Earth Observation for Biodiversity Assessment (EO-BA)

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THE ROLE OF EARTH OBSERVATION IN PROVIDING BIODIVERSITY INFORMATION

Biodiversity encompasses four levels: genetic, species, ecosystem and functional diversities. By sustaining the diversity of genes, species, ecosystems and functions (stock of natural capital), human society will continue to derive benefits from a plethora of ecosystem services including:

- Regulation of local and global climate
- Energy and chemical composition of air and water
- Protection of watershed, soil erosion and floods
- Nutrient cycling
- Biomass storage
- Provision of food, water, fuel and energy, raw materials and genetic resources for the pharmaceutical industry
- Cultural services.

The role of Earth observation in providing biodiversity information at the broad landscape cannot be overstated. Earth observation for biodiversity and ecosystem assessment are amongst the nine societal benefit areas identified by the Group on Earth Observations (GEO), an intergovernmental organisation working to improve the availability, access and use of earth observation to benefit society. Other societal benefit areas are agriculture, climate, disasters, energy, health, water and weather.

The Earth Observation for Biodiversity Assessment (EO-BA) programme is designed to enhance biodiversity assessment and conservation through the application of earth observation data, with particular focus on the African continent.

MISSION

To initiate and develop an operational monitoring programme to assess changes in key ecosystems in South Africa and Africa using earth observation technology.

BROAD OBJECTIVES

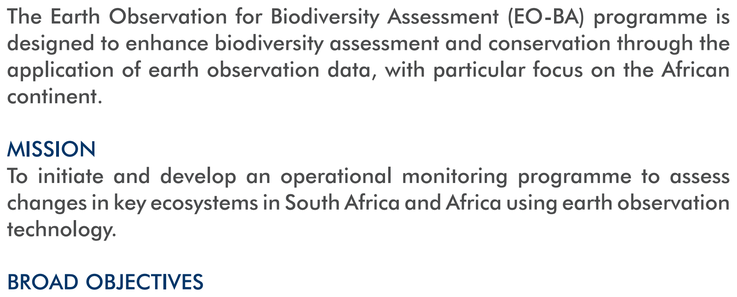
- To provide information on the extent, condition, structure, function and composition of key ecosystems in South Africa and Africa – distribution and status of key populations and communities
- To understand the drivers (biotic and abiotic variables) of biodiversity in South Africa and Africa
- To understand the threats to biodiversity in South Africa and Africa and to understand the impact of climate change on biodiversity in South Africa and Africa
- Collaborate with key institutions involved in biodiversity assessment in South Africa and Africa
- To share information on biodiversity distribution in Africa amongst users involved in technical, policy management and decision-making activities.

TECHNICAL OBJECTIVE

To develop processing routines and software to quantify the extent, condition, structure, function and composition of key ecosystems in South Africa and Africa, from earth observation data.

CONCEPTUAL FRAMEWORK

Biodiversity assessment has been a topic of intense research, but has reached a point at which accurate large scale (e.g. regional to global scale) modelling and monitoring are hindered by limitations in conventional assessment methods such as direct field sampling; modelling from environmental drivers such as temperature, precipitation and available nutrients; and modelling from conventional remote sensing data. The EO-BA recommends an integrated approach for assessing biodiversity at the regional or systems level. This perspective is based on the assumption that a modelling approach that exploits the strength of the various techniques (*in situ* environmental variables, direct field observation and remote sensing data) could potentially improve the assessment of biodiversity, ecosystem state and functioning at various geographic scales.

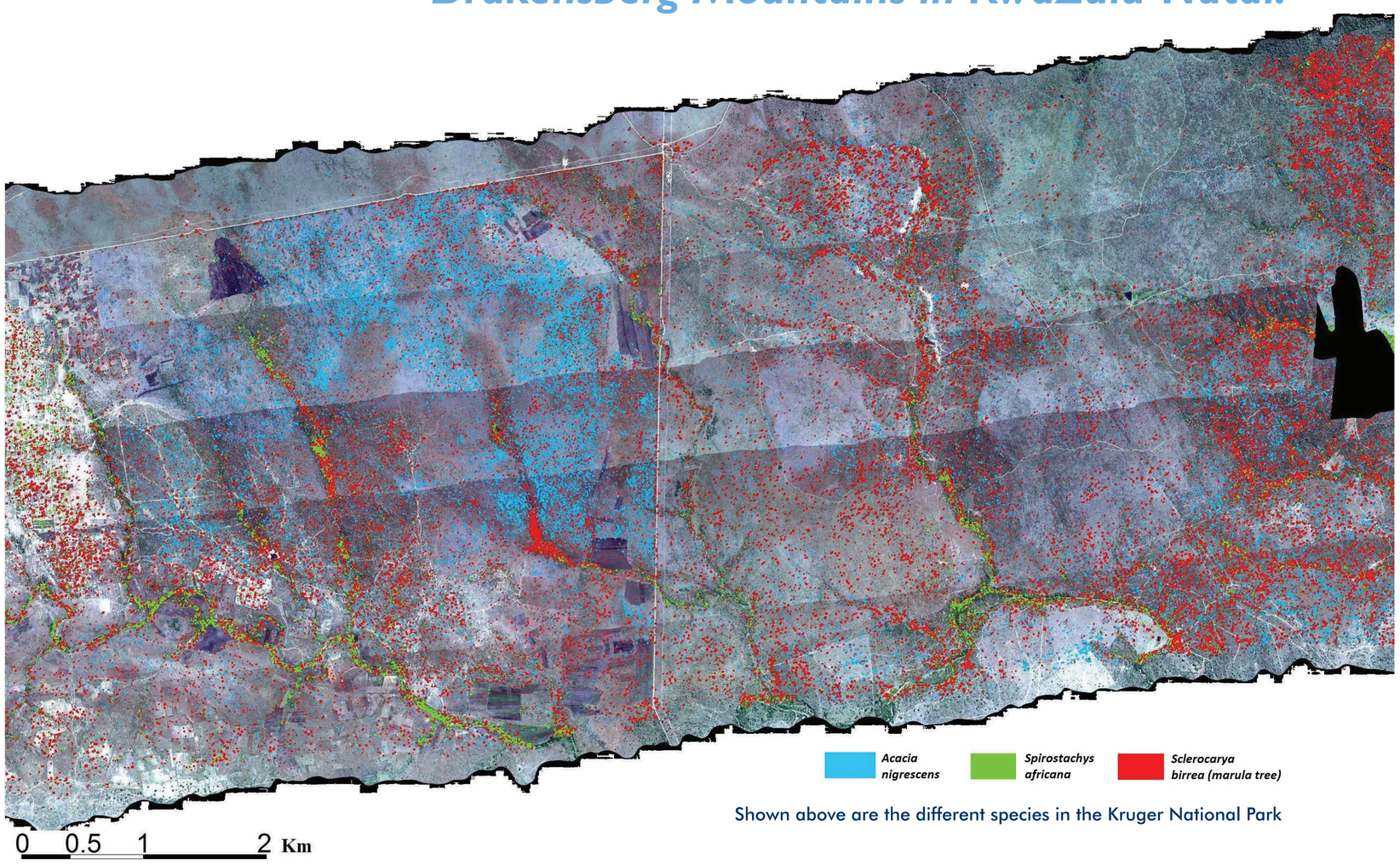


Schema of key elements in EO-BA

ONGOING COMPONENTS OF EO-BA

- Discriminating savanna tree species using an integrated LiDAR/ hyperspectral system (Carnegie Airborne Observatory system or CAO)
- Remote sensing of closed canopy coastal forest health and species (Pilot study in the Dukuduku forest in KwaZulu-Natal, South Africa, 2010 to 2013)
- Remote sensing of wetland species in the St Lucia wetland park, South Africa
- Spectral discrimination of dominant C3 and C4 grass canopies in the Cathedral Peak range of the Maloti-Drakensberg Mountains, South Africa
- Remote sensing of Camel Thorn in the Kumba ore mining area of Kathu, Northern Cape, South Africa.
- Remote sensing of scattered big trees in the Kruger National Park.

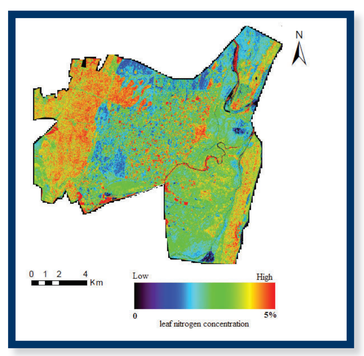
The Earth Observation for Biodiversity Assessment programme is designed to enhance biodiversity assessment and conservation in Africa through the application of earth observation data. The programme has already achieved major milestones in areas such as the Kruger National Park, the Dukuduku Forest and Maloti-Drakensberg Mountains in KwaZulu-Natal.



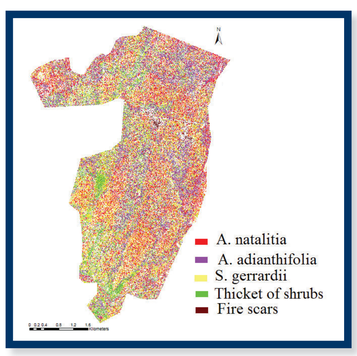
Shown above are the different species in the Kruger National Park

MILESTONES

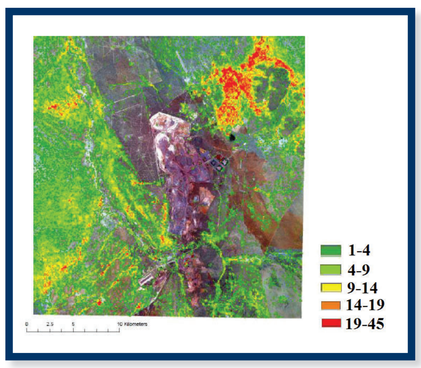
- Discriminating dominant tree species in savanna ecosystems
- Mapping dominant tree species in a sub-tropical forest (Dukuduku forest, KwaZulu-Natal, South Africa)
- Modelling leaf nitrogen distribution in a sub-tropical forest landscape following forest fragmentation
- Mapping big tree presence in open savanna, using tree shadow and high resolution multispectral imagery, based on object oriented classification techniques
- Spectral discrimination and mapping of dominant C3 and C4 grass canopies in the Cathedral Peak range of the Maloti-Drakensberg Mountains, South Africa, using Worldview-2 imagery
- Mapping dieback of Camel Thorn (*Acacia erioloba* - a protected species) using Worldview-2 imagery in an iron ore mining area, Northern Cape South Africa.



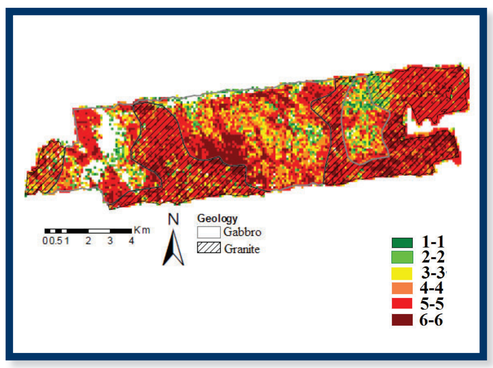
Leaf nitrogen distribution following forest degradation in the Dukuduku coastal forest



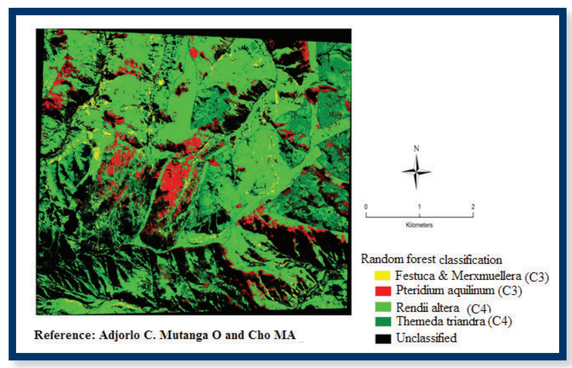
Map of dominant species in the Dukuduku coastal forest



Acacia erioloba (camel thorn) tree density (trees/ha), Kathu, Northern Cape



No. of different species (species/ha) in the Kruger National Park



C3 and C4 grass species cover: Cathedral Peak area, Drakensberg

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