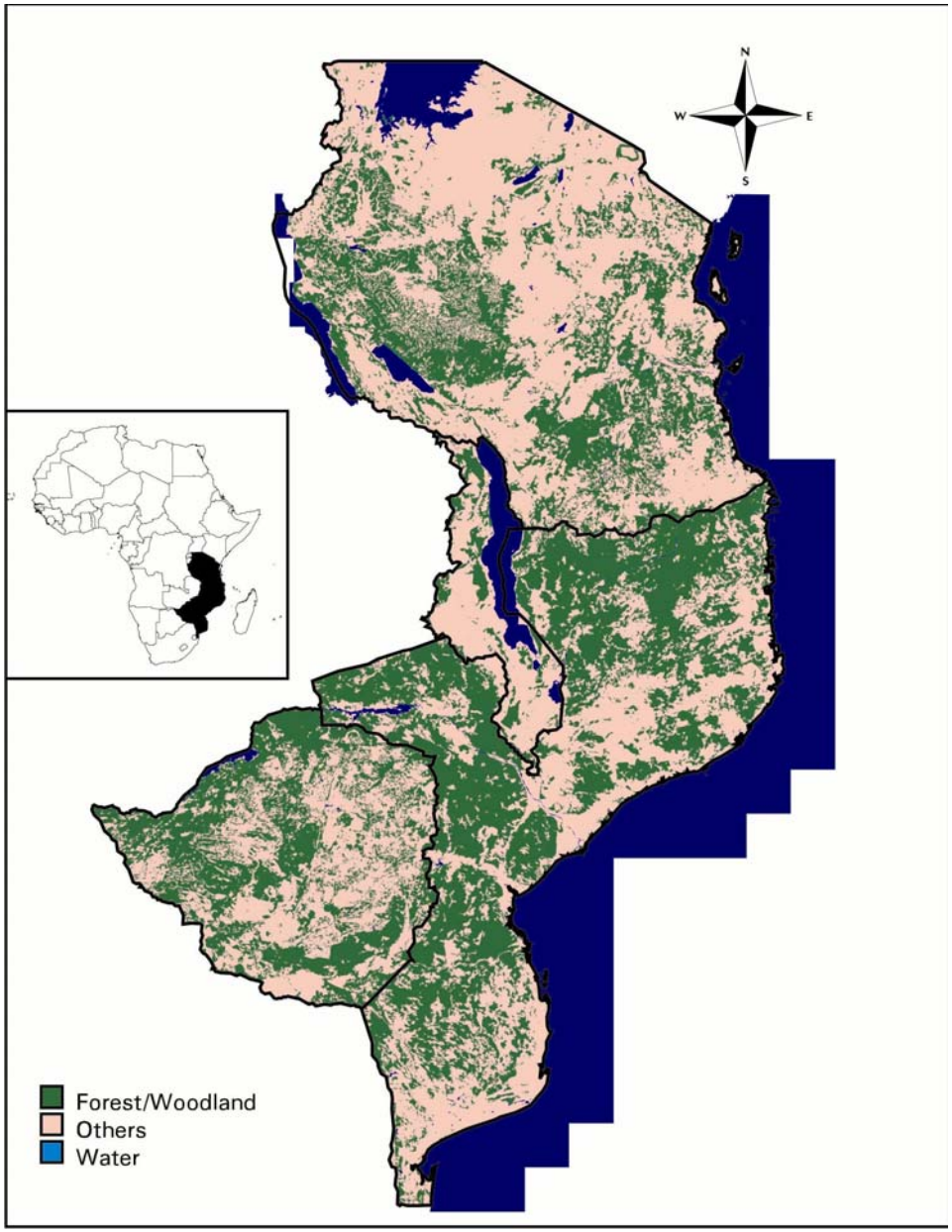


Mapping:

Goal is produce Land Cover maps for 1990 and 2000

Build on African 1990 Landsat Mosaic to develop baseline maps (including wetlands) for region

Use national TM products



Map Product for the 1990-2 period showing Forest/Non-Forest Classes

Table X. Summary of Land Cover by Country based on Miombo Regional Harmonized Map for ~1992 except for Mozambique which is 1995-8

	Zimbabwe		Mozambique		Malawi		Tanzania	
Land use categories	**Km^2**	**percent**	**Km^2**	**percent**	**Km^2**	**percent**	**Km^2**	**percent**
0. Other	408	0	27	0	134	0	6,391	1
1 Natural Forests	121	0	11,014	1	826	1	25,368	3
2. Plantations	1,547	0	452	0	1,417	1	1,313	0
3. Woodlands	208,548	53	438,489	56	23,942	20	305,587	32
4. Bushlands/thickets	49,604	13	202,380	26	53	0	81,051	9
5. Wooded grassland	12,226	3	1,204	0	415	0	110,046	12
6. Grassland/Dambos	6,909	2	42,556	5	7,273	6	36,697	4
7. Barren areas	575	0	6,365	1	4	0	922	0
8, Water	2,888	1	12,347	2	24,608	21	57,117	6
9. Swamps and Marshes	1	0	24,437	3	1,663	1	9,545	1
10. Cultivated Land	107,638	27	48,738	6	57,947	49	311,240	33
11 Builtup area	1,376	0	649	0	225	0	527	0
TOTAL	391,841	100	788,659	100	118,508	100	945,804	100

MELT

Partitions landscape into admin boundaries called Traditional Authorities – **TA** (several villages) as land use decisions constrained within these (for public land use) (Communities in previous diag)

At national level, land distributed to major land uses to reflect broad population needs for food, fuel and for conservation efforts (including protection)

Processes at different levels operate at their own timeframe (10-year for national planning, annual for landscape level)

Demand for food major driver at local level for land needs, constrained by available land within **TA**, moderated by land production potential (function of soil, climate as well as inputs)

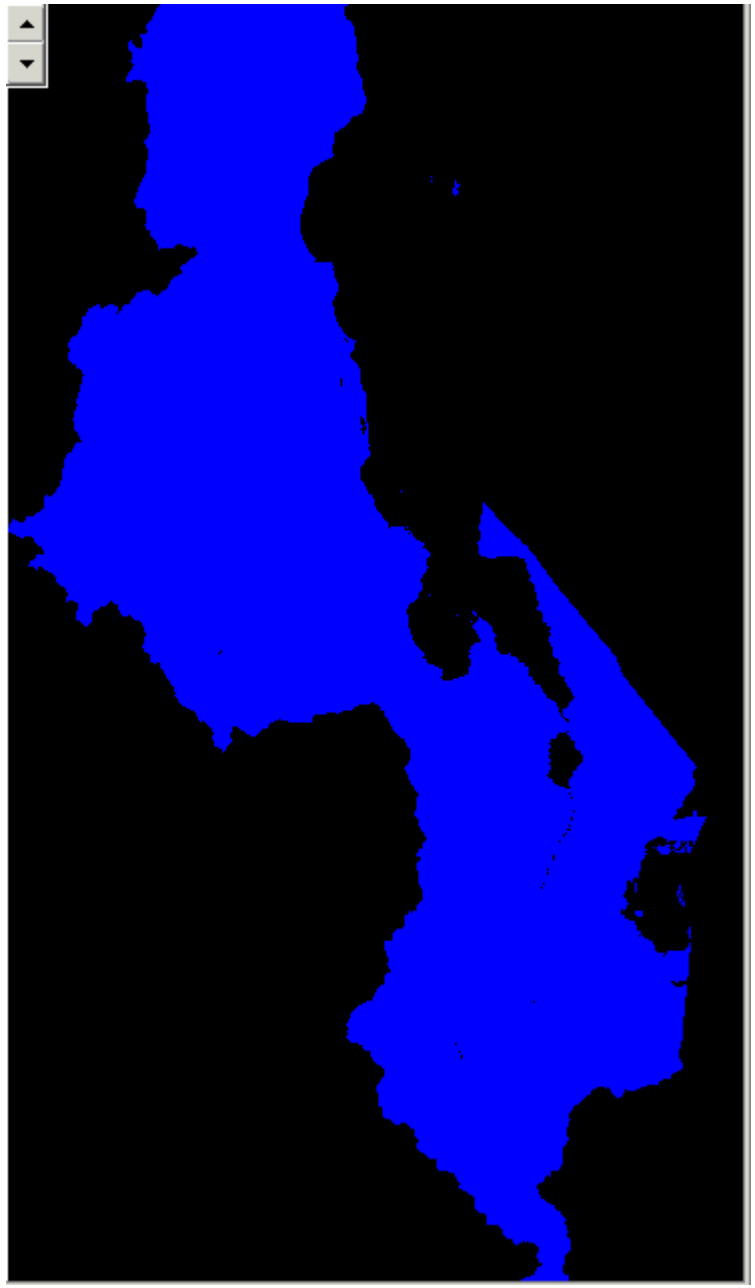
RS data used to provide context for process description of LUC

Land Use primary variable (versus land cover)

MELT:

Miombo Ecosystem Land Transformation Model

Sample run from Bare in Malawi using Traditional Authority admin boundaries



MELT

Representation of hierarchy of land use scales (community to regional) is essential to understanding LUC in this region

Will allow analysis of interacting scales when fully implemented

Object-oriented nature of MELT allows implementation of any spatial land use change model.

Teams in different countries designing their local variants of MELT

MELT issues

Many technical difficulties in fully implementing model including how to constrain changes between the different levels (national and community level – TA level) over time

How to integrate different LCC processes (e.g. urbanization, with rural agric expansion, etc) across whole spatial domain

Feedbacks – forward and backward between the levels especially due to economic activity between rural (lower circuit) economics with market (upper circuit) economics, given these overlap in urban areas

Role of Policies and historical factors in determining pathways

How to model human action when land conversion no longer an option to satisfy production demands

Other Activities 4

Stakeholder meeting in September 2001:

Needs assessment for community level land management (Manica, Mozambique)

Participation in IPCC and UNFCCC

Assessments and Meetings; and other projects (Millennium Assessment, AIACC, Carbon Projects)

Summary

Products available

- Regional forest cover map for 1990
- Map set for regional characterization (GIS layers)
- Country Landsat data available through national coordinators in region
- *Prototype land use change model (MELT: object-oriented shell for flexible modeling of any spatial land use)*

Products in Pipeline

- Journal special issue
- Biomass/carbon data and models

Possible extensions of results

- Community carbon projects under Kyoto
- Monitoring and modeling application in Millennium Assessment
- Routine monitoring of land cover at national and regional level using common methods
- Integration of land use into climate change integrated assessment

Schedule/Critical Path

Year 1

Landsat Data Acquisition and preprocessing (in progress)

Regional coordination workshop and special issue (in prep)

Data bundle for regional characterization (web delivery in process)

Setup field sites in Mozambique (done)

Year 2

Continue Landsat processing and production of new maps

Regional workshop with country partners (done)

Biomass allometries and growth/yield models (in progress)

Preliminary Carbon Budget (in progress, soil components complete)

Synthesis of Processes of Land Use: Country implementations of MELT

Year 3

Full carbon account for miombo region (coupling to Land Use Change Model in progress)

Sampling and mapping strategy for region: transition into operational mode (in planning with MA projects)