Land use/ cover mapping of the dry and wet season of Kikuletwa catchment using GIS and remote sensing techniques

Anna Msigwa, Ann van Griensven, Hans C. Komakech, Boud Verbeiren

Vrije Universiteit Brussel, Belgium

The Nelson Mandela African Institution of Science and Technology, Arusha, Tanzania

Outline

- Introduction
- Material and method
- Results
- conclusion

Why mapping wet and dry land use/cover?

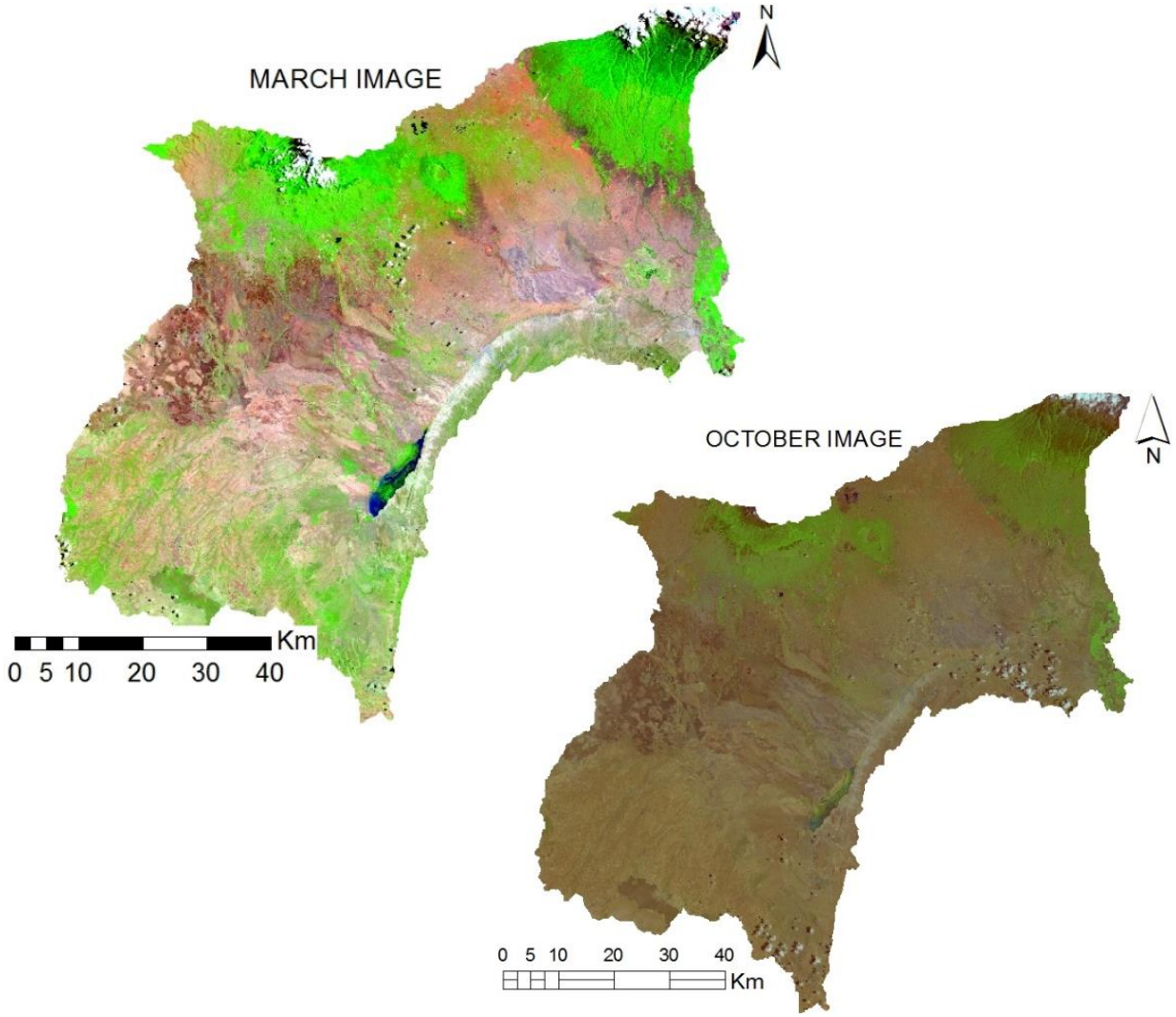
- Kikuletwa catchment is an area with intensive and expansive irrigated agriculture
- Agricultural water withdrawal is leading to basin closure evidence in drying out of some sections
- However, there is no reliable data to quantify actual water depletion due to the agricultural water management practices.

Why mapping wet and dry land use/cover?.....

- Hence a detailed land use map representing the changes between hydrological seasons is needed.

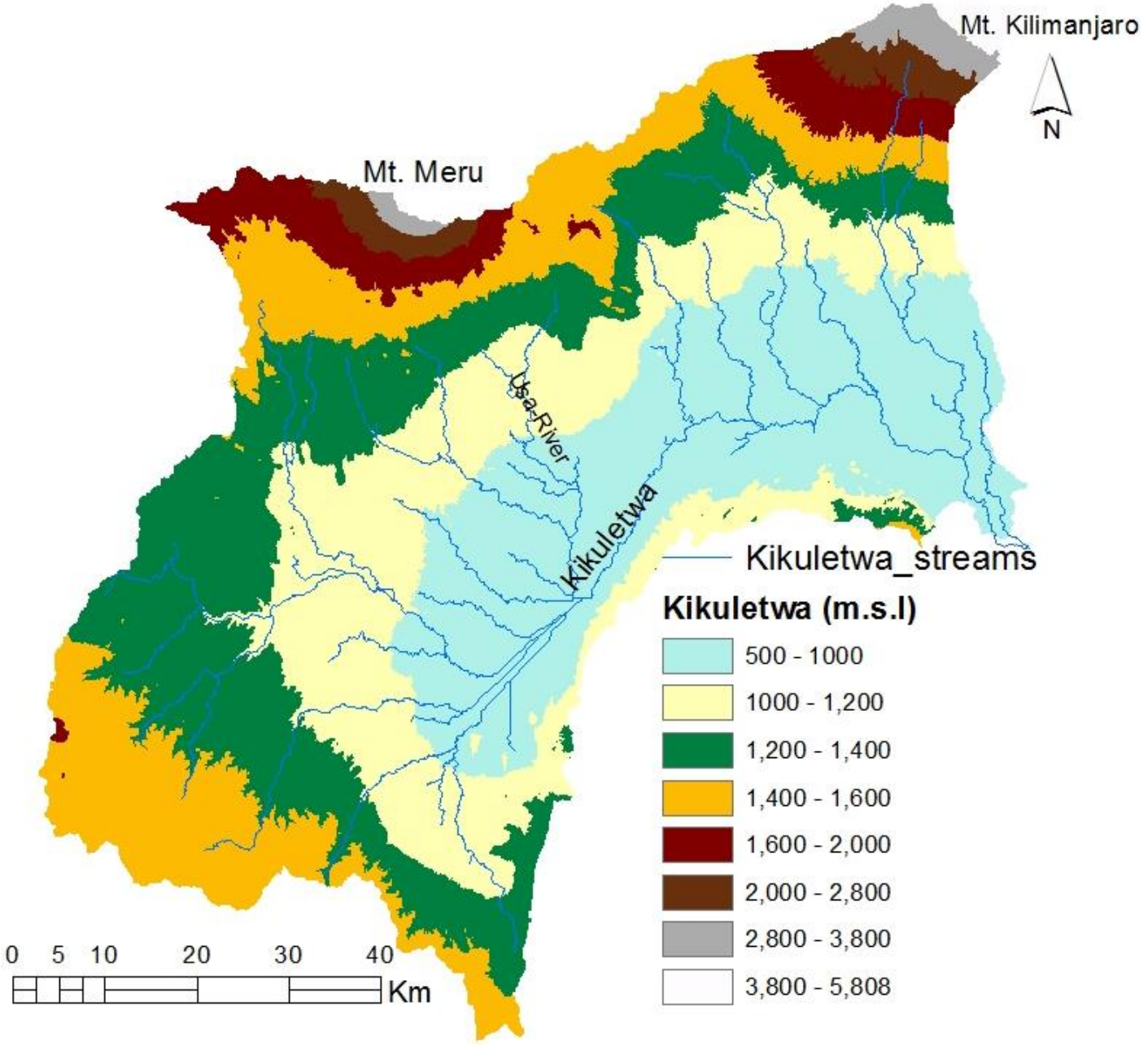
Objective of the study

- To develop detailed land use maps for the two main seasons (dry and wet season) of the semi-arid Kikuletwa catchment, Tanzania.



Kikuletwa catchment

- Kikuletwa one of the catchment in the upper Pangani, total area is 6,077 km^2
- High gradient in elevation and rainfall (300mm/yr-2000mm/yr)
- Bimodal rainfall- March – June, and October – December



Landsat images Used

Name	Date Acquired	Path	Row	Cloud %
LC81680632016088LGN00	2016-03-28	168	63	1.38
LC81680622016088LGN00	2016-03-28	168	62	3.88
LC81680632016216LGN00	2016-08-03	168	63	1.16
LC81680622016216LGN00	2016-08-03	168	62	0.37
LC81680622016296LGN00	2016-10-22	168	62	3.95
LC81680632016296LGN00	2016-10-22	168	63	1.01

GIS and Remote Sensing

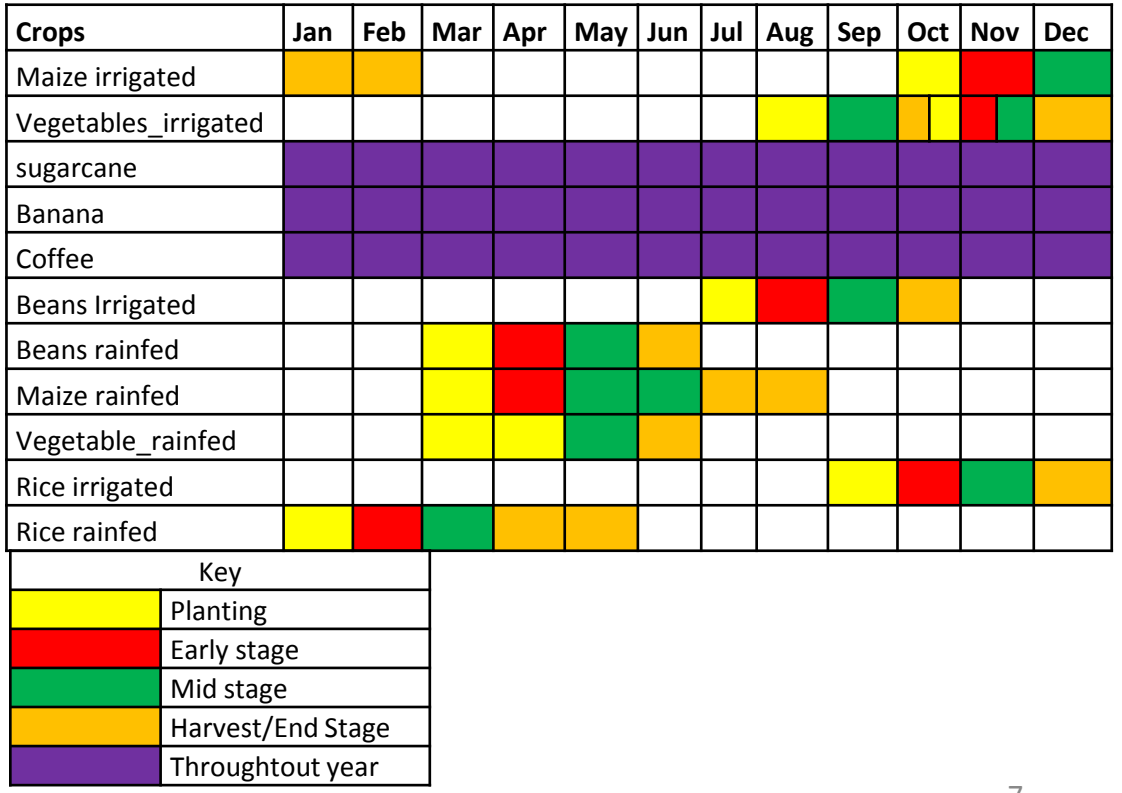
- Pre-processing of the Landsat image

Eg Composite, Mosaicking, Clipping to study area, Cloud masking

- Image classification – Iso cluster unsupervised and Maximum likelihood classification

- Accuracy assessment
  - Overall accuracy
  - Producer and users accuracy
  - Kappa coefficient

- Ground truthing points -150
- Crop Calendar- from farmers interviews

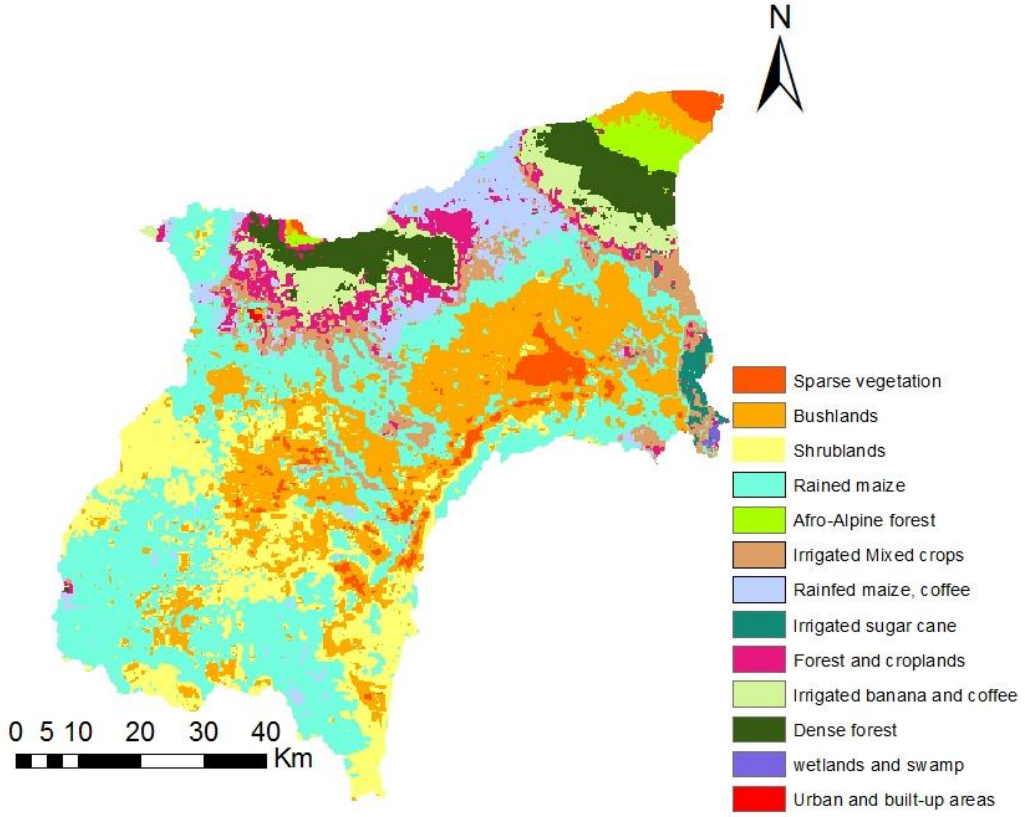


Crops	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Maize irrigated												
Vegetables_irrigated												
sugarcane												
Banana												
Coffee												
Beans Irrigated												
Beans rainfed												
Maize rainfed												
Vegetable_rainfed												
Rice irrigated												
Rice rainfed												

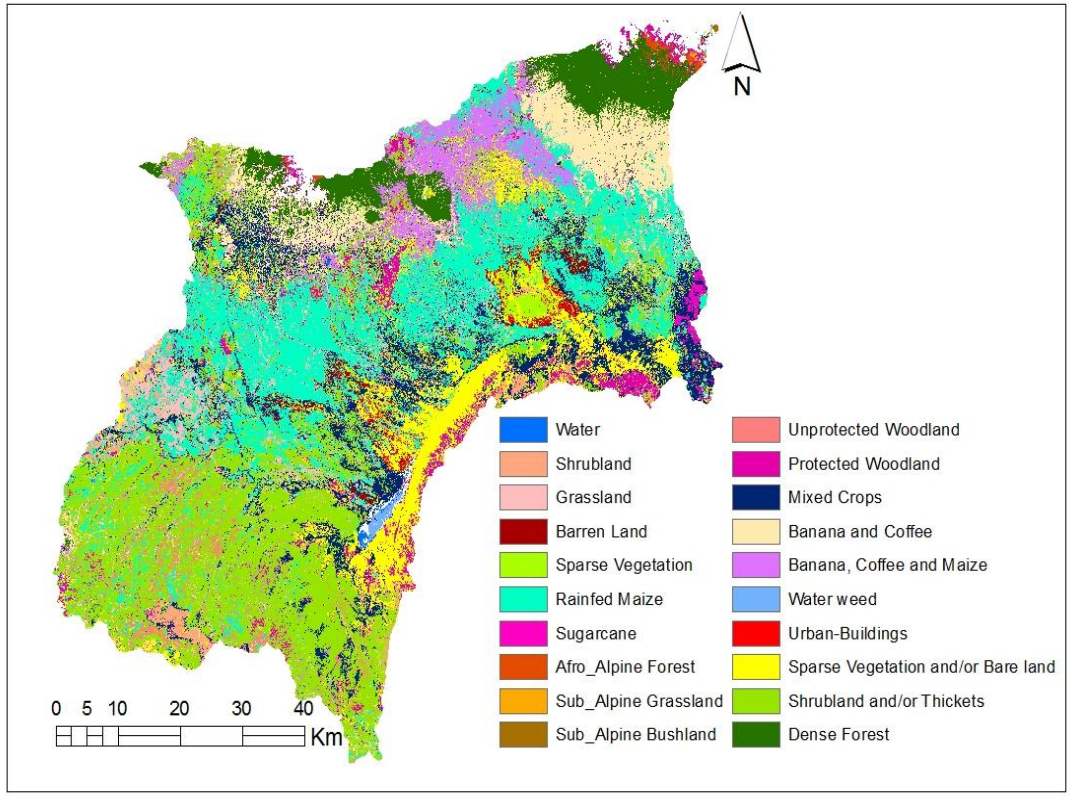
Key	
	Planting
	Early stage
	Mid stage
	Harvest/End Stage
	Throughtout year

Results – Land use/cover

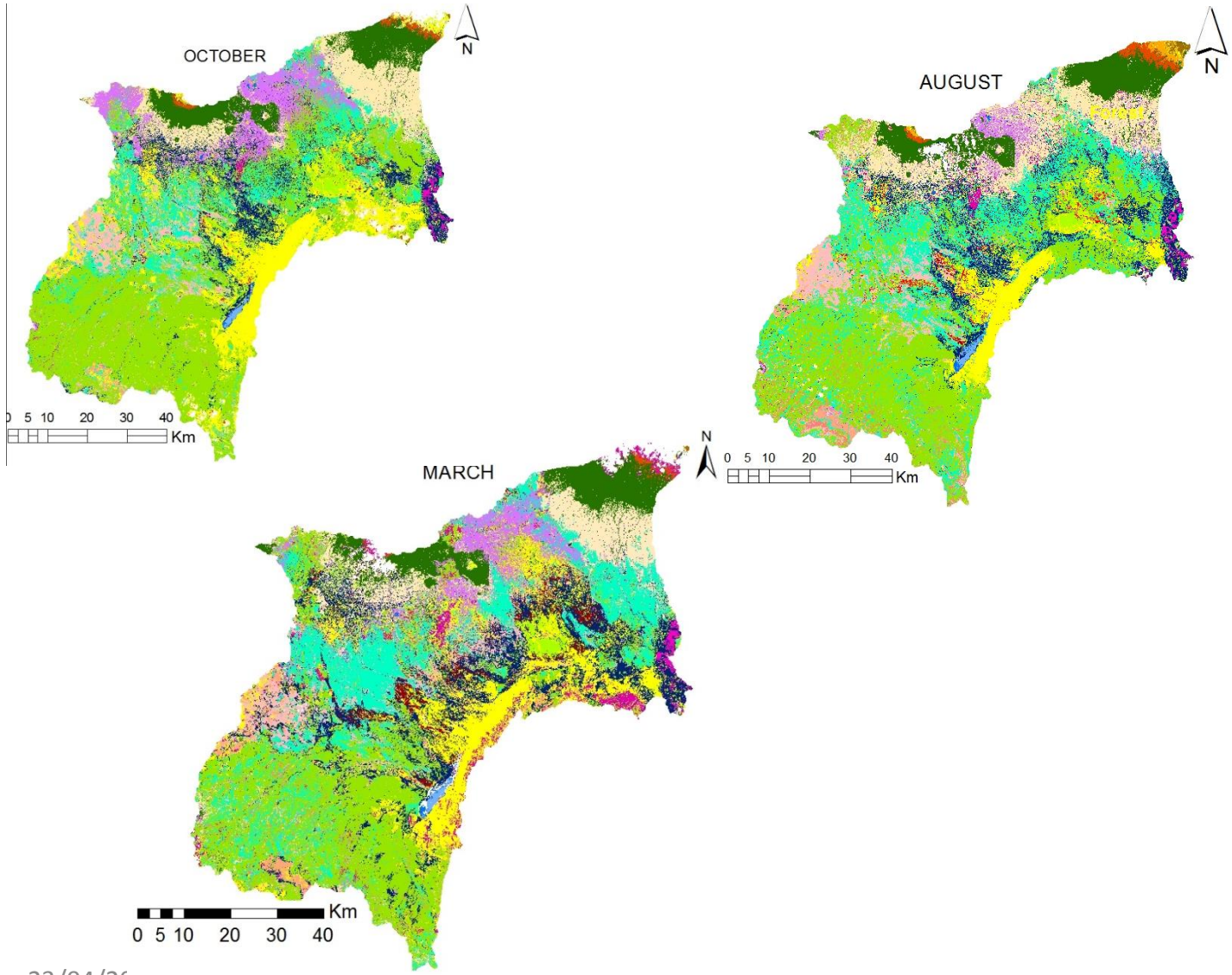
Land use (250m x 250m) (kiptala et al, 2013)



Land use for Kikuletwa (30m x 30m)- March



Results – Land use/cover

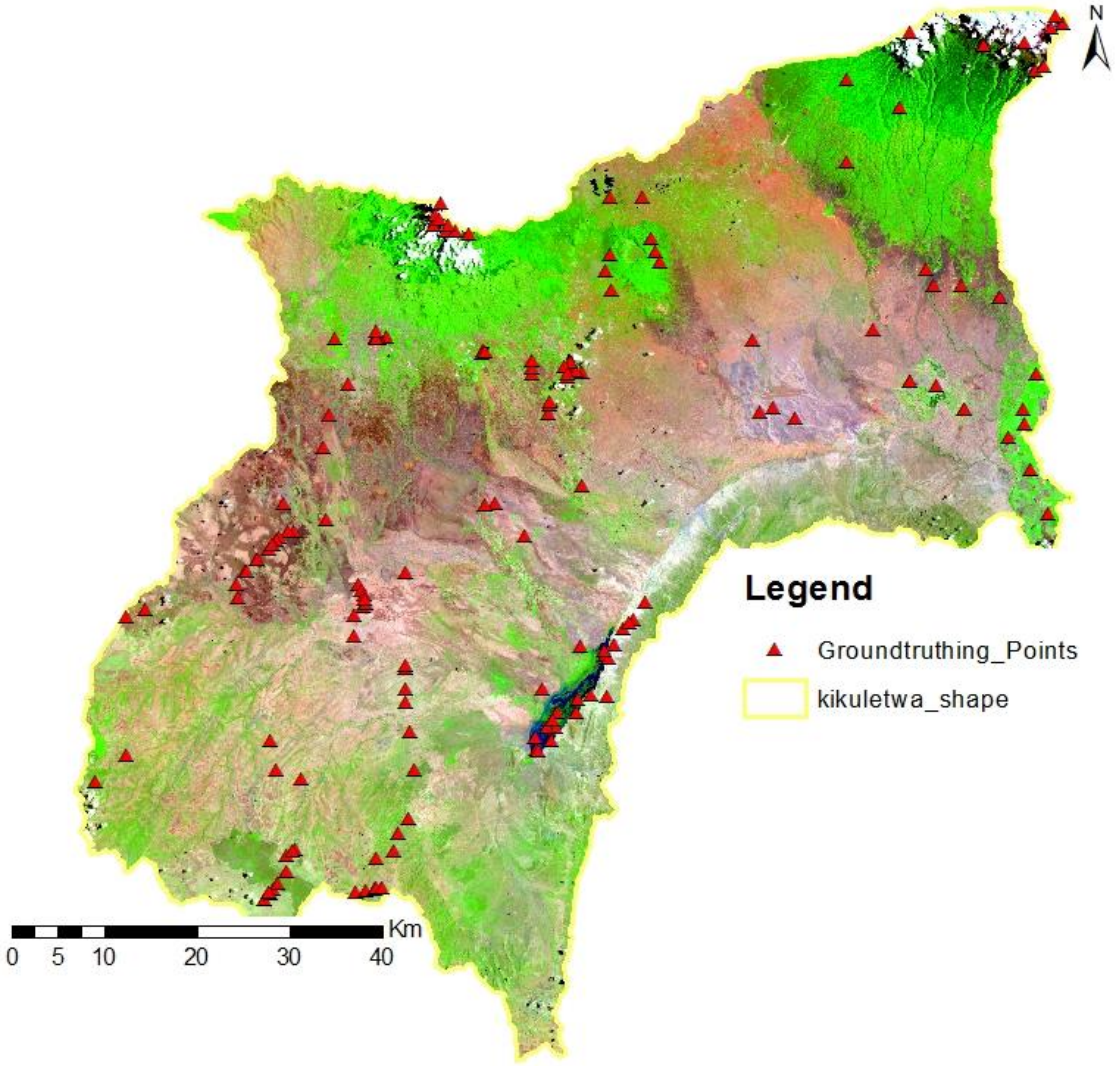


Legend

- Water
- Grazed Shrubland
- Grazed Grassland
- Barren Land
- Sparse Vegetation
- Rainfed Maize
- Irrigated sugarcane
- Afro_Alpine Forest
- Sub_Alpine Grassland
- Sub_Alpine Bushland
- Grazed woodland
- Protected Woodland/Bushland
- Irrigated Mixed Crops
- Irrigated Banana and Coffee
- Irrigated Banana,coffee and Maize
- Water weed
- Urban-Buildings
- Sparse vegetation and/or Bare land
- Shrubland or/and Thickets
- Dense Forest

Accuracy assessment

- An average of about 150 field points, different from the data set used to produce the training samples were corrected.
- The overall accuracy for March, August and October were 74%, 73% and 86% respectively.
- The kappa coefficient were 0.71, 0.70, 0.85.



Accuracy Assessment

- Producers and Users accuracy

	Producers Accuracy %		Users accuracy %	
Class Name	**October**	**March**	**October**	**March**
Water	92	67	100	100
Grazed shrubland	75	50	100	57
Grazed grassland	82	73	90	53
Barrenland	100	80	100	100
sparse vegetation	100	100	67	100
Rainfed Maize	63	71	77	67
Irrigated Sugarcane	100	100	100	100
Afro_Alpine forest	100	100	100	100
Subalpine bushland	80	100	100	100
Woodland/grazed	75	80	100	80
Woodland_P	63	88	100	88
Irrigated mixed crops	88	43	78	46
Irrigated Banana and coffee	100	100	33	100
Irrigated Banana coffee and maize	100	100	100	100
Water weed	100	75	100	60
Urban	75	25	100	50
Sparse vegetation/bare land/cropland	75	100	64	89
Shrubland/thickets	100	75	77	67
Dense Forest	89	100	100	100

Land use practices comparison between wet and dry seasons

CLASS_NAME	Area %-October	Area %-March
Grazed shrubland	0.47	2.04
Grazed grassland	5.16	6.21
sparse vegetation	1.98	1.19
Rainfed Maize	11.70	10.64
Irrigated Sugarcane	0.34	0.62
Grazed Woodland	0.26	0.93
Protected Woodland/Bushland	0.40	3.21
Irrigated mixed crops	7.81	13.24
Irrigated Banana and coffee	9.46	10.12
Irrigated Banana coffee and maize	6.23	5.89
Sparse vegetation and/or Bare land/crop land	15.11	12.25
Shrubland and/or Thickets	33.49	25.51
Dense Forest	6.28	5.73

Points to take home

- There is a significant difference on Land use practices in wet and dry seasons.
- Detailed land use maps is useful to quantify water use and depletion in two distinct seasons
  - Hence water use management- water allocation
- Crop calendar is very useful tool for seasonal land use mapping.

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SHARING MINDS, CHANGING LIVES

WELCOME QUESTIONS AND COMMENTS

Nelson Mandela African Institute of Science and Technology
Arusha
Academia for Society and Industry

EGU

Formulas

- Kappa coefficient

$$K = \frac{N \sum_{i=l}^{r} X_{ii} - \sum_{i=l}^{r} (X_{i+} * X_{+i})}{N^2 - \sum_{i=l}^{r} (X_{i+} * X_{+i})}$$

$$\frac{(Total * Sum\ of\ correct) - sum\ of\ all\ the\ (row\ total * column\ total)}{Total\ squared - sum\ of\ all\ the\ (row\ total * column\ total)}$$