REMOTE SENSING RESEARCH FOR SPATIAL ASSESSMENT OF WOODY STRUCTURE IN AFRICAN SAVANNAHS & WOODLANDS – PAST, ON-GOING, AND FUTURE WORK BY THE CSIR

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Introduction:

- Appropriate techniques are needed to monitor woody vegetation cover, biomass and carbon stocks
- Important for energy security of rural communities in Africa, climate change & REDD+ program, & ecosystem processes
- Light Detection and Ranging (LiDAR) & Synthetic Aperture Radar (SAR) interact with vegetation morphology and structure
- Aim: To assess and demonstrate the available remote sensing techniques, implemented in recent CSIR research, which can be utilized to map vegetation structural parameters at various scales

Box 1: LiDAR (Laser altimeter)

- Emits highly repeating laser pulse of given size or footprint and time resolution (discrete vs waveform)
- Based on laser returns detailed structural information can be attained on vegetation structure:
  - Tree height (from Digital Surface & Ground Models)
  - Canopy shape & architecture
  - Woody cover
  - Vertical tree profiles (from pseudo-voxel analysis (Asner et al, 2007)
  - Biomass models

Box 2: LiDAR Studies and Examples

- The change in vegetation structure resulting from rural resource extraction was investigated by Fisher et al (2009) and Wessels et al (2009)

Savannah vertical tree profile

Tree height image

Conclusions:

- Appropriate technology and guidelines still need to be researched to move one step closer towards the development of woody structure products for effective savanna & woodland management
- This research is on-going and is a key area of interest for the CSIR Ecosystems Earth Observation unit

Box 3: SAR, Products & Studies

- E.g. of spaceborne satellites: RADARSAT 1-2; ENVISAT-ASAR; ALOS-POLSAR & TerraSAR-X

- Permits the usage of various analytical techniques:
  1) Interferometry (allows accurate measure of distance in the landscape e.g. tree height)
  2) Multi-frequency polarimetry (allows investigation of vegetation structure e.g. biomass).

Le Toan (2007)

References

Mathieu R; Mathieu L; Leblon X; Mathieu A; Mathieu B; Mathieu C; Leblon J; Mathieu D; Mathieu M; Mathieu P; Mathieu M (2010). Potential of polarimetric RADARSAT-2 C-band SAR imagery to map woody vegetation composition structure in African savannas. Remote Sensing of Environment, Vol 114, Pages: 2282-2299

Box 4: Multi-angle optical technique

- E.g. Coarse scale Multi-Angle Imaging Spectroradiometer

- Use Bidirectional Reflectance Distribution Function principles and multi-angle view points of several cameras on board of satellite (forward, nadir, backward) to extract structure