

### science & technology

Department: Science and Technology REPUBLIC OF SOUTH AFRICA



lower

Dr C. Adjorlolo Dr P. Mangara J.O. Botha

THE LAUNCH OF 2013 SPOT5 NATIONAL MOSAIC, THE INNOVATION HUB, PRETORIA September 5, 2014

SPACE AGENCY

# Background

# Natural agricultural resources monitoring and assessment

## Earth observation applications for:

- Agricultural zones and land-cover classification
- Cropland monitoring
- Bush encroachment and bush thickening
- Modelling grazing and browsing capacity

# Summary of benefits

# General conclusions



# Background

- Long-term monitoring of agro-ecological systems- a national priority.
- Monitoring is required to inform decision making and to assist relevant stakeholders carry out their legal obligations.
- key legislations:
  - Conservation of Agricultural Resources Act, 43 of 1983
  - Sub-division of Agricultural Land Act, 70 of 1970
  - National Environmental Management Act, 107 of 1998
  - National Veld and Forest Fire Act, 101 of 1998
  - Spatial Planning and Land Use Management Act, 16 of 2013



# Natural Agricultural Resources Assessment

### Scientists and land managers identify **HEU** – several mapping tools

- Topographical maps
- High resolution satellite imagery;
  - 5m/20m contour/DEM
  - Drainage lines
  - Roads



- Satellite-derived land-cover/land-use base maps;
  - Differentiate between transformed and un-transformed land
  - Differentiate between grassland & woodland
  - Different density classes of woodland





### Monitoring for all seasonal conditions



agriculture & environmental affairs Department: Agrouture & Environmental Affairs PROVINCE OF KWAZULU-NATAL



### Soil survey



**Production** 



#### agriculture & environmental affairs

Department: Agriculture & Environmental Affairs PROVINCE OF KWAZULU-NATAL



### Rangeland burning

### Grazing land





### **Applications:** Classification of agricultural land and associated threats



# Applications: Cropland monitoring

SPOT6: Panel **a**-natural colour; panel **b**- Normalized Difference Vegetation Index (NDVI)







REPUBLIC OF SOUTH AFRICA

# Multi-temporal analysis: LANDSAT 5/7/8 for 1993/2003/2013, respectively





### SPOT5-Derived Land-cover Classification

#### Legend **KZN\_LC2008** Susbsistence (rural) Bare rock Alpine grass-heath Annual commercial crops dryland No Data Annual commercial crops irrigated KZN national roads Water natural Forest KZN main & district roads Plantation Dense bush (70-100 cc) Water dams Plantation - clearfelled Bushland (< 70cc) Water estuarine Wetlands Woodland Water sea Wetlands - Mangrove Grassland / bush clumps mix Bare sand coastal Permanent orchards (banana, citrus) Grassland Forest glade Permanent orchards (cashew) dryland Bare sand Outside KZN boundary Permanent pineapples dryland Degraded forest KZN railways Sugarcane - commercial Degraded bushland (all types) Airfields Sugarcane - emerging farmer Degraded grassland Old plantation- high vegetation Mines and quarries Kilometers GTI Old cultivated fields - grassland Old plantation - low vegetation Built up dense settlement Old cultivated fields - bushland Rehabilitated mines - high vegetation 5 Golf courses 0 10 Smallholdings - grassland Rehabilitated mines - low vegetation Low density settlement Erosion **GE T E R R A I M A G E**

# Quantifying bush encroachment and bush thickening

- Bush thickening
  - Decreases quantity & quality of grazing land
  - Decreases carrying capacity & biodiversity
  - Aggravated by climate change
- Bush encroachment is compromising rural livelihoods





agriculture & environmental affairs Department: Agriculture & Environmental Affairs

#### Example: an assessment of bush thickening and expansion in uMkhuze Game Reserve



















# Modelling grazing and browsing capacity

### Woody vegetation

- Negative logarithmic relationship between tree density and grass production
- Grass production a maximum at tree densities of 300 TE/ha
- Tree densities in excess of 2100 TE/ha resulted in a 70 % decrease in grass production potential
- Maximum forage production can be attained at 1220 TE/ha (Cattle &Goat)
- Maximum live mass production at 1320 TE/ha

### IMPACT OF TREE DENSITY ON GRASS PRODUCTION

Relationship between tree density and grass production





SPOT5-derived woody tree density (TE/ha) & Total leaf mass (LMASS/kg/ha)

Kilometers 30

High : 8194.42 Low : 461.85





### **Grazing Capacity & Stocking Rate**

Calculate the grazing capacity of site

- ha/AU
- Growing season (250 days)
- Annual (365 days)

# Stocking rate of farm is based on animal numbers





# **Summary of benefits**

- Livestock production: Communal and commercial
  - Sheep, cattle and goats
- Cropland monitoring: rural subsistence and commercial
- Ecosystem goods and services
  - Biodiversity conservation
  - Grazing and browsing management
  - Fuel wood,
  - Timber
  - Raw material for craft
  - Medicinal plants
  - Carbon stock for carbon credits
- State of the environment reports
- International UN obligations: e.g. REDD+

## **General conclusions**

- Good policy decisions need to be based on timely, consistent and accurate information" (DEA, 2006): - SANSA Earth Observation (EO) data products make important contribution.
- Long-term EO data products are key to South Africa's national geospatial information and data management.
- Scientists and application developers at SANSA EO seek collaboration with stakeholders.
- Constructive collaboration: improved monitoring of natural resources in South Africa
- This is SANSA's contribution to GEOGLAM/RAPP



### science & technology

Department: Science and Technology REPUBLIC OF SOUTH AFRICA



# Thank you