International Meeting on Food Security, Earth Observations and Agricultural Monitoring

Nov. 21 , 2013

Brussels, Belgium

Agriculture Monitoring: African Perspective

By :

Dr. Tesfaye Korme

Director of RS, GIS and Mapping

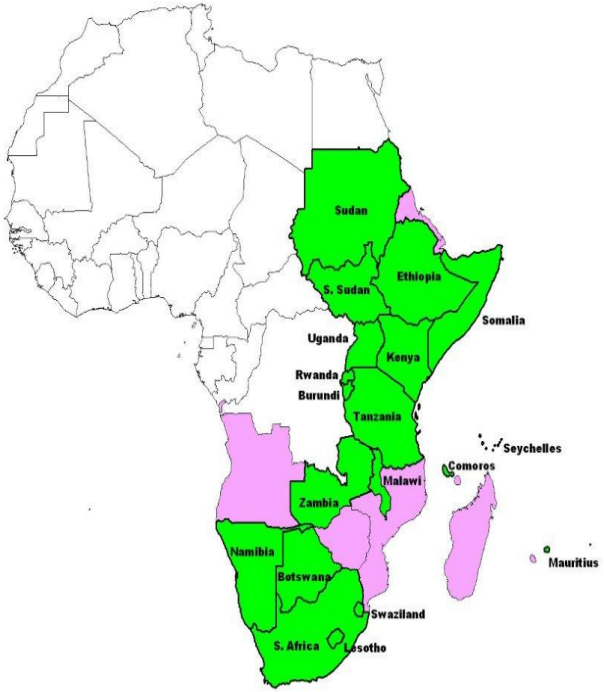
RCMRD, Nairobi-Kenya

I. About RCMRD:

- Is Intergovernmental Organization
- Established in 1975, in Nairobi Kenya by five founding countries
- Currently has 20 member States

REGIONAL CENTRE FOR MAPPING OF RESOURCES FOR DEVELOPMENT

RCMRD



Our Vision

To be a premier Centre of Excellence in provision of Geo-information services.

Our Mission

romote sustainable development through generation, plication and dissemination of geo-information and allied ICT services and products in the Member States and beyond.

Major Activities of RCMRD

A. Advisory services

B. Training

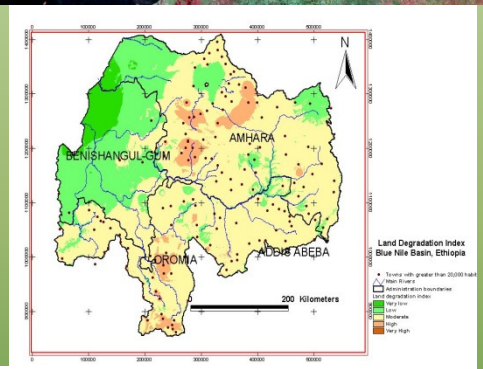
C. Project implementation

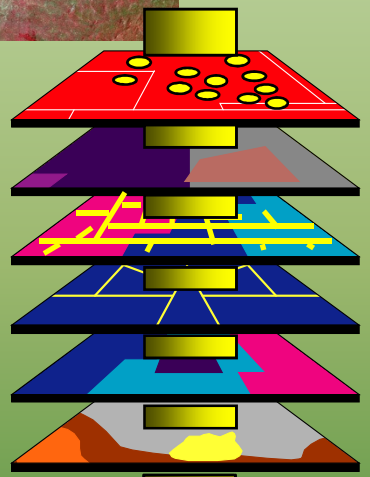
D. Research and Development

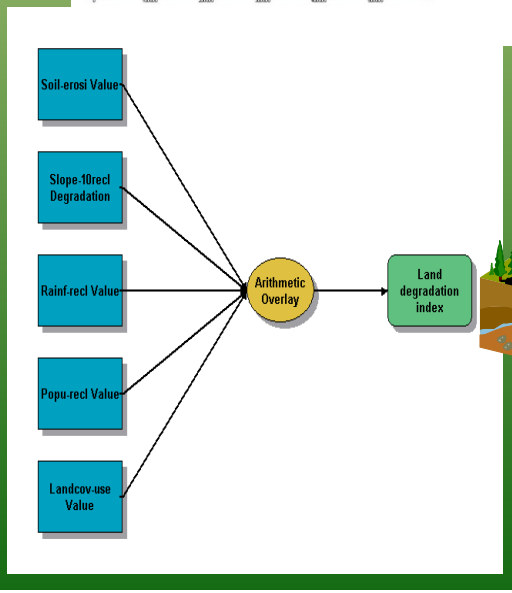
E. Data and information Dissemination

F. Disaster Early Warning

G. Servicing and Calibration of Mapping Equipment

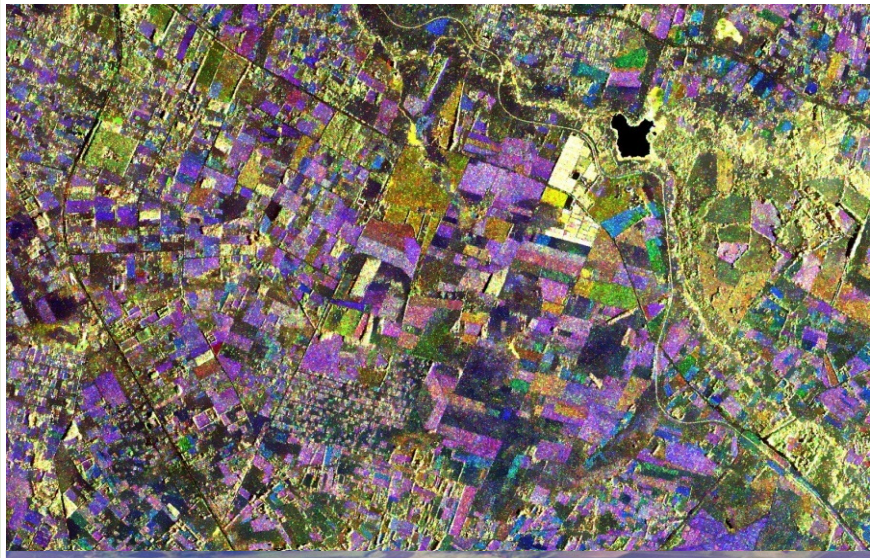






II. Agricultural Mapping and Monitoring in Africa

- Issues of Concerns as Compared to other Regions
  - Agricultural Statistics in Africa
    - Not up-to-date and not good enough for decision making for food security
    - Expensive exercise to undertake in a regular manner
      - List-frame surveys based
      - Vast land mass to cover
      - Area frame survey is not being used operationally
      - No data and expertise
  - Crop Acreage and Mapping
    - Land parcels are fragmented and too small
    - Cropping pattern
      - Mixed Cropping , difficult for aerial survey as well



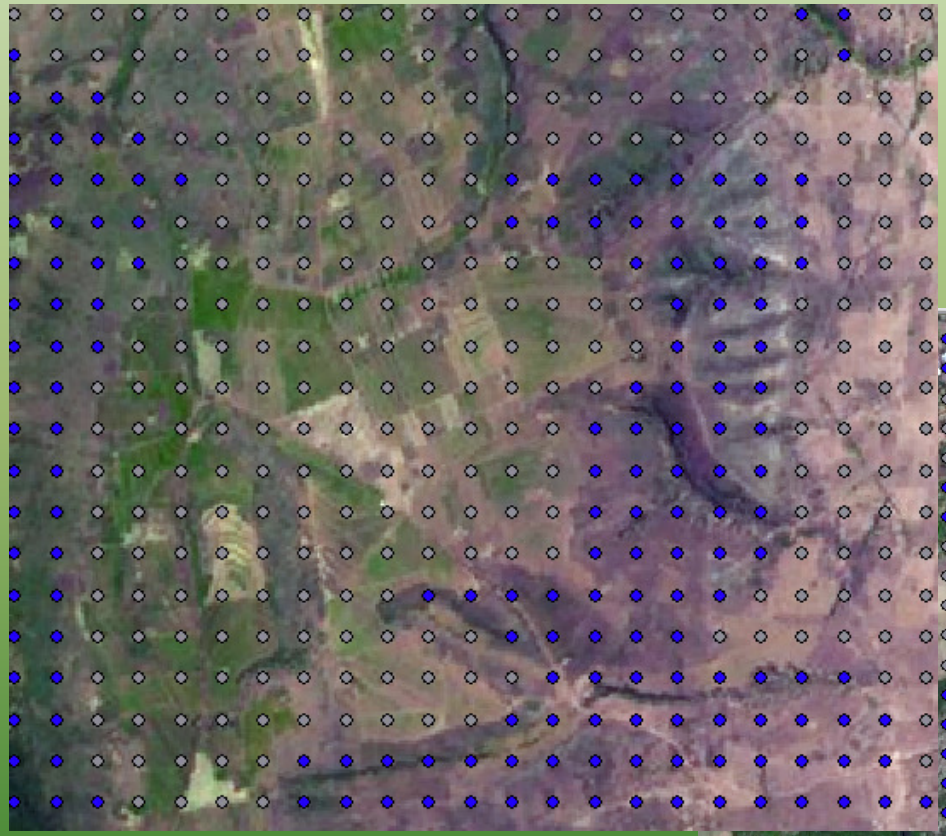
III. Current Efforts and Initiatives in Agricultural Mapping and Monitoring in Africa

- Arable Land identification and Mapping
  - Detailed land use and land cover Mapping and assessment
  - Land use planning
  - Land suitability analysis and mapping
- Monitoring of plant health and growth
  - Plant nutrition monitoring
  - Plant health monitoring
    - Viral diseases
    - Pest infestation and control
- Yield estimation and forecast
  - Crop acreage mapping
  - Yield estimation

Initiatives for Building on Capacity for African Agricultural Monitoring in Africa

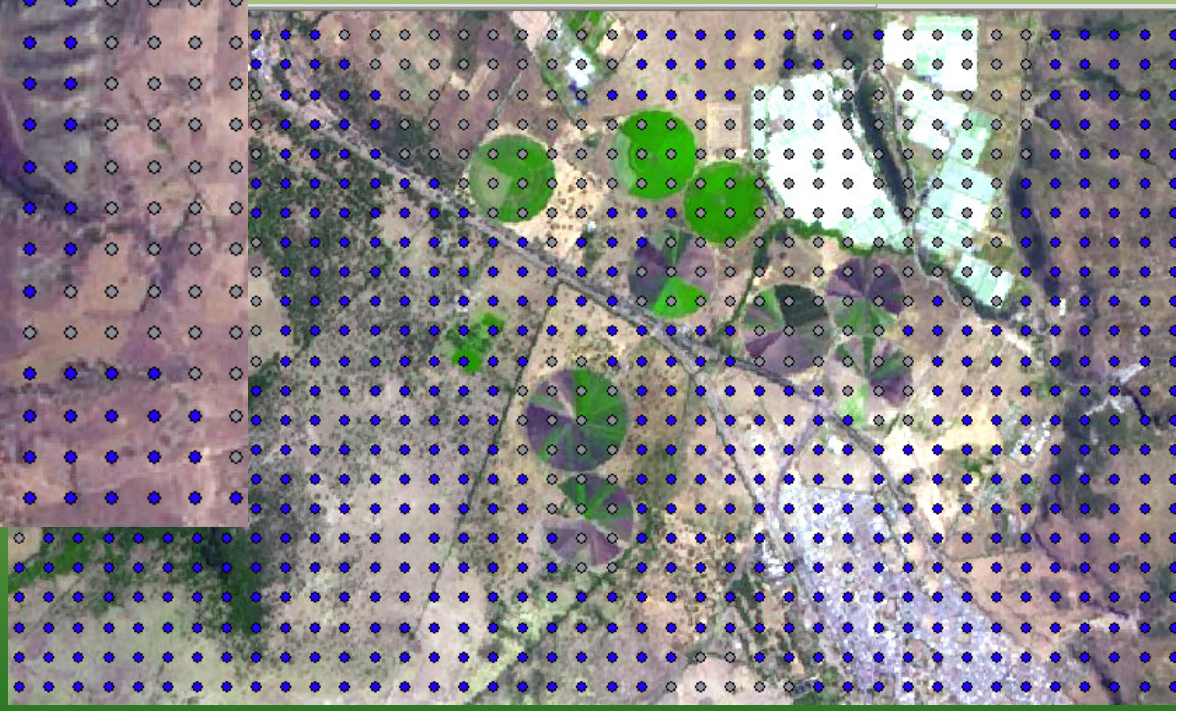
- Research projects in Crop Modeling
  - SERVIR (NASA JPL Team, FEWSNet)
    - Sites in Kenya and Tanzania
  - FEWSNet activities
    - In Most of African Countries
  - FP7 Projects (GMFS, AFRICAB, SIGMA,.)
    - Ethiopia, Sudan, Malawi, Kenya , Mozambique
  - JRC -MARS activities

A. RAPID Cropped Area Assessment using Satellite image (Naivasha area, Kenya), RLCM



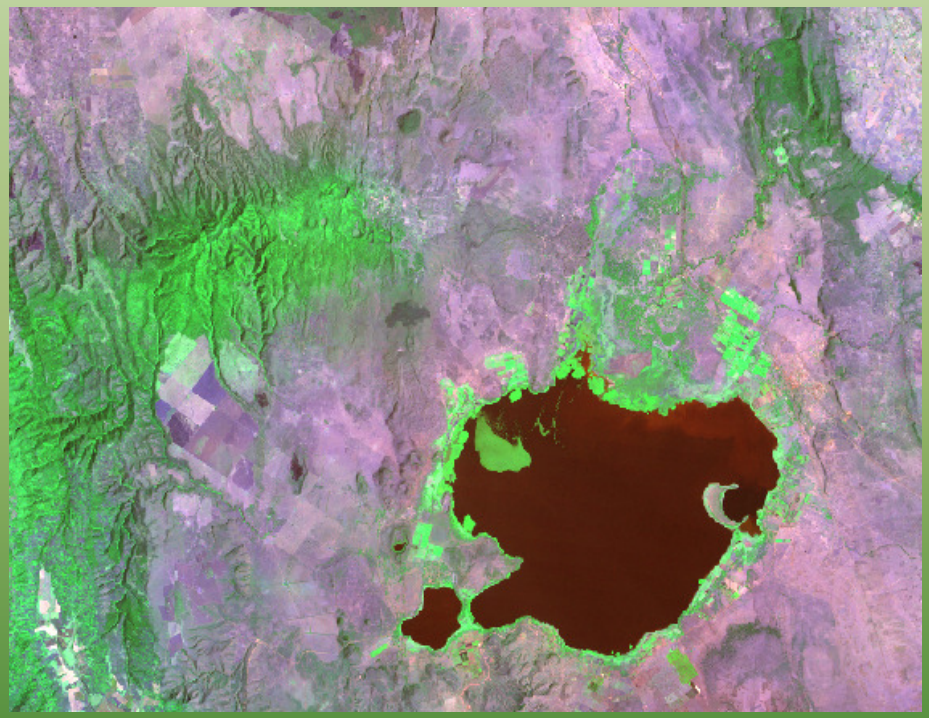
Two Classes:

- Cropped
- Non Cropped

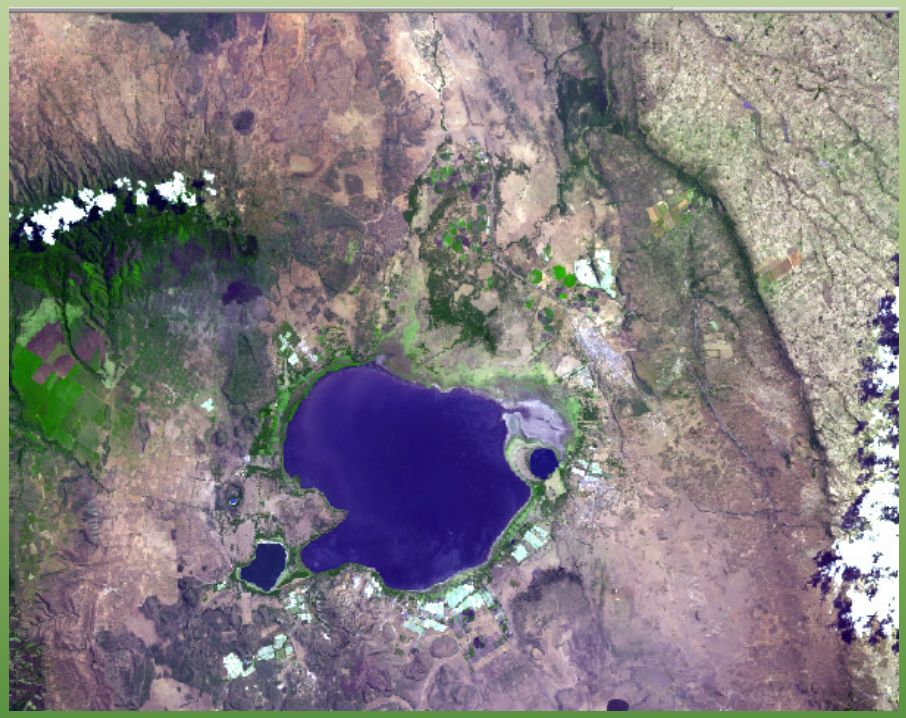


Cropped area in Raster format for Naivasha

High Resolution Satellite images of Lake Naivasha, Kenya for land use and crop area change

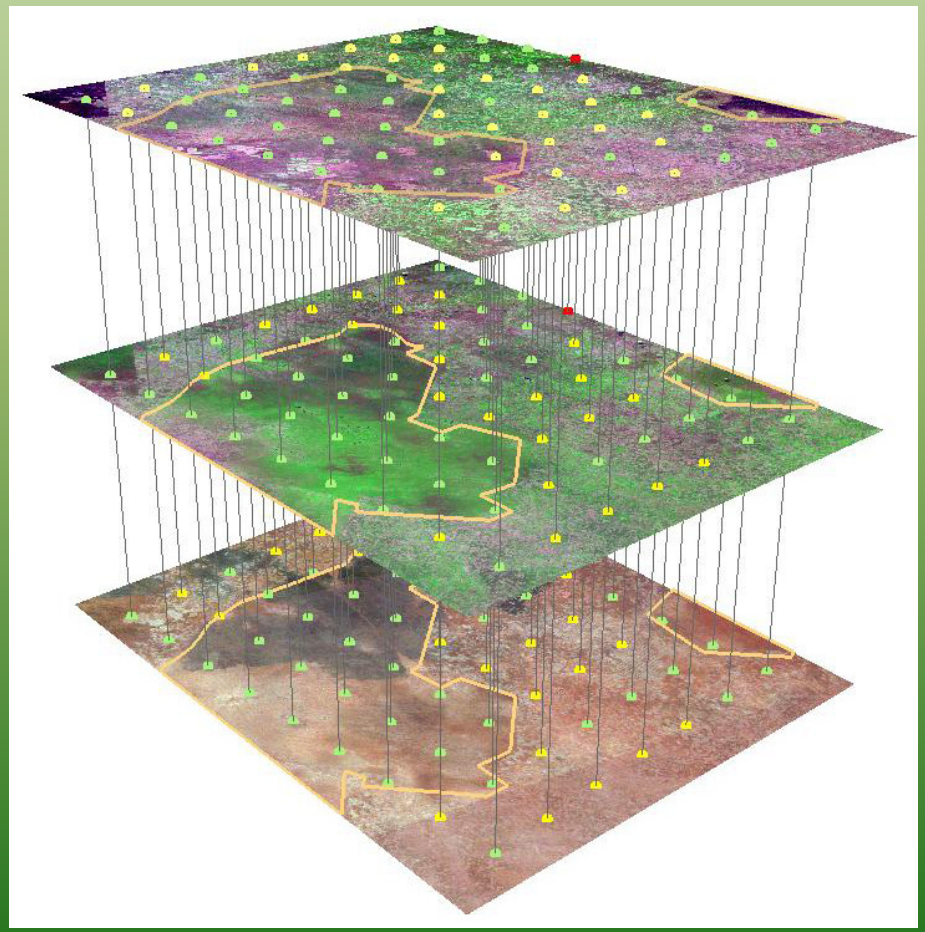


Jan, 1986
Landsat-TM



Feb. 2009
(ASTER)

Multi-temporal land use mapping using RLCM



B. Cropped Area and Crop - type Mapping GMFS Approach

FOODSECURITYscape® – The GMFS approach

	Multi-temporal • ENVISAT ASAR or • ALOS PALSAR-1 or • Radarsat-2 or **Single-date** • Landsat TM-5 or • SPOT-4/5	• Interferometric Cosmo-SkyMed StripMap or • RapidEye or • Ikonos or • QuickBird	Multi-temporal • ENVISAT ASAR and/or • Cosmo-SkyMed SS and/or • TerraSAR-X SS and/or • Radarsat-2 and/or • RapidEye
Potential crop extent prior to the start of crop season	PotCropExt once every n years		
Potential cultivated area at start of crop season		PCA-SoS once every m years	
Crop growth extent			CropGrowthExt every crop season

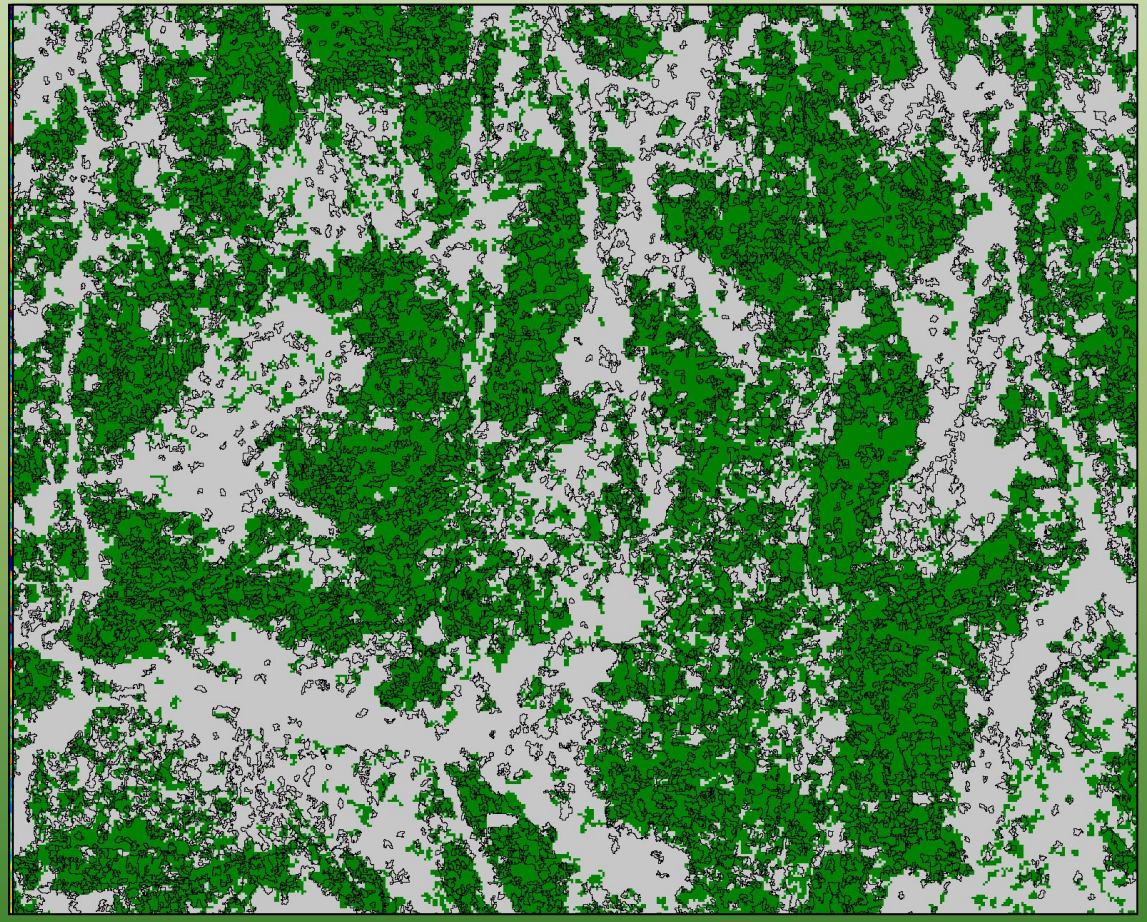
Cultivated Area = PotCropExt ∩ PCA-SoS ∩ CropGrowthExt

Cultivated Area (Acerage)

Pot Crop Area 1

Pot Crop Area 2

Pot Crop Area 3

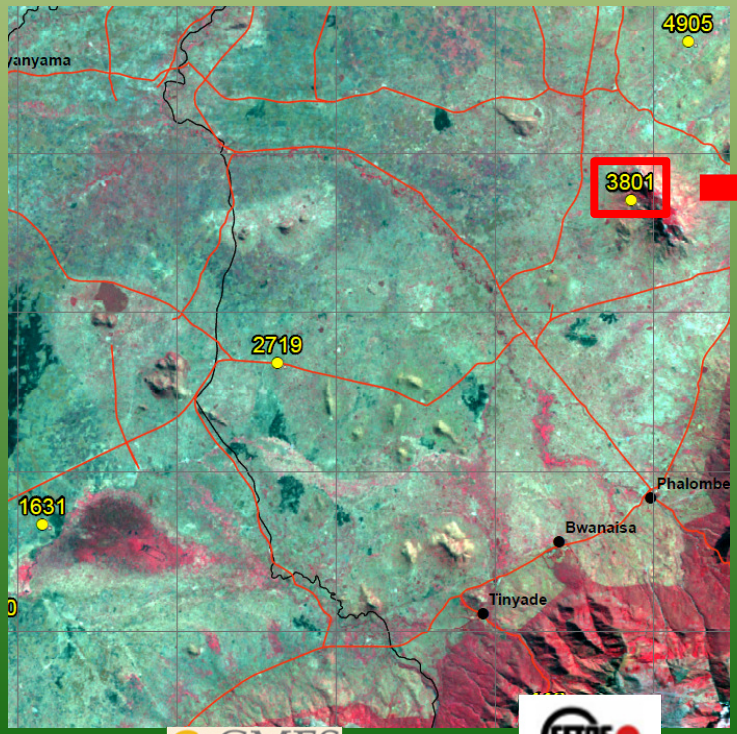


Polygons in green areas represent the cultivated areas

Malawi Cultivated Area validation

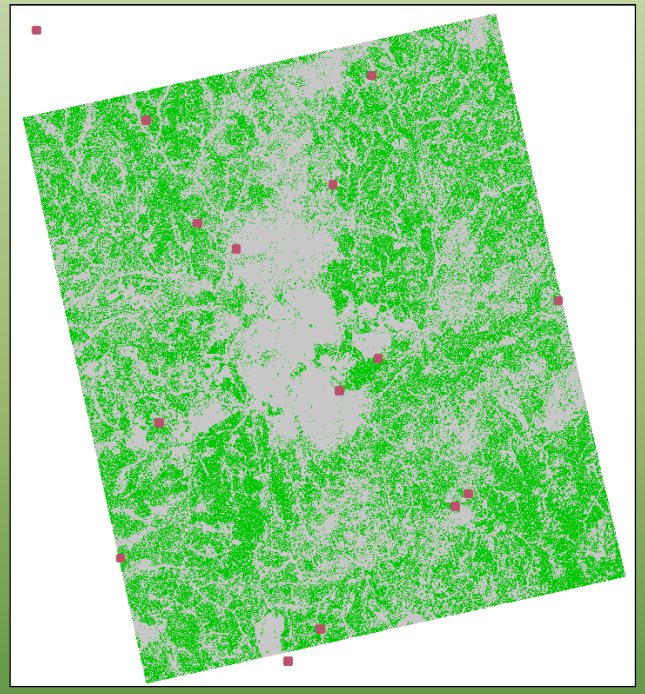
Field work:

Sampling units: predefined POINTS
Systematic grid: representative and well distributed samples for any kind of application
Clustering: reduced travelling time and costs



sarmap

Malawi 2010/11 – Lilongwe

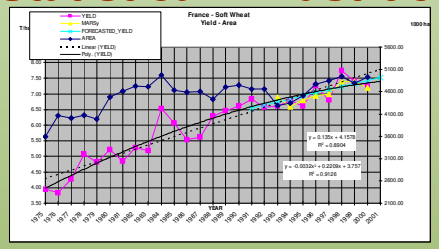


	Other	Crop	**Total**	Omission error (%)
Other - A	32	0	32	0
Crop - B1-6	8	94	102	8
Other - B7	4	0	4	0
Other - C	0	0	0	0
Other - D	4	0	4	0
Other - E	0	0	0	0
Other - F	15	1	16	6
Other - G	0	0	0	0
Other - H	13	0	13	0
Total	76	95	171	**K-coeff 0.9**
Commission error (%)	11	1	**Overall accuracy 95%**	

Field work performed by MoAFS and EFTAS

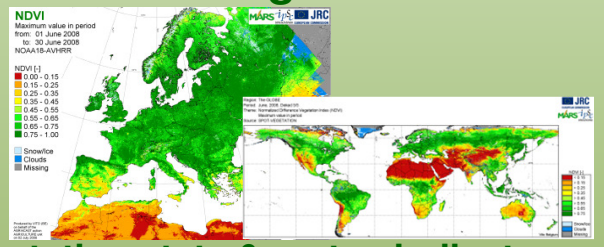
C. Crop Yield Forecasting System from GMFS and MARS

Statistical infrastructure



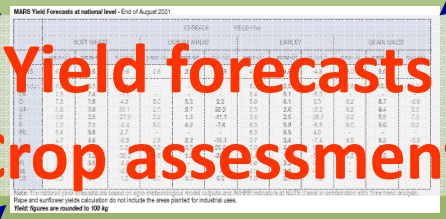
time series regression, similarity analyses

Remote Sensing infrastructure

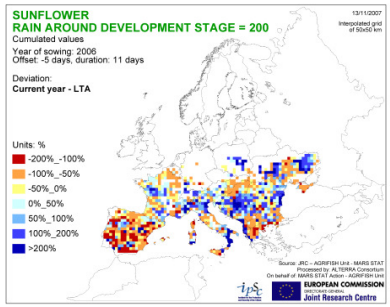


Vegetation state & meteo indicators since 1981 Europe, 1998 worldwide

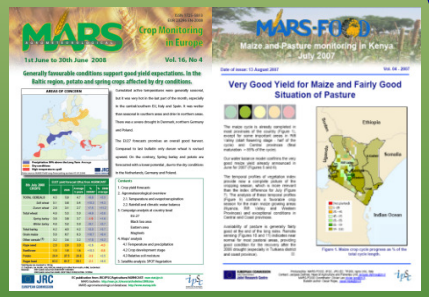
Yield forecasts Crop assessment



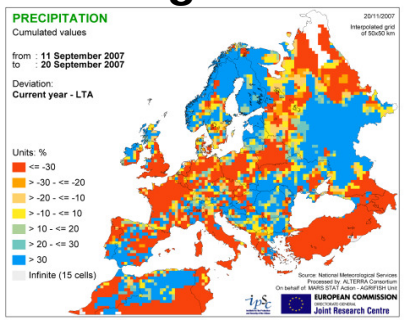
Crop Model infrastructure

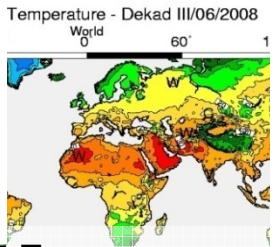


Agrometeo indicators derived from crop growth model – WOFOST / LINGRA / WARM and GWSI



Meteorological infrastructure

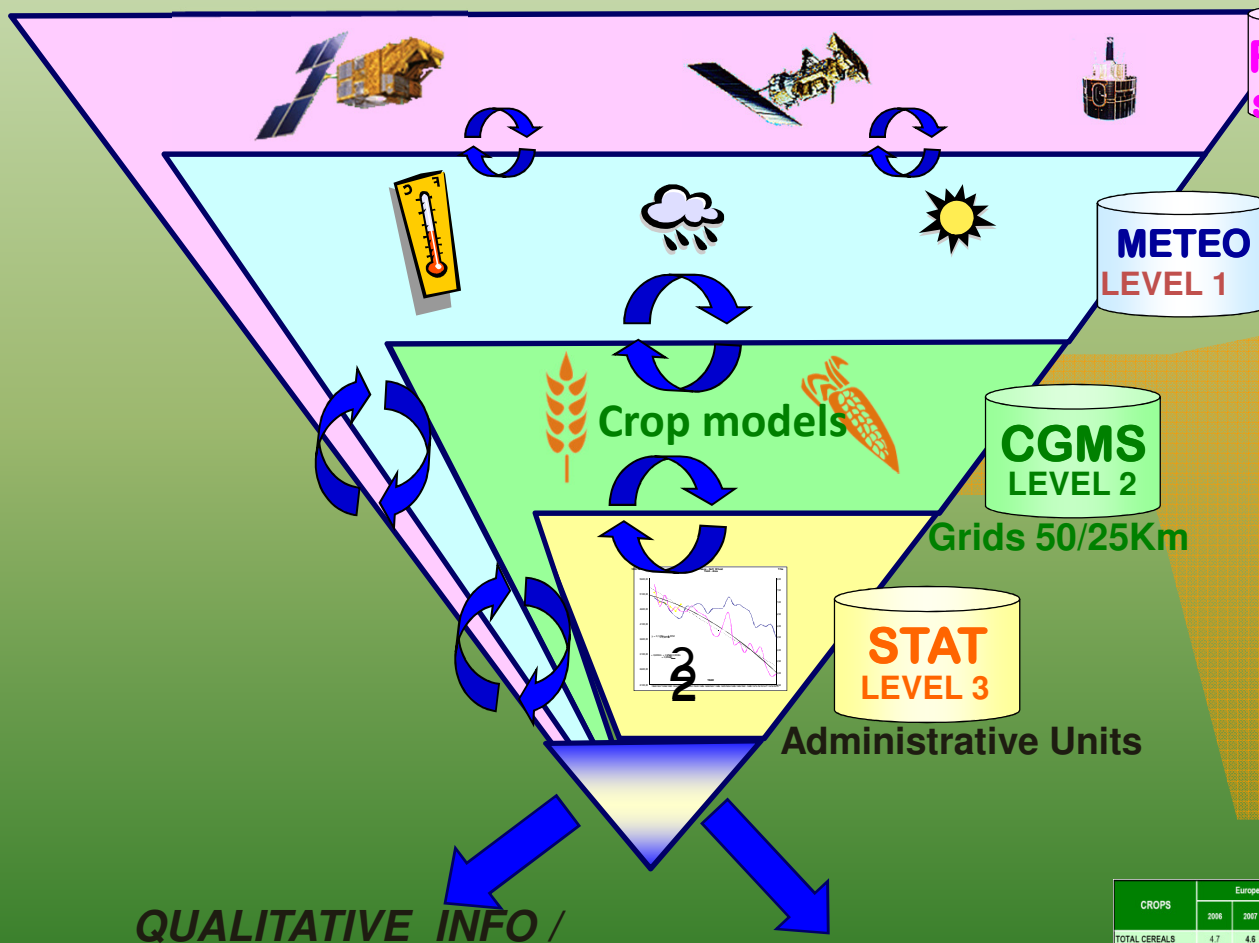


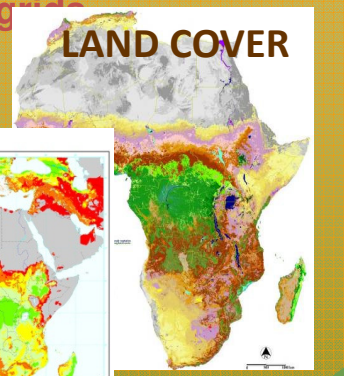


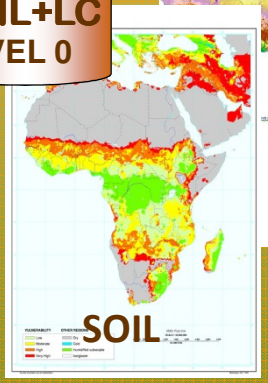
observed data since 1975 Europe
under construction for Africa
worldwide ECMWF data + archive

Crop Monitoring and Yield forecast Systems

MARS Crop Growth Monitoring and Yield forecast Systems (CGMYS)







QUALITATIVE INFO / EWS

Near real- time Crop monitoring

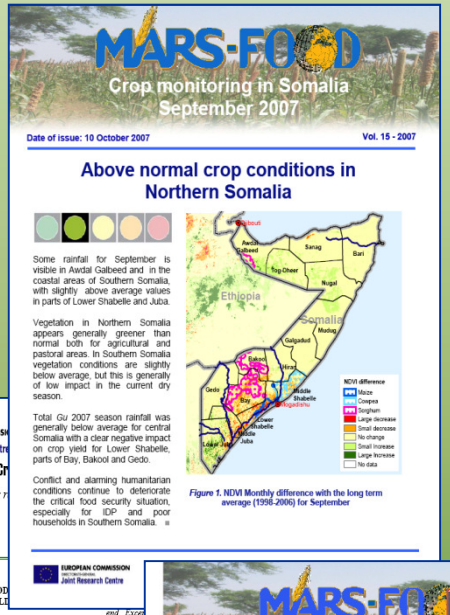
QUANTITATIVE INFO

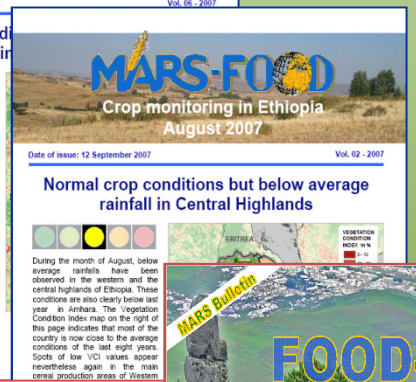
Yield forecast

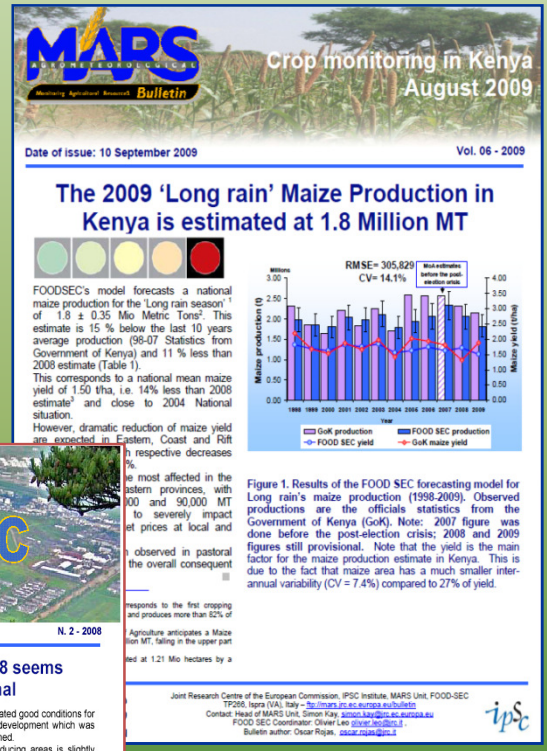
CROPS	European Union 27 Yield (t/ha)				
	2006	2007	Average 5 years	% 2007/06	% 2007 Average
TOTAL CEREALS	4.7	4.6	4.7	-1.0	-2.2
Soft wheat	5.4	5.4	5.4	-0.3	-1.6
[illegible]	[illegible]	[illegible]	2.7	-2.5	+9.2
[illegible]	[illegible]	[illegible]	5.1	-0.2	+0.2
Total barley	4.1	4.3	4.2	+4.6	+2.6
Grain maize	6.5	5.9	6.5	-9.1	-8.0
Other cereals (1)	2.9	2.9	3.2	+1.0	-7.2
Rape seed	3.0	2.9	3.0	-4.3	-5.1
Sunflower	1.7	1.5	1.6	-13.1	-8.3
Potato	25.3	27.3	26.6	+7.8	+2.7
Sugar beet	58.5	60.3	57.8	+3.1	+4.3

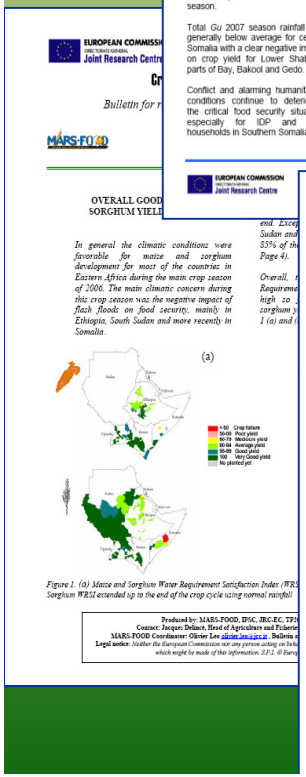
Examples of FOOD SEC bulletins from JRC- MARS

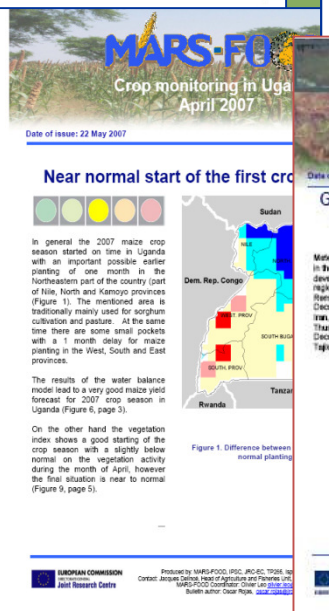
Crop yeild forecast in the Horn of AFRICA

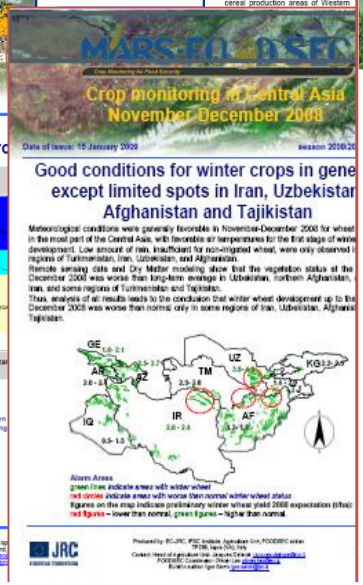












Regional Centre for Mapping of Resources for Development (RCMRD)

Quantitative yield forecasts (GMFS)

Statistical models combining best predictors from EO (NDVI, LAI, DMP) or Agromet model and trend.

KENYA

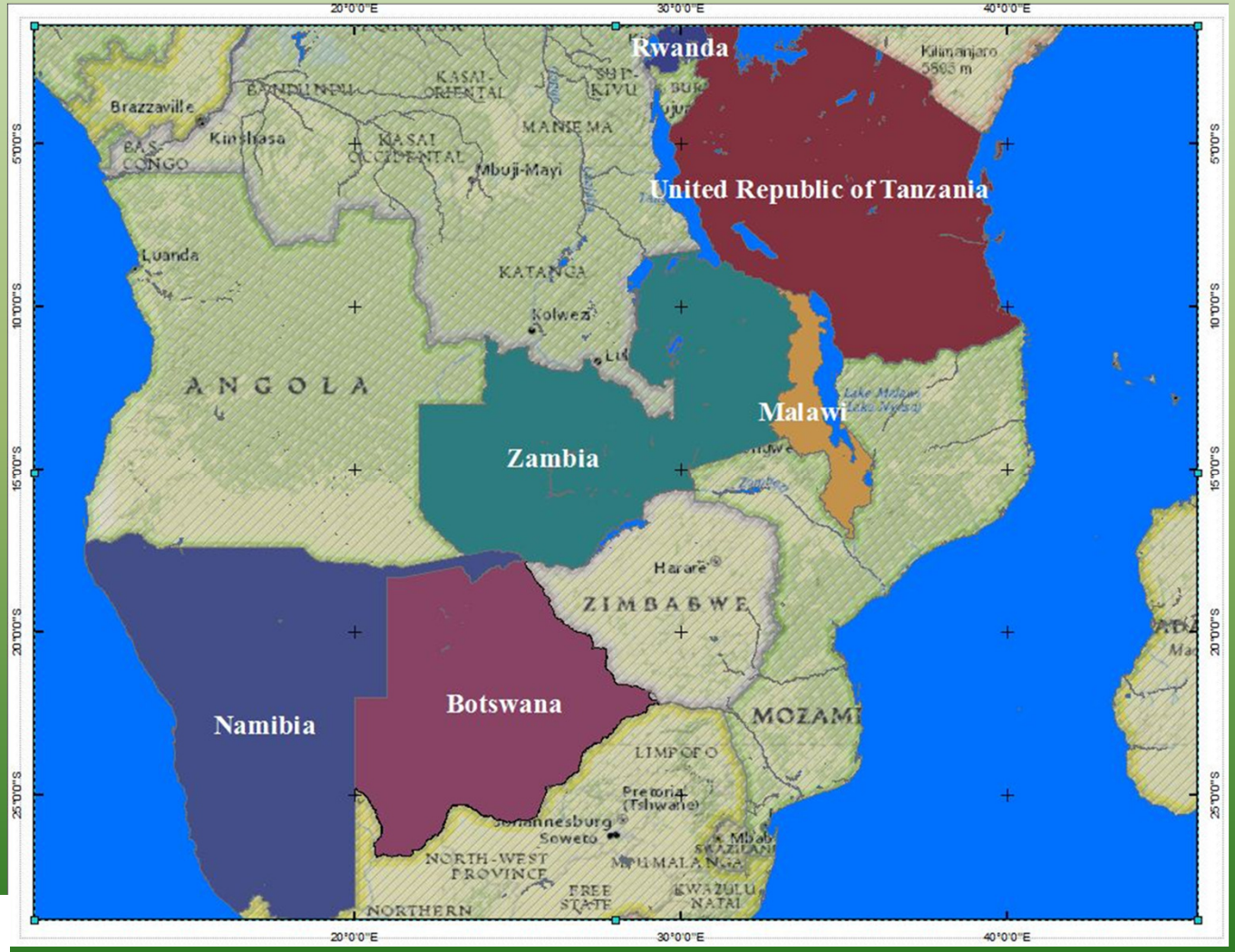
Estimation of the National maize production during the "Long rain" crop season 2009 and comparison with the FOOD SEC 2008 estimates.

Province	Estimated yield 2009	Wf*	Estimated maize area 2009	Maize production 09 MT	Maize production 08 MT	Variation % (2009 vs 2008)	Absolute difference MT
Central	1.60	0.07	84,890	136,129	134,312	1	1,817
Coast	0.71	0.04	48,508	34,348	49,975	-31	-15,627
Eastern	0.11	0.18	218,287	24,072	114,365	-79	-90,293
Nyanza	1.61	0.13	157,652	254,402	252,361	1	2,041
Rift Valley	1.80	0.43	521,465	939,715	1,085,765	-13	-146,050
Western	2.39	0.15	181,906	435,431	418,706	4	16,725
National	**1.50**		**1,212,708**	**1,824,097**	**2,335,886**	**-22**	**-511,789**

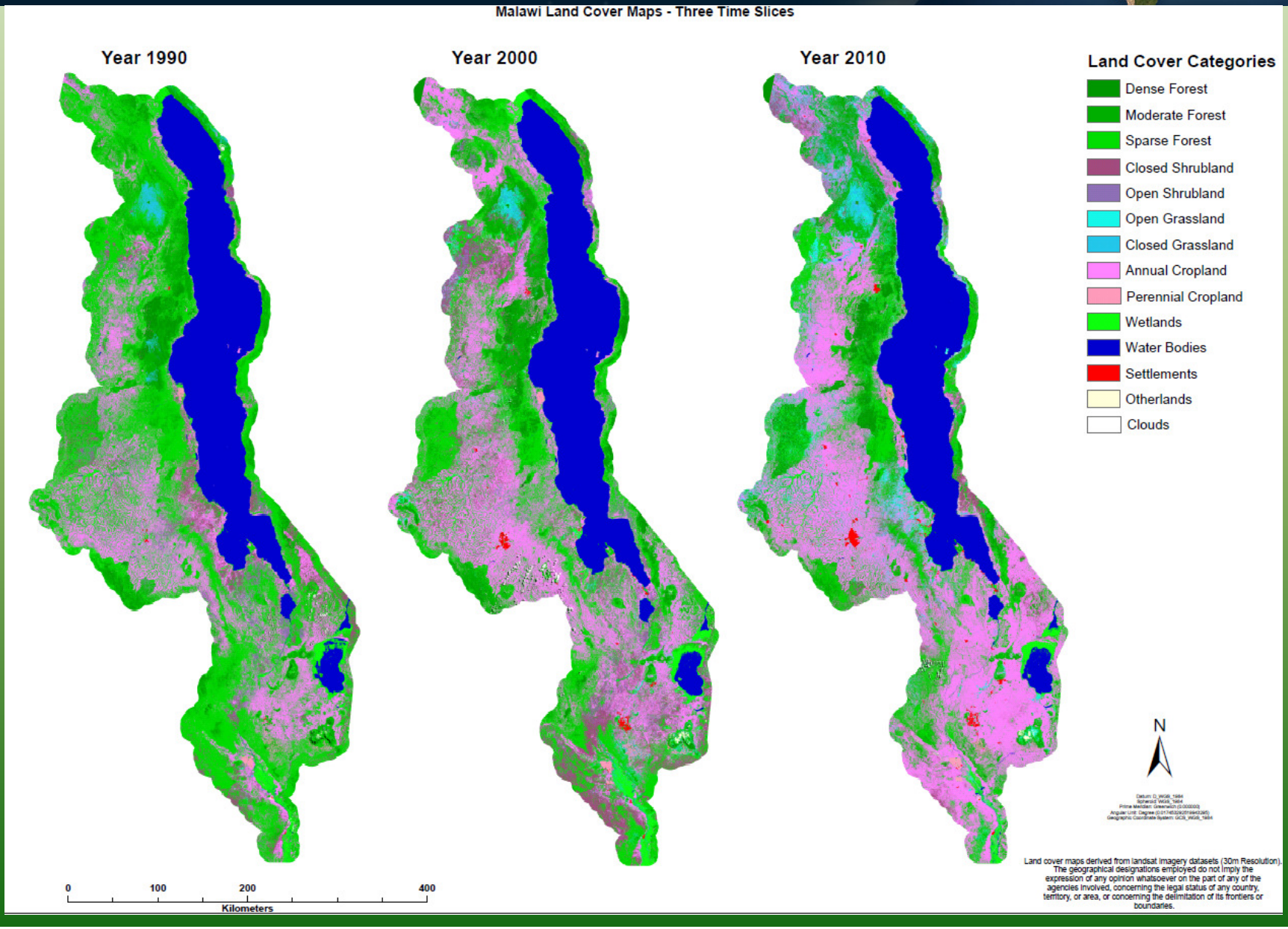
IV. National Scale Land Use Land Cover Mapping (Crop land is one of the classes)

Countries participating in the project

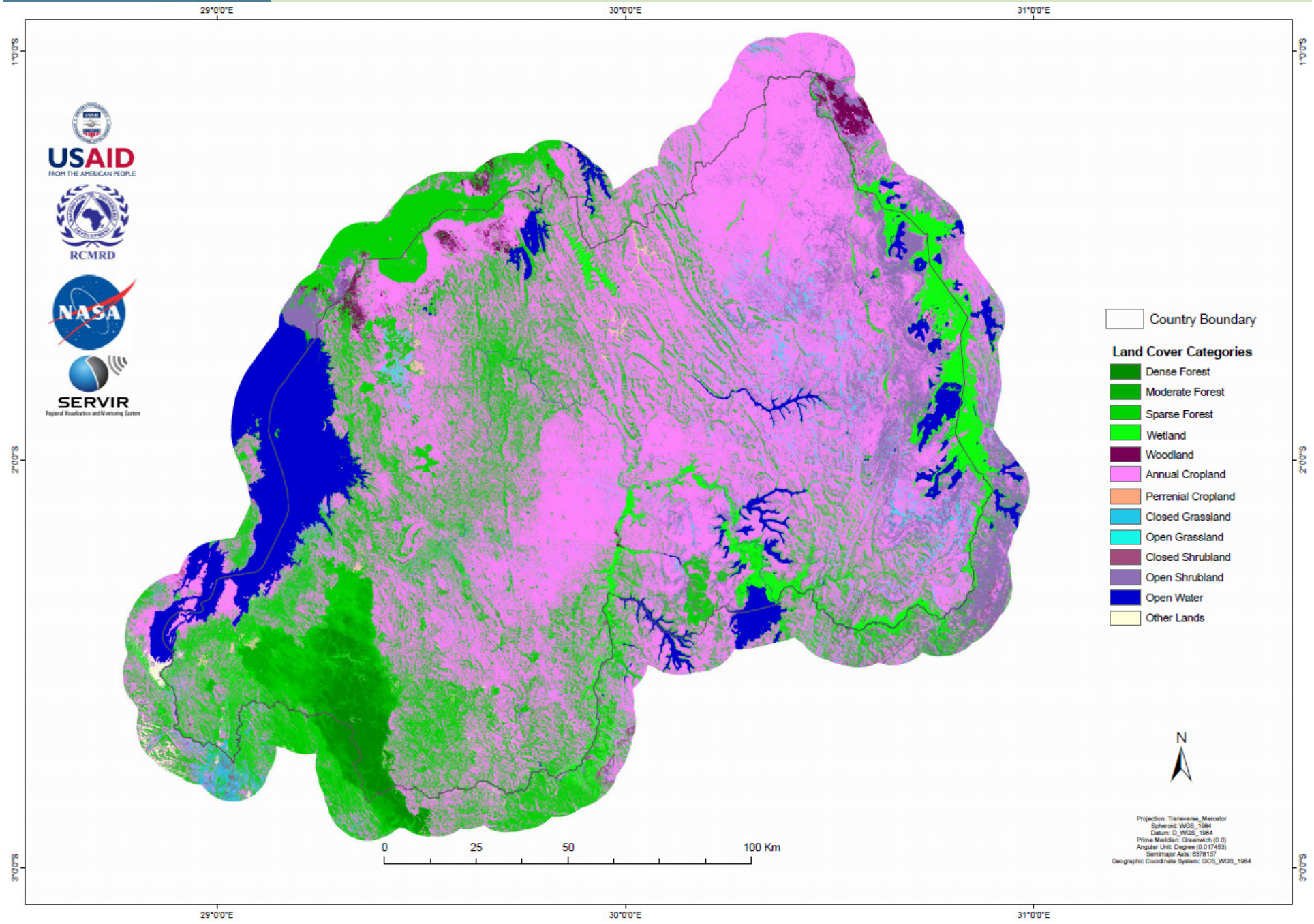
1. *Malawi*
2. *Rwanda*
3. *Tanzania*
4. *Zambia*
5. *Namibia*
6. *Botswana*



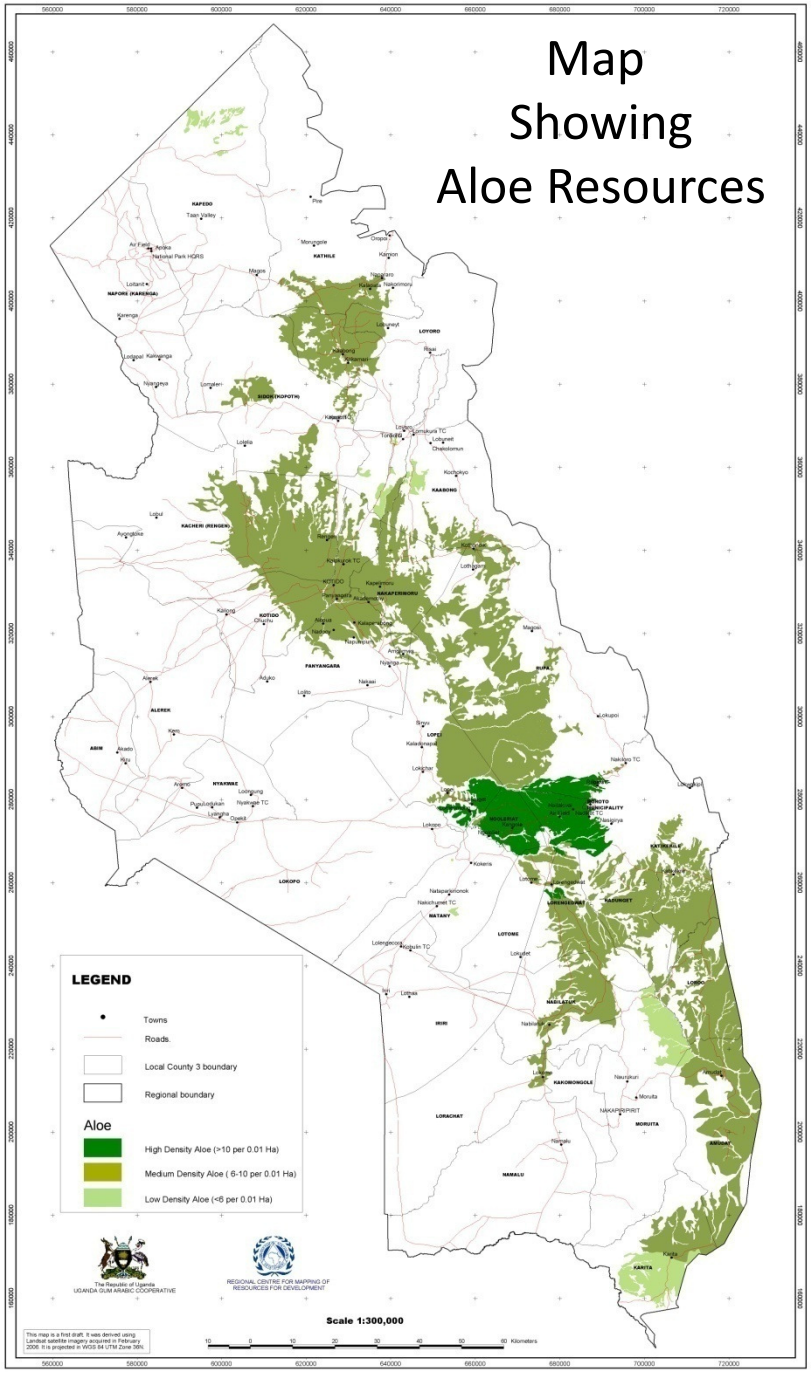
Malawi Land Cover Maps



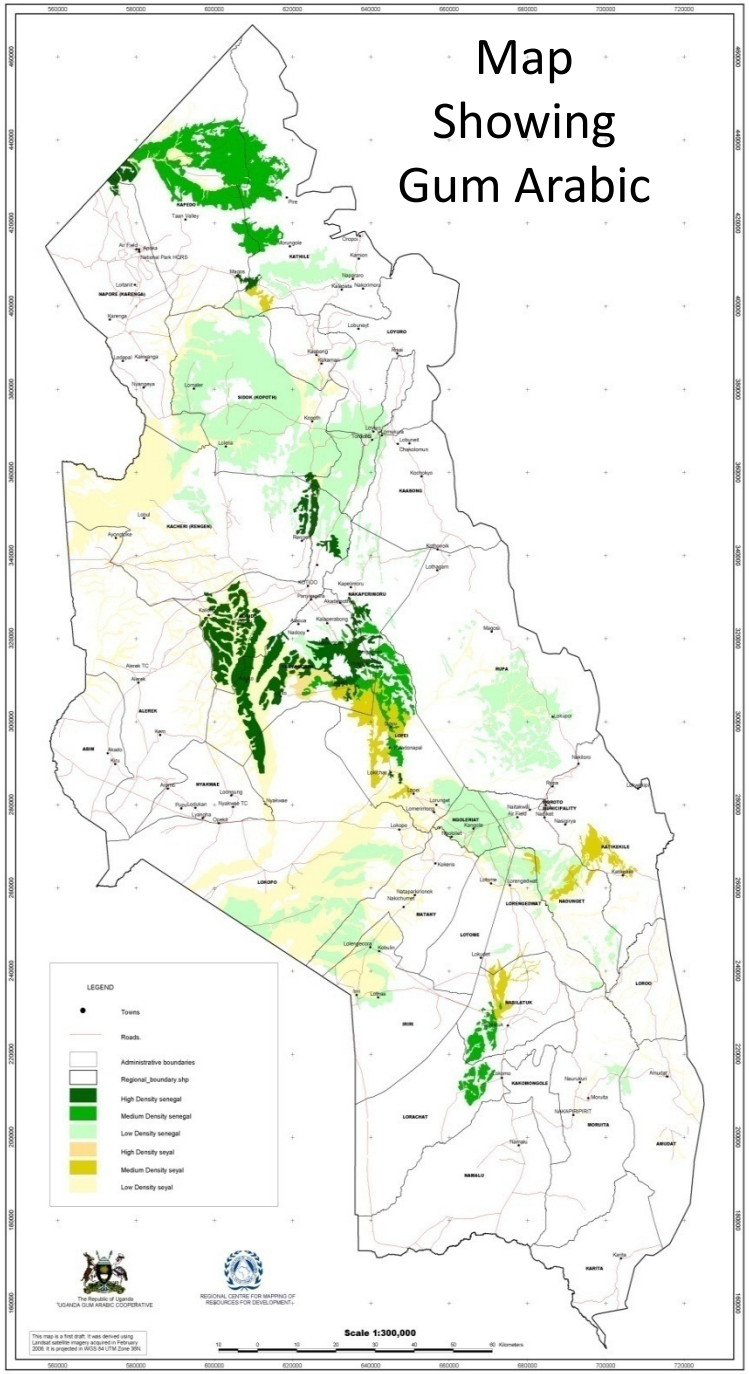
Rwanda Map – LC 2010



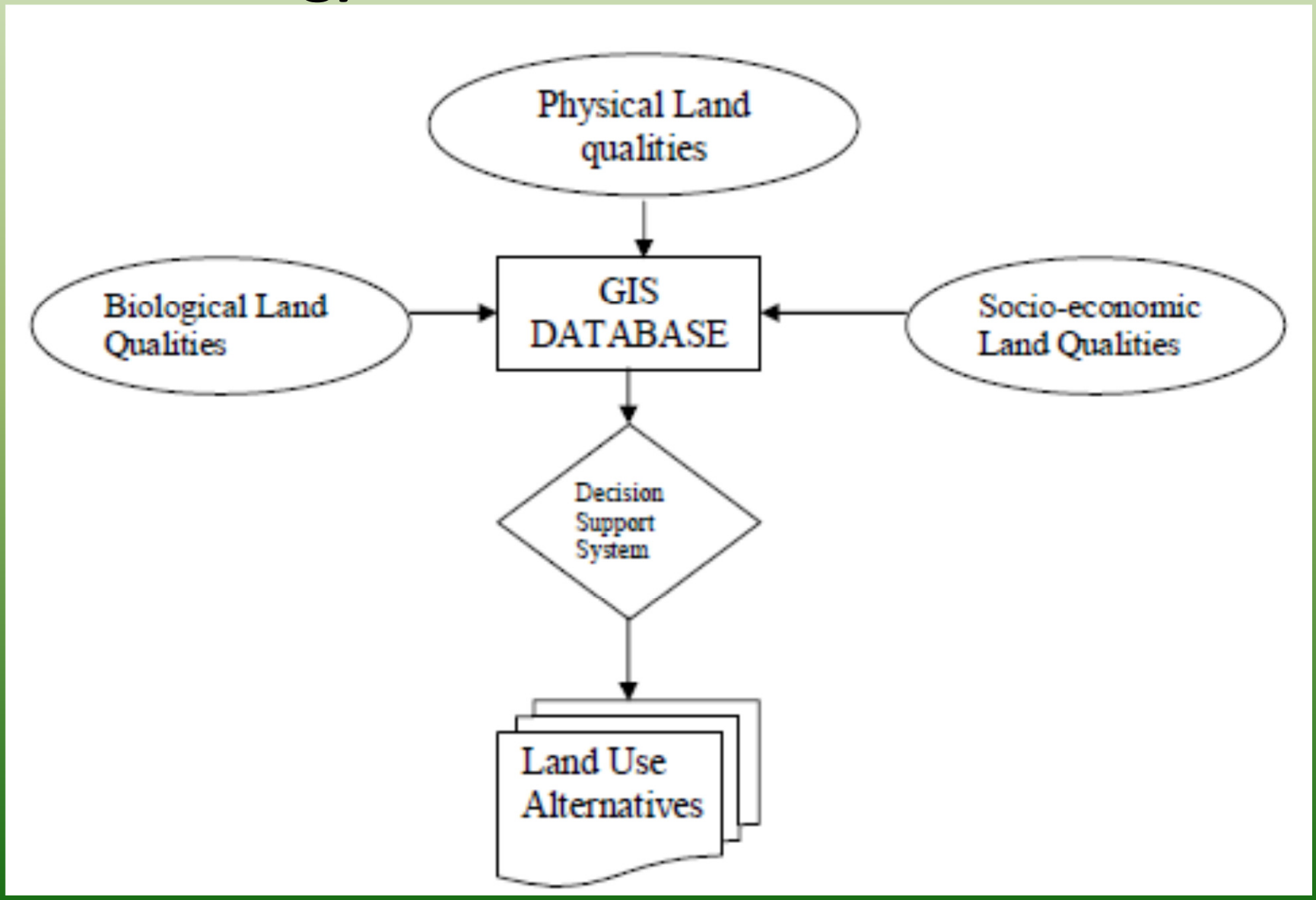
COMMERCIAL ALOE RESOURCE MAP OF KARAMOJA REGION - UGANDA



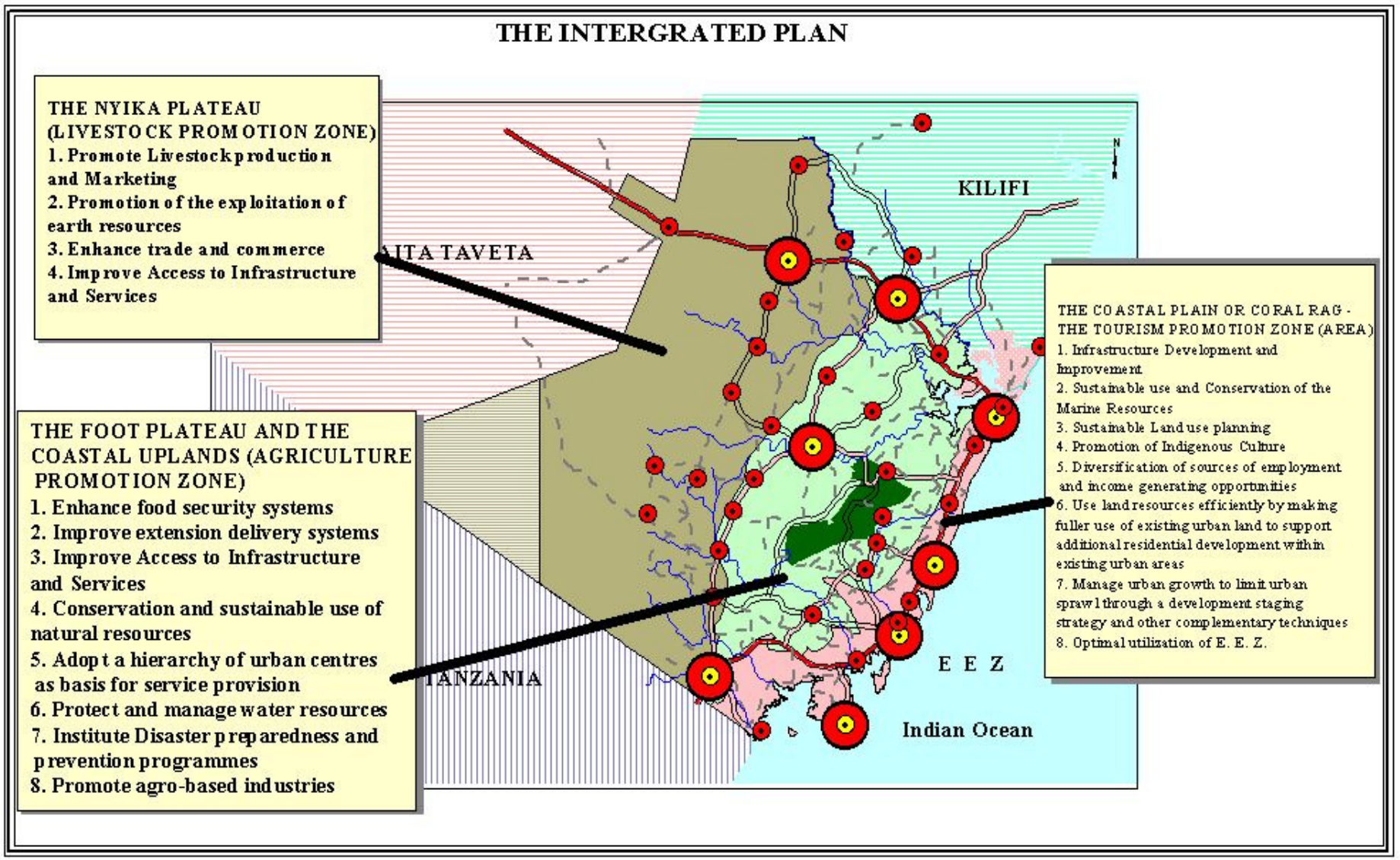
GUM ARABIC MAP OF KARAMOJA REGION- UGANDA



V. Land suitability determination (Physical Planning)



Proposed Land use Plan



VI. GEOGLAM and Africa

- Africa is given less priority (Observation)
  - Despite food security issue and dynamic land use and land cover changes,
  - Despite complex factors affecting Satellite based agricultural Monitoring ,
  - Despite lack of data (Satellite and in-situ) and knowledge
  - Governments are ready to embark on improving Ag. Monitoring in Africa

JECAM
Joint Experiment for Crop Assessment and Monitoring

GROUP ON EARTH OBSERVATIONS

- JECAM Goal: to develop best practices guidelines through a network of study sites representative of many of the world's cropping systems
  - Support monitoring enhancements within operational agricultural monitoring systems
- JECAM Program Office is coordinated by AAFC, Canada and UCL

15 sites currently exist, at least 5 new in development

GEOGLAM
Global Agricultural Monitoring

VI. Conclusion

-Need to establish more JECAM Sites in Africa

-Build capacity of African institutions so that there is a uniform and comparable Agricultural information

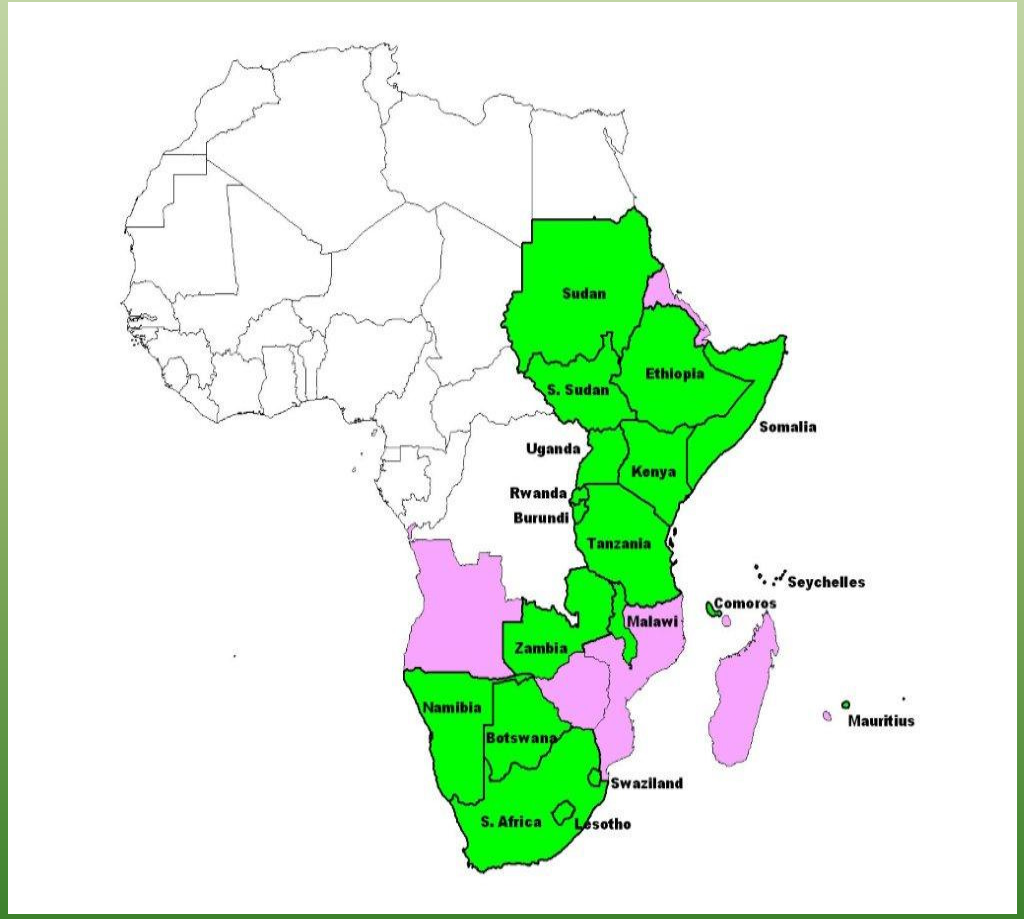
-Continue working with Regional and national institutions

-Need to bring together Statistics and Agriculture Sectors together

-National mapping institutions can play important role

REGIONAL CENTRE FOR MAPPING OF RESORCES FOR DEVELOPMENT

RCMRD



Thank you very much!
Merci Beacoup!

Contact Information:

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RCMRD

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254-20-856-1775
254-20-856-0335

Botswana Burundi Comoros Ethiopia Kenya Lesotho Malawi Mauritius Namibia Rwanda Seychelles Somalia South Africa Sudan Swaziland Tanzania Uganda Zambia