GEOGLAM RAPP sites in South Africa

Clement Adorlolo (PhD)

Earth Observation Directorate

Our core business

- Data reception
- Archive
- Data processing
- Data dissemination
- Geo-information Products & Applications

Contribute to

- greater utilisation of earth observation in addressing day-to-day societal problems & needs
- better planning & decision making; performance monitoring; environmental & resource management; disaster management; national Food security & health

Sensor Portfolio Management & Data reception

Data Archiving, Processing & Dissemination

Geo-information Products & Applications
Data received by SANSA Space Operations demodulators is ingested, archived and catalogued by SANSA Earth Observation ground segments. Direct reception sensors include:

- SPOT 5, 6 & 7
- Landsat 5, 7, 8
- MODIS (Aqua and Terra)
- NOAA AVHRR
- CBERS 4

Savannahs and woodlands: 35% (42M ha), cover ranging from 20-70%, biomass < 50T ha-

Grassland and "Forested" landscapes in South Africa:

- Indigenous dense forests: 0.4% (0.5M ha)
- Commercial plantation: 1.0% (1.2M ha), mostly pine, eucalyptus, and acacia
- Albany thicket: 2.6% (3.2M ha), dense impenetrable vegetation with spiny, often succulent trees and shrubs, height < 5m
Threats

- Mining
- Forestry
- Climate Δ
- Development

- Transformation
  - D. Jewitt
  - Land-use
  - Land-cover
  - C3-C4

NPP? Food security? Carbon & Water?
Land use gradients
Rangelands

- Assess relative impacts of local & global drivers on vegetation dynamics over time.
- Structure, cover, composition
- Implications for secondary productivity?

Biodiversity shifts
Rangeland vegetation

- Climate envelopes
- Fire as a local driver
- Land use - grazing impacts
- C3-C4 dynamics
  - Temp - CO₂ - Moisture?
  - C3 woodies C3 grasses?

C. Adjorlolo

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Water delivery

Is there a change in quality & quantity of water delivered?

- Climate & streamflow data
- Infilling & Cross Calibration
- Change detection
- Water balance: Processes
- Water Quality
Carbon Dynamics

Source or sink?
Current and under climate & landuse \(\Delta\)

- Stocks & Fluxes
  - Eddy co, Soils
  - (Respiration), (LAI), Biomass

- NEE
  - Phenology
  - Time since fire
  - Elevated temperature

Earth system processes & feedbacks

What is the Net effect?

\(\alpha\) Landuse – climate \(\Delta\) trajectories (COP21)

- Biodiversity
- Climate data
- Water balance
- Carbon
- Soil Moisture (COSMOS)
- Energy balance
Species shifts, soil moisture, temperature - phenology?

Fire! Frost?

Water use, energy balance, productivity, palatability, carbon dynamics

Figure 1 Time series FCover of winter-green grass cover profile, using n= 206 samples.

Grazing capacity map for RSA: policy
Application examples

Long-term time Series of Satellite-derived Vegetation Indices

9 January 2015

Biomass mapping in South Africa

2010 CSIR above ground biomass map in Lowveld (250m)
Method: Combination of global GLAS LiDAR and MODIS VCF products

2010 CSIR above ground biomass map in Lowveld (75m)
Method: Integration of airborne LiDAR and ALOS PALSAR using machine learning algorithm (Random Forest)

Le Toan & team
2005/2010/2015 CESBIO-CSIR above ground biomass map in SA forest belt; method: semi empirical methods, use small number of cal plots, MIPERS SAR simulator (forest/env parameters), water cloud models & Bayesian inversion
Field sampling effort – above ground biomass

- 1 ha square plots (cal/val LiDAR & SAR)
  - Height & DBH
  - Species
- ~ 100 plots over various veg types
- Allometric equations

STANDARD OPERATING PROCEDURES

- Client driven projects:
  - Commercial agriculture & subsistence agriculture
  - Game farming sector
  - Conservation sector
  - Risk & Disaster
- Range condition, carrying capacity & management planning recommendations
- Type of data collected:
  - Herbaceous species composition
  - Standing herbaceous biomass
  - Woody vegetation composition, phytomass & browseable material
  - Soil properties
- Project areas: 50 – 50 000 ha
- 80 – 120 sites per annum covering between 20 000 and 80 000 ha
Satellite data aided the quantification of bush thickening in KwaZulu-Natal (KZN) Province

Data Requirements

<table>
<thead>
<tr>
<th>Variables/Parameters</th>
<th>Spatial Resolution</th>
<th>Spectral Resolution</th>
<th>Temporal frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biomass (AGB): woody &amp; grass/herbaceous</td>
<td>20-30 m</td>
<td>Pan-VIS-NIR-SAM data</td>
<td>Updated monthly over the growing season</td>
</tr>
<tr>
<td>Grazing/Browse capacity maps and stocking rate</td>
<td>10-20 m</td>
<td>VIS-NIR</td>
<td>Updated seasonally and on demand requests</td>
</tr>
<tr>
<td>Vegetation condition/ status indicators</td>
<td>10-20 m</td>
<td>Pan-VIS-NIR-SWIR- TIR</td>
<td>Weekly during growing season</td>
</tr>
<tr>
<td>Plant type identification</td>
<td>0.5-5 m</td>
<td>Pan-VIS-NIR-SWIR</td>
<td>Growing season/yearly products</td>
</tr>
<tr>
<td>High resolution drought monitoring/assessment</td>
<td>50 m ±</td>
<td>VIS-NIR-SWIR-TIR</td>
<td>Monthly products</td>
</tr>
<tr>
<td>Vegetation Indices: NDVI, SR, SAVI, EVI</td>
<td>10-30 m</td>
<td>VIS-NIR</td>
<td>Monthly or bi-weekly</td>
</tr>
<tr>
<td>Biophysical variables: LAI, FPAR, FAPAR, FCover, leaf Chl, canopy nitrogen, Leaf Area Index, Soil fraction</td>
<td>5-20 m</td>
<td>VIS-NIR</td>
<td>Monthly or bi-weekly</td>
</tr>
<tr>
<td>Cloud free surface reflectance products</td>
<td>10-50 m</td>
<td>VIS-NIR-SWIR-TIR</td>
<td>Monthly or bi-weekly</td>
</tr>
</tbody>
</table>
Thank You