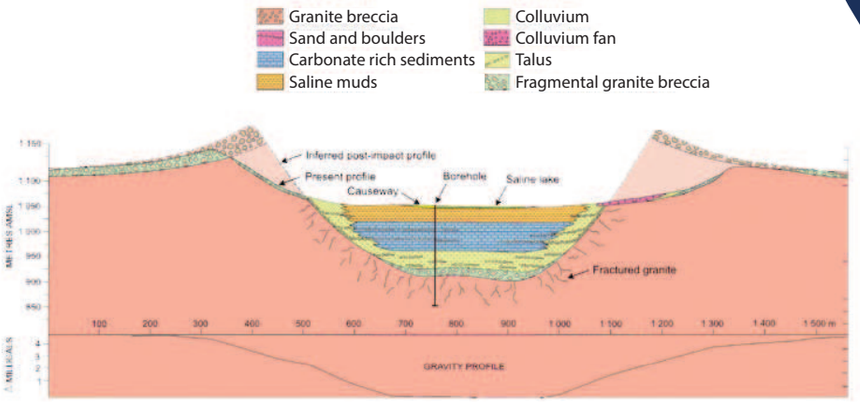
The Tswaing Crater

The **Tswaing Crater** is 40km northwest of Pretoria with a diameter of 1,13km and is 100m deep. The crater formed as a result of a meteorite strike believed to have been between 30m and 50m wide. As a result the **Tswaing Crater** is classified as an impact crater. Tswaing means Place of Salt in Tswana, hence its former name of Saltpan Crater.

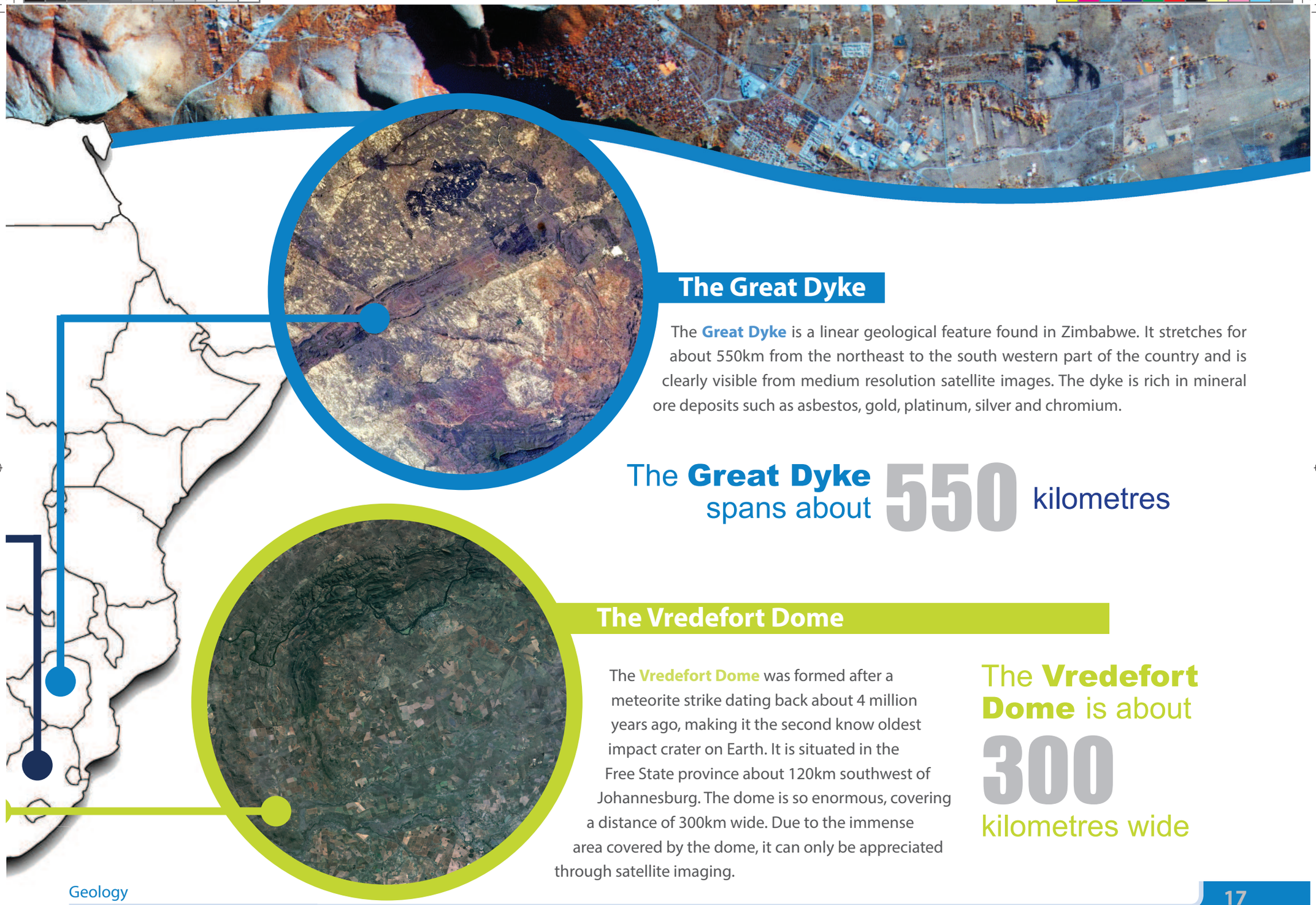
The **Tswaing Crater** is about

220 000

years old



Source: David A. Kring (USRA-LP)



The Great Dyke

The **Great Dyke** is a linear geological feature found in Zimbabwe. It stretches for about 550km from the northeast to the south western part of the country and is clearly visible from medium resolution satellite images. The dyke is rich in mineral ore deposits such as asbestos, gold, platinum, silver and chromium.

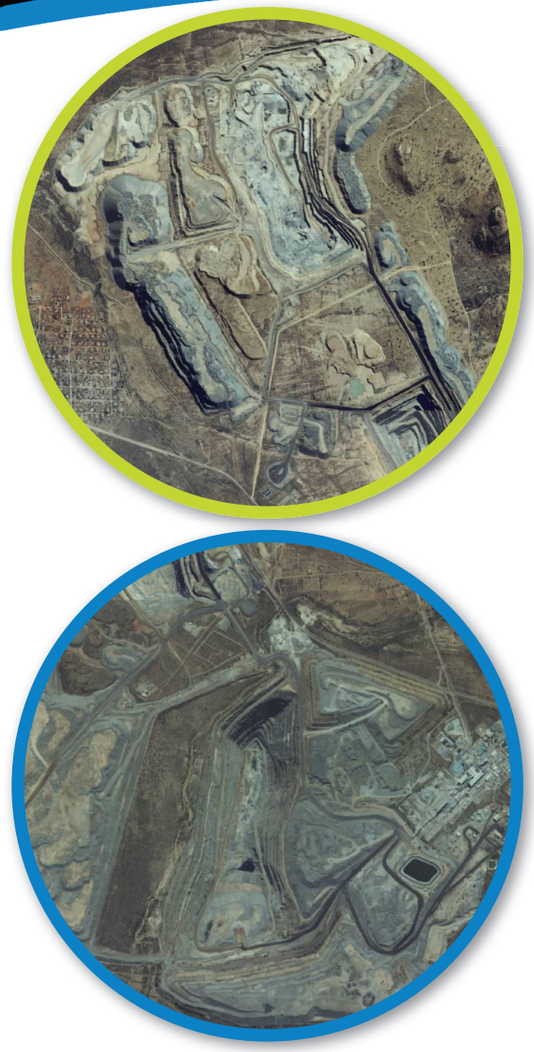
The **Great Dyke** spans about **550** kilometres

The Vredefort Dome

The **Vredefort Dome** was formed after a meteorite strike dating back about 4 million years ago, making it the second know oldest impact crater on Earth. It is situated in the Free State province about 120km southwest of Johannesburg. The dome is so enormous, covering a distance of 300km wide. Due to the immense area covered by the dome, it can only be appreciated through satellite imaging.

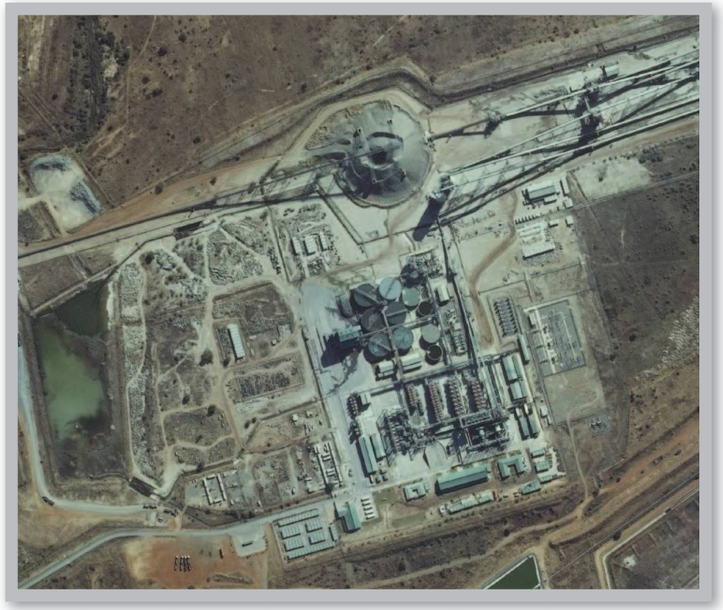
The **Vredefort Dome** is about **300** kilometres wide

Mining

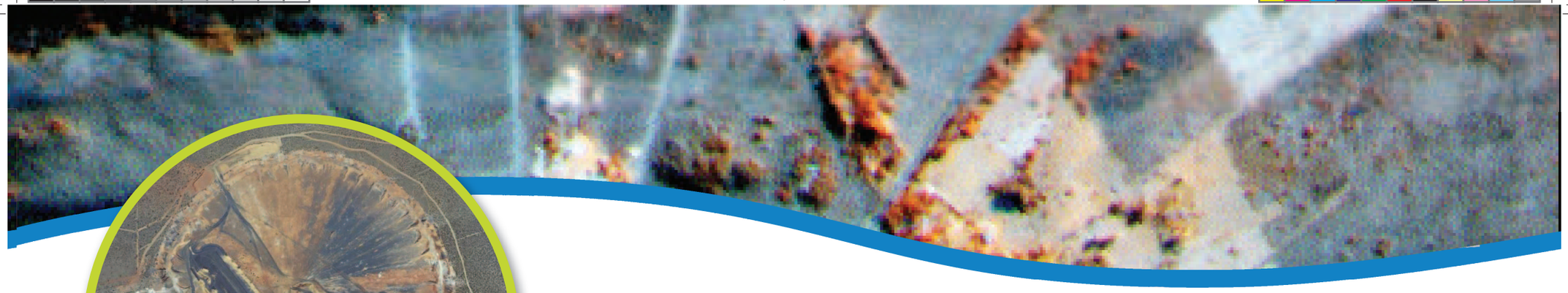


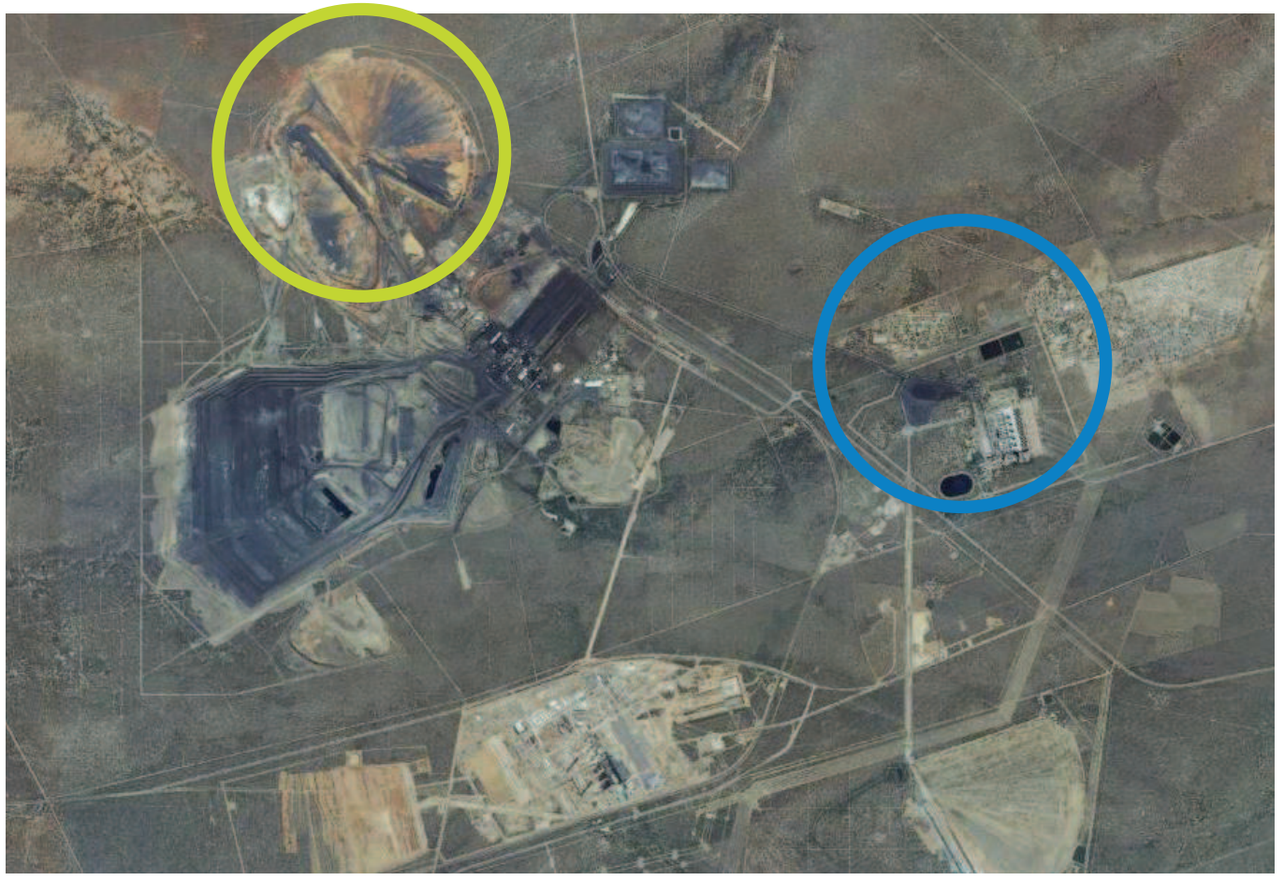
A detailed aerial photograph showing open-pit mines and ore stockpiles.

The Mogalakwena open-pit mine, as seen from a 0,5m aerial photograph, is 30km northwest of Mokopane in Limpopo Province. Visual interpretation of the image shows land features such as rock outcrops, settlements and mine infrastructure. The three inserts (green, blue and grey) illustrate in greater detail the activities in the mine when zoomed in.



A zoomed in aerial image showing the mine processing plant with conveyor belt, buildings,mineral stock pile, dam and other infrastructure.

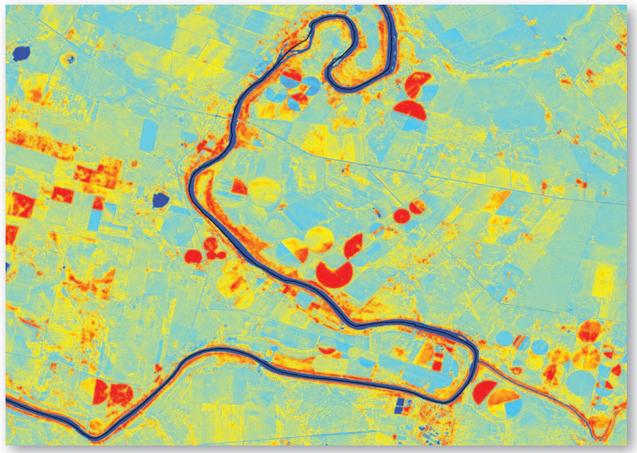




Aerial photograph (0,5m) of Grootegeluk open-pit coal mine situated 25km from Lephalale in the Limpopo Province. The Matimba Power Station and the mine can be seen in greater detail from the zoomed-in images on the left.

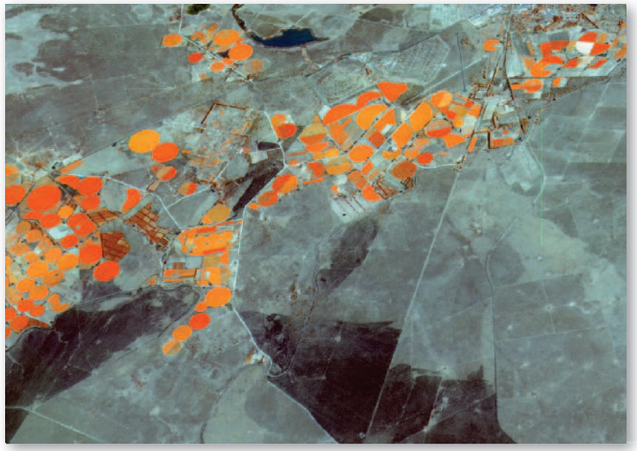
Agriculture

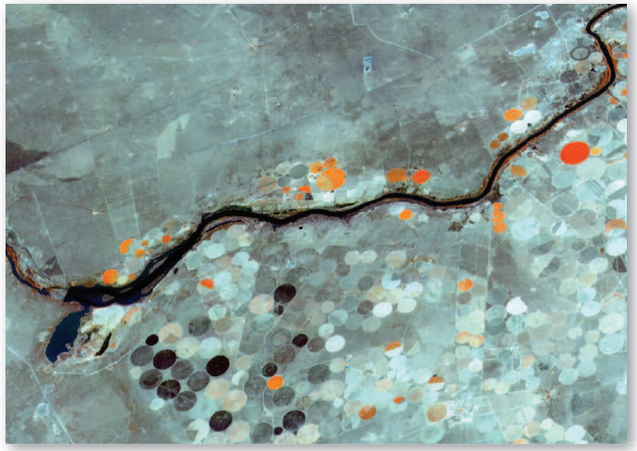
LandSat 8 false colour composite image showing agricultural fields at Bothaville in the Free State. The colour combination used shows healthy vegetation in deep red, water bodies in black and non-cultivated areas in different shades of green.



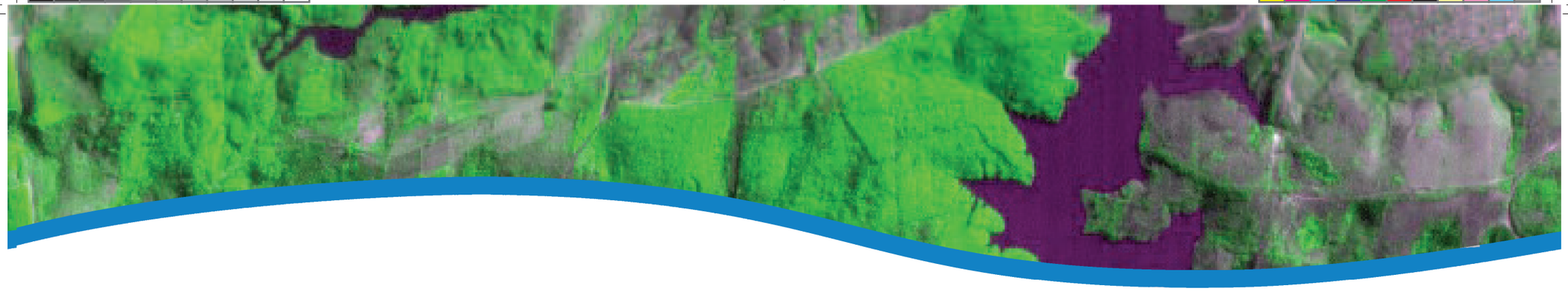
A Normalised Difference Vegetation Index (NDVI) of LandSat 8 image was calculated by using the near infrared and visible spectral bands using the following formula (NIR-R/NIR+R). The image shows healthy vegetation in red, water bodies in blue and non-cultivated areas in cyan.

A false colour composite of SumbandilaSat image of Jan Kempdorp in the Northern Cape shows agricultural fields in different shades of orange. At the bottom of the image, burnt areas (scars) can be seen in black.

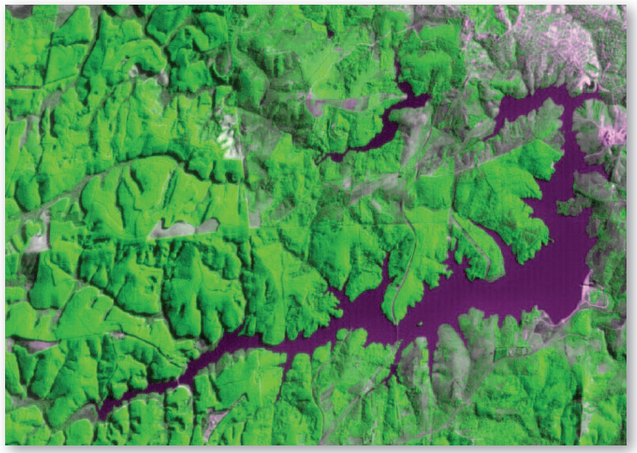




SumbandilaSat False colour composite of agricultural fields at Warrenton in the Northern Cape. Uncultivated fields in the image shown in different shades of grey whilst the river is shown in black.

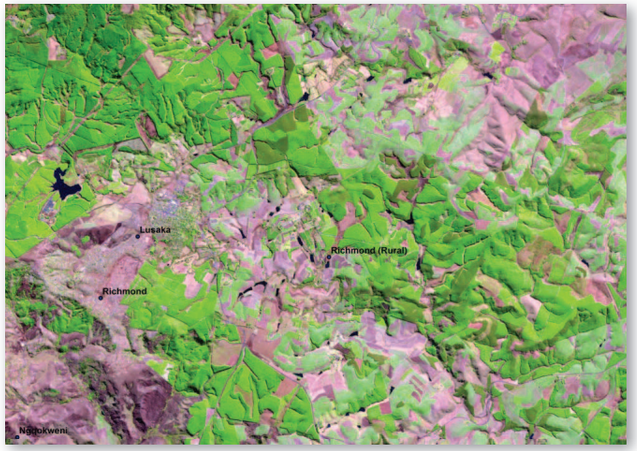


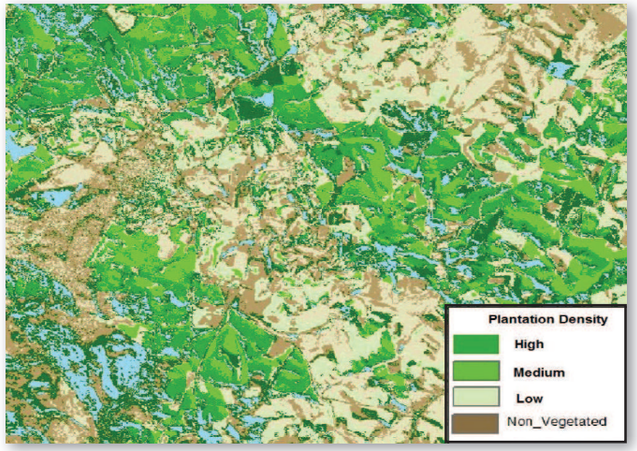
Injaka Dam at Bushbuckridge is shown in blue surrounded by forest plantations.



Agricultural plantations at Kirkwood in the Eastern Cape Province.

Sugar cane plantations in the Richmond area in KwaZulu- Natal.





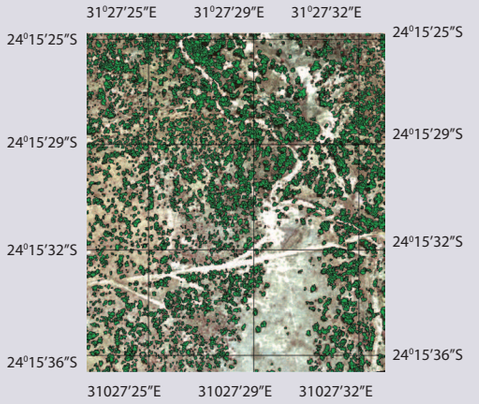
Classification of the sugar cane plantation, showing three classes of plantation density.

Woody cover mapping

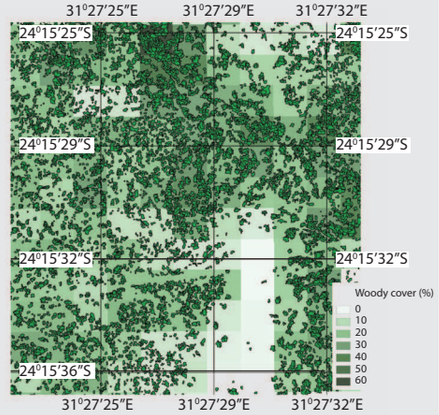
Historical mapping of woody cover

With increased concerns on the impact of climate change on vegetation, it is useful to monitor how vegetation has changed over time. Woody cover vegetation is of interest for both conservation and rangeland management. It is therefore useful to understand historical canopy cover to predict future changes. Making use of historical aerial photography and object-based image analysis in small areas, it is possible to create models and upscale these to larger areas using medium-resolution images such as Landsat & CBERS imagery. In this example we mapped woody cover vegetation in the Kruger National Park from an aerial image acquired in 1991.

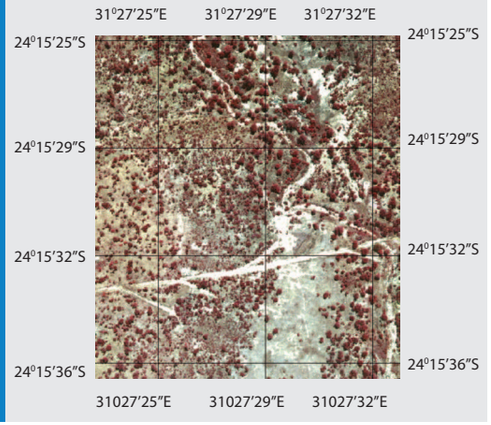
A NIR aerial photograph (0.5m resolution) acquired in 1991 by KNP Scientific Services.



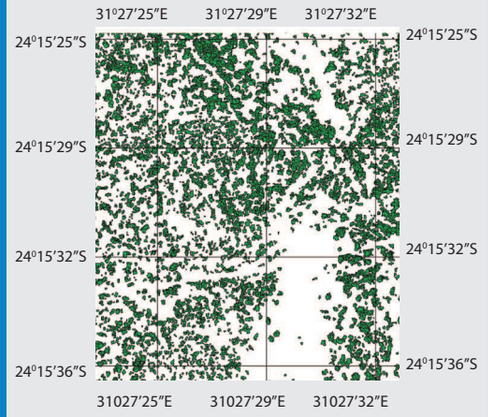
Based on the extracted wood cover, it is possible to calculate the percentage of woody cover at medium resolution that can be used to create models to map woody cover of the entire KNP.



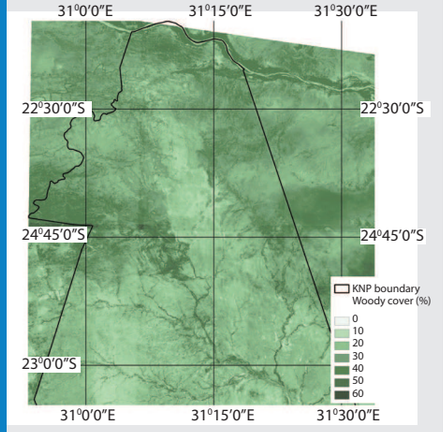
Using Object Based Image Analysis (OBIA), which makes use of both spectral and object properties, the woody trees are extracted from the aerial photograph.



The mapped woody cover as extracted from the aerial photograph.



Using modelling techniques with input from Landsat 5 imagery (30m resolution) from the summer and winter of 1991, and the woody cover maps created from aerial photos, a historical woody cover map for the northern region of the KNP was created.



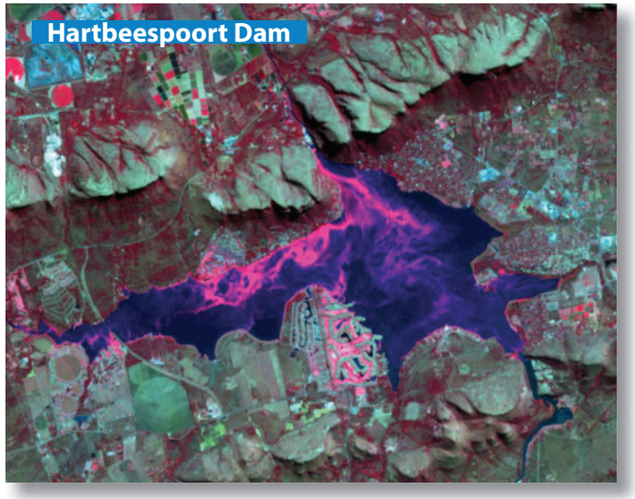
Water quality

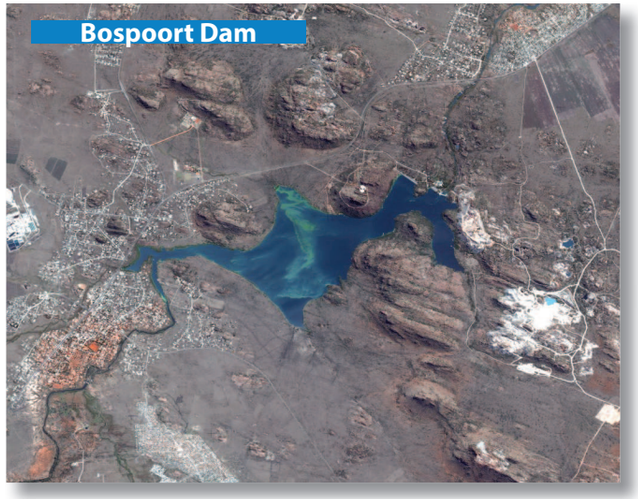
Algal blooms are ecological disasters that threaten the aquatic ecosystem. As a result it is important to identify and monitor their development for the protection and management of the water biome.

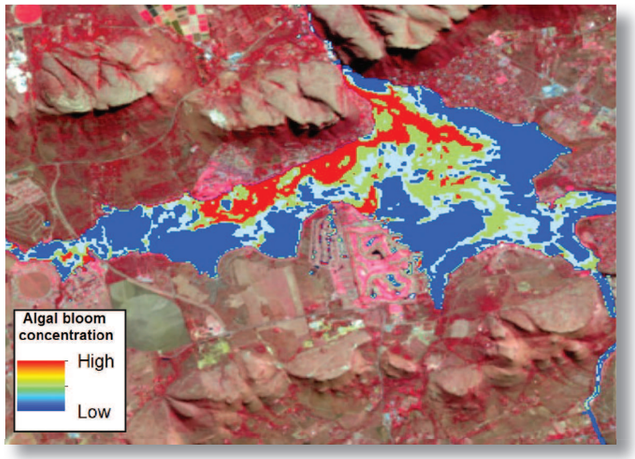
Conventional in-situ methods are not ideal for such an activity as they are time consuming and require substantial resources. Remote sensing is therefore the appropriate technology for such an application because of its ability to cover wide areas at different temporal scales. The different satellite images taken at various wavelengths, including the infrared region, make it possible to identify algal bloom because of their high chlorophyll concentration.

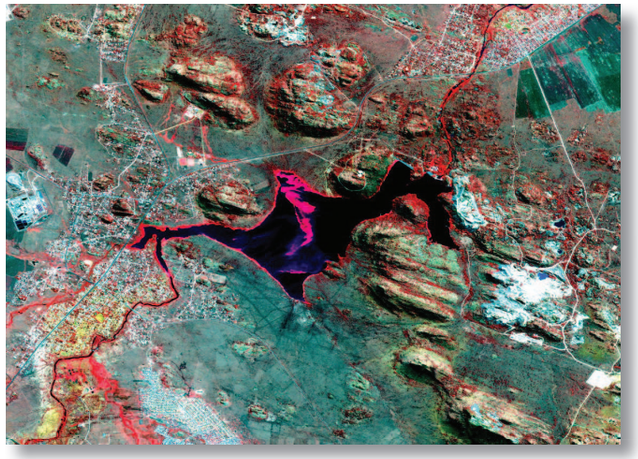
The Hartbeespoort Dam and the Bospoort Dam situated north and northeast of Pretoria respectively, are affected by algal bloom.

An **algal bloom** is a rapid increase or accumulation in the **population of algae** (typically microscopic) in a water system.



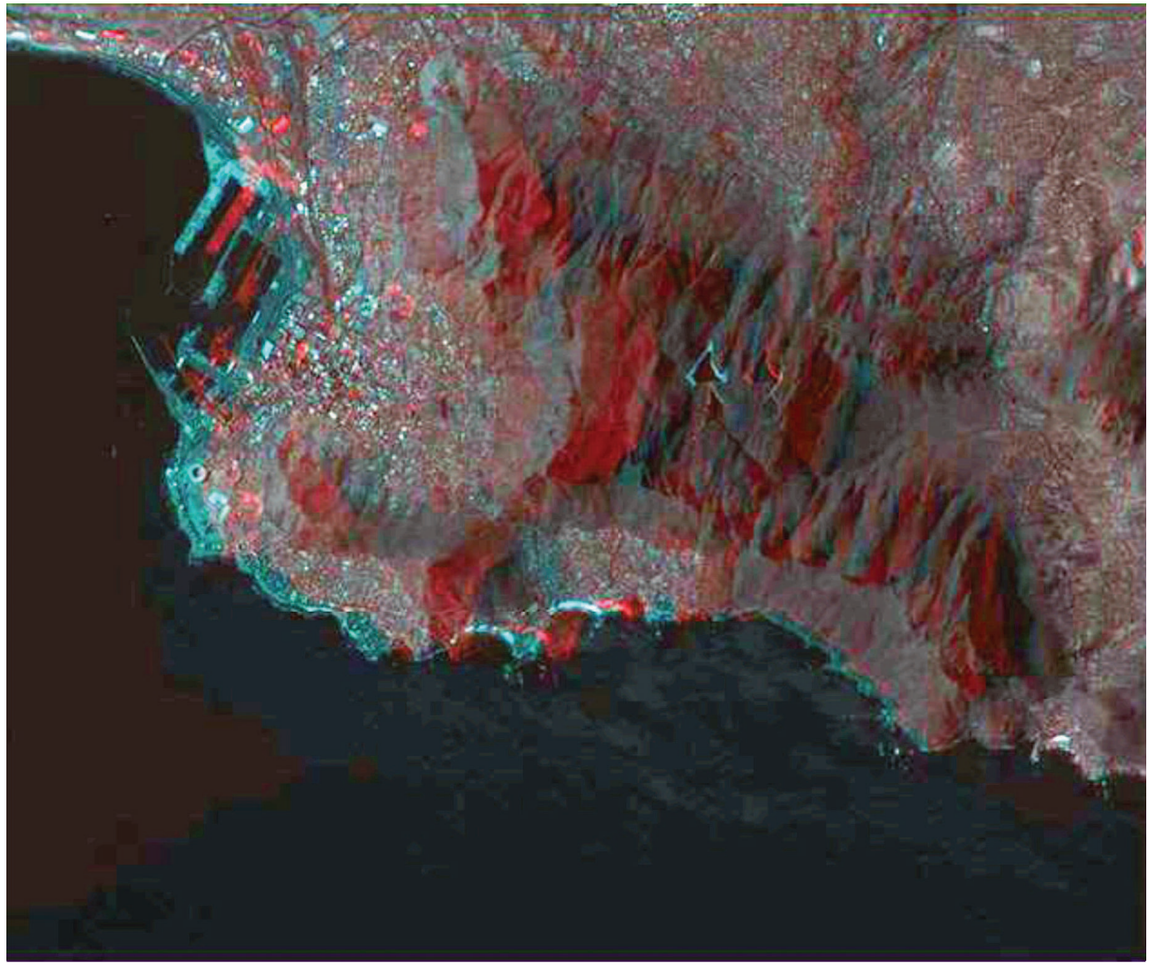


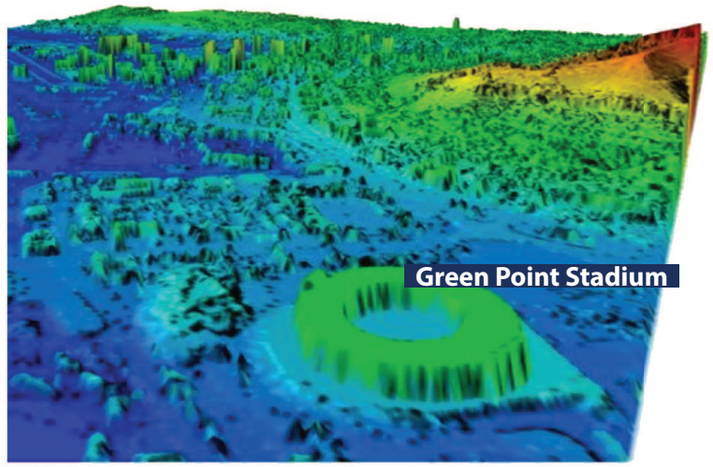




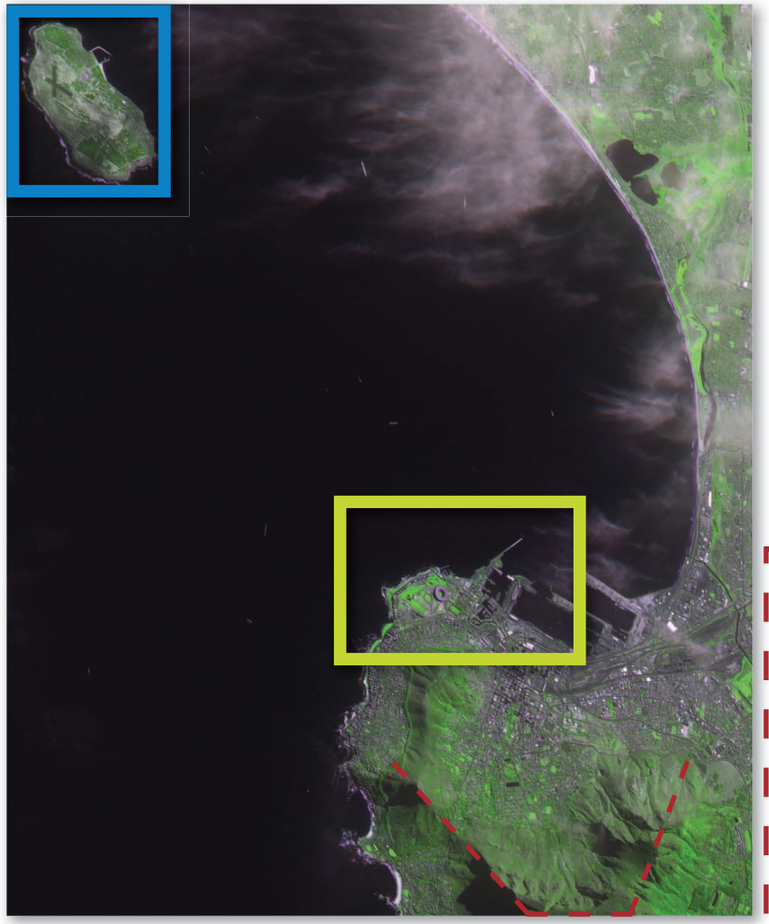
Urban planning

Stereo optical image of Cape Town



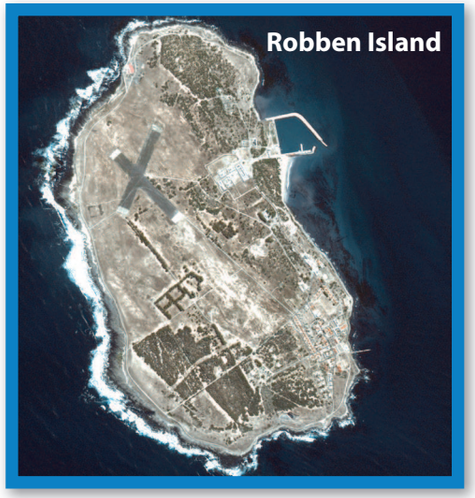


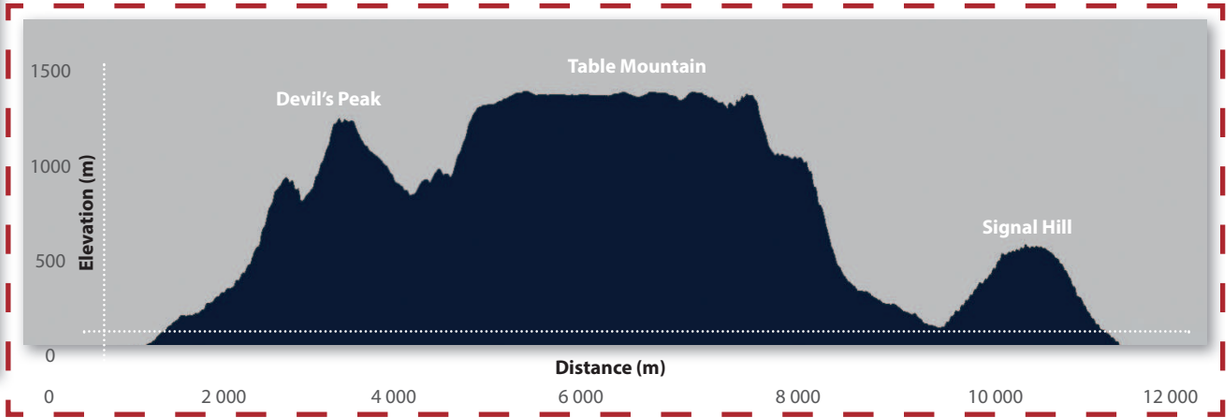
Stereo optical imaging is a technique that displays images in three dimensions (3D). It is increasingly becoming an important application in heritage preservation, archaeology, urban planning and city development. In remote sensing, 3D images are created by taking satellite images of the same area from different angles and fusing them to create an anaglyph. *To view the images in three dimensions, 3D anaglyph glasses are used.*



Cape Town and Robben Island as seen from a SumbandilaSat Image

Green Point Stadium and the Waterfront.

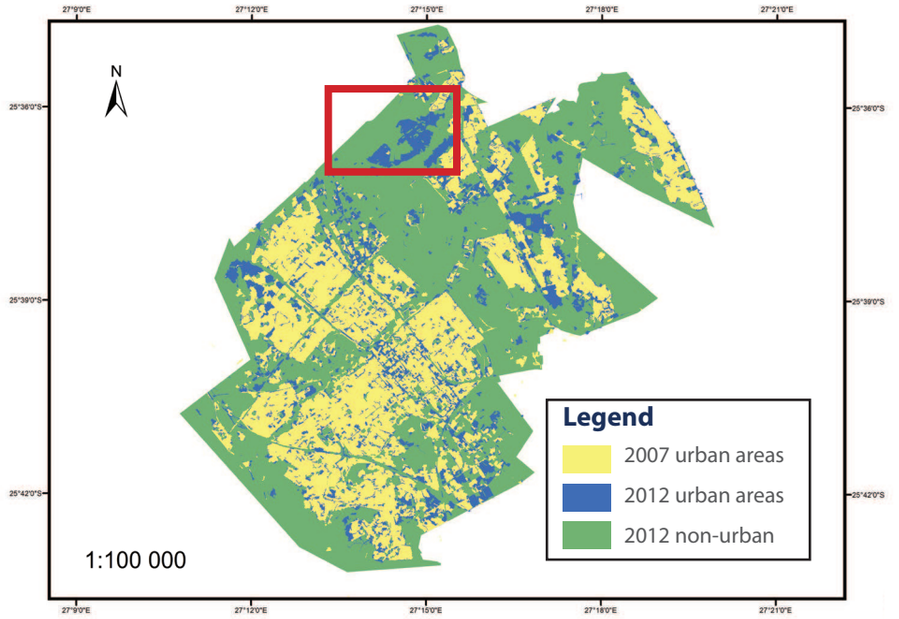




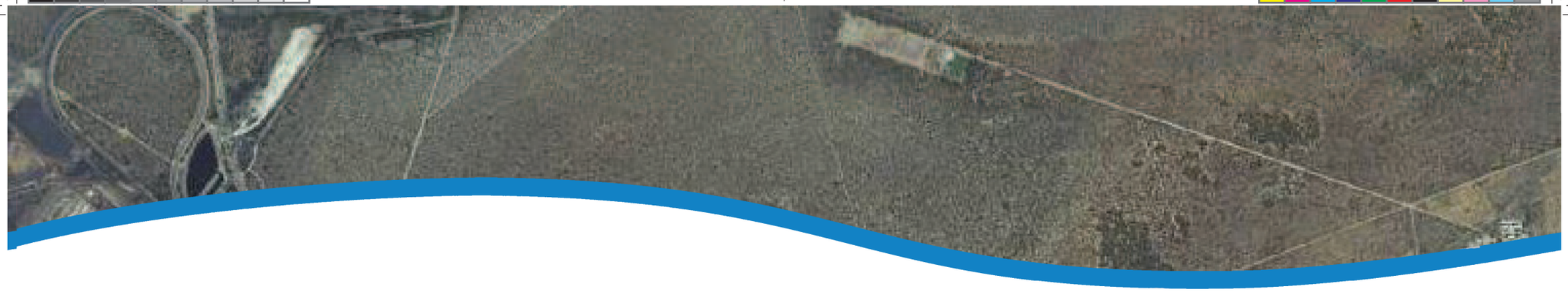
Cross section profile of Table Mountain, Devil's Peak and Signal Hill

Urban development

Rustenburg spatial urban growth



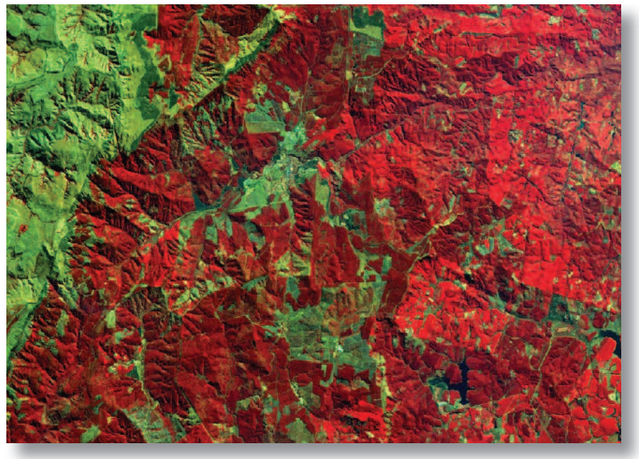
Satellite images are significant in monitoring urban development. This application involves the acquisition of satellite images of the same area at different periods. Continuous acquisition at different time intervals ultimately builds a time series database of the area. The images are then interpreted to identify changes, in this case development in building structures. Such an application is critical to advance and support government and environmental programmes such as social upliftment and climate change, and monitoring service-delivery projects, such as the constriction of low-cost housing.



Acquiring imagery of the same area over time provides us with data required to study changes in human settlements. Some of the changes that we can observe currently are settlement expansion (informal and formal), decline or conversion of informal into a township and development of new informal settlements. SANSA and the National Department of Human Settlement have conducted informal settlement change detection between 2006 and 2011. The results show that even though there were a number of informal settlements that were upgraded (in-situ or relocation), new informal settlement developments and expansion were observed during this period.

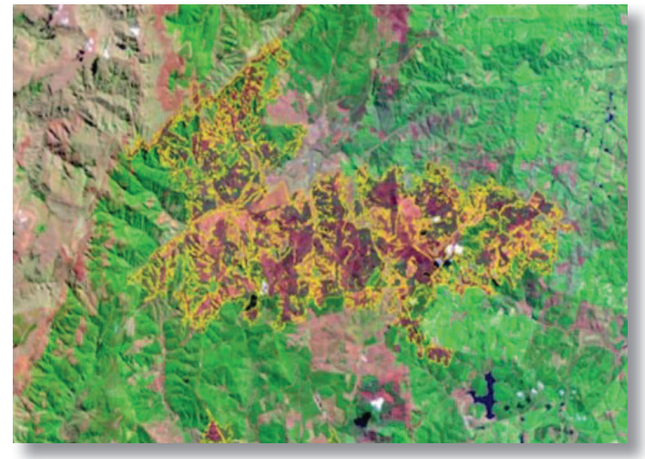
The Union Buildings are in Pretoria on the Meintjieskop hill overlooking the suburb of Arcadia. The buildings have an important significance to South Africa, as a result it is a national heritage site. The offices of the president are housed in the Union Buildings.

Burnt scar mapping



Before the fire

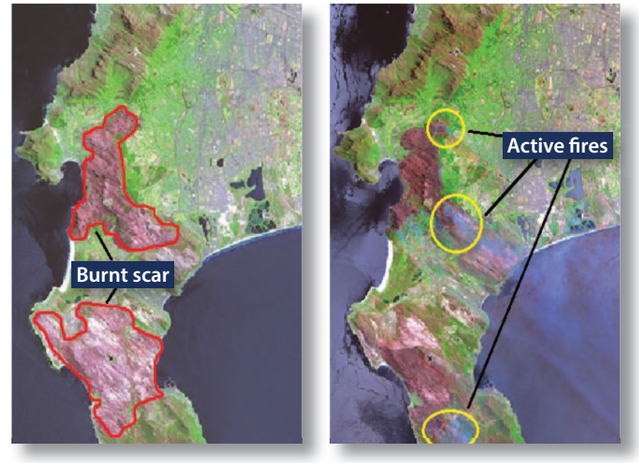
During the fire



After the fire

Natural disasters are devastating events that result from natural processes of the Earth. Remote sensing has the capability to map and monitor the impact of catastrophic events such as landslides, volcanic eruptions and veld fires. With the use of satellite imaging, different views of the affected areas before, during and after the fire can be acquired. Such information provides a different yet valuable perspective of the disaster-affected area. The LandSat 8 images above and the MODIS images on the right show veld fires in the Western Cape. The fires were captured while still actively burning on the ground and subsequently the satellites captured the burnt scars during their next overpass.

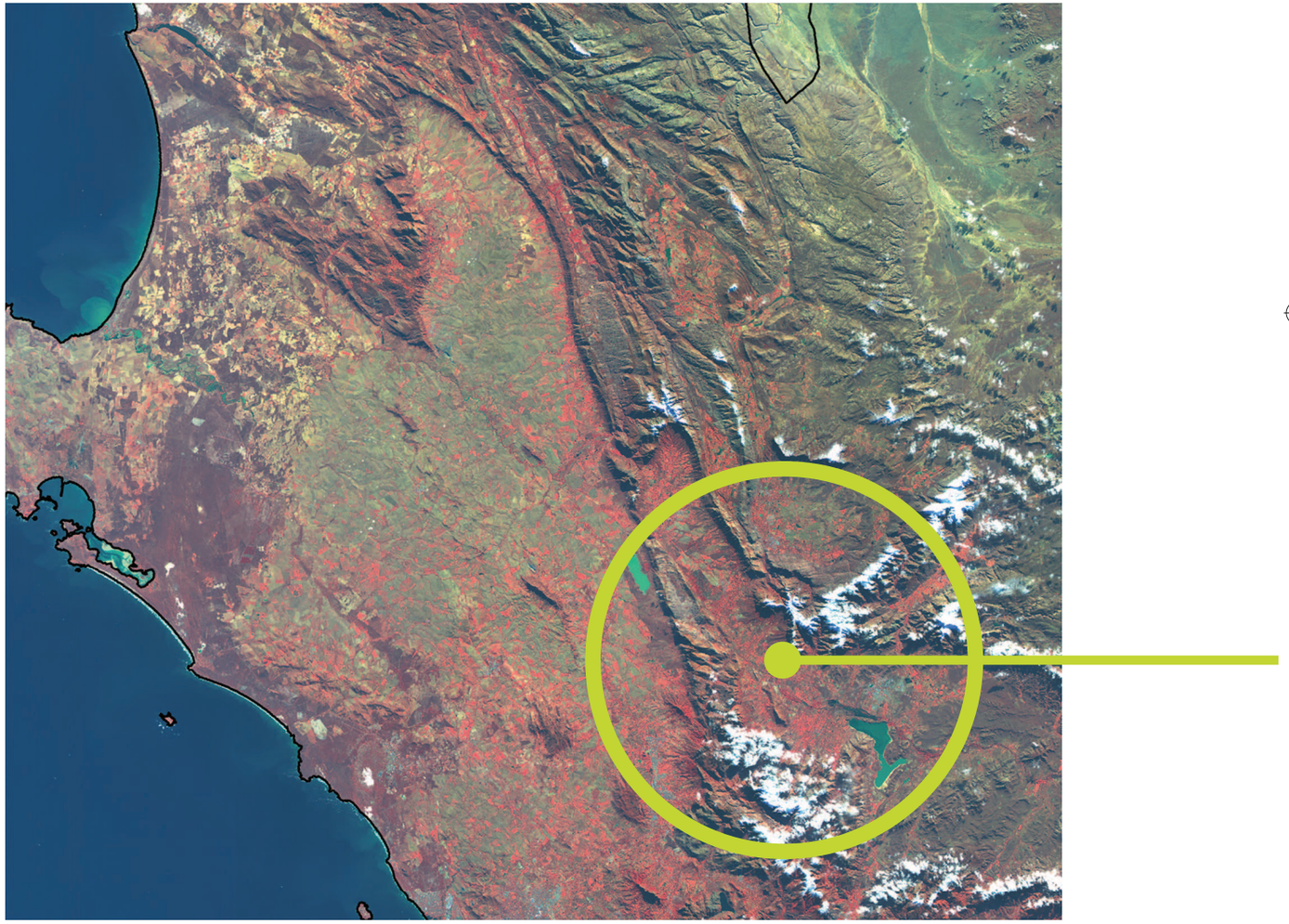
Remote sensing offers the **ability to monitor** the impact of **disastrous events** such as veld fires



Snow mapping

Satellite images serve as a vital source of information to understand and investigate different weather phenomena. As the climate changes, historical satellite images are analysed to better understand how weather conditions have changed over the years. This helps to understand weather dynamics that contribute to changes in climatic conditions making it possible to predict and monitor catastrophic events related to climate change such as droughts, floods and snow.

Satellite images serve as a vital source of **information** to **understand** different **weather phenomena**.



Right: Snow covers the mountain ranges at Ceres in the Western Cape as captured by LandSat 8 on the 9th of June 2013.