The use of computer sciences

Satellite imagery and Geographic Information Systems for evidence-based policy and decision making

in modern-day environmental compliance and enforcement?

Dr Naledzani Mudau

10th Environmental Compliance and Enforcement Lekgotla
Drakensberg, KwaZulu-Natal
18 November 2024

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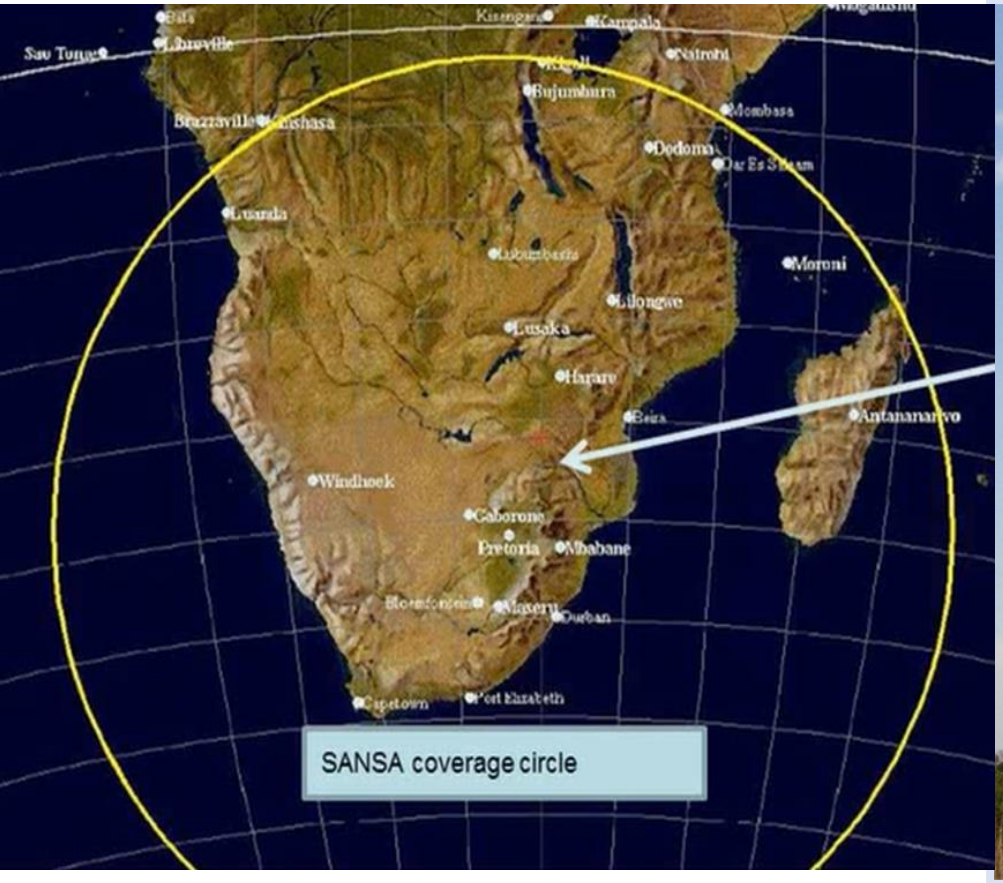
Act No. 36, 2008, SOUTH AFRICAN NATIONAL SPACE AGENCY ACT

To provide for the promotion and use of space and co-operation in space-related activities, foster research in space science, advance scientific engineering through human capital, support the creation of an environment conducive to industrial development in space technologies within the framework of national government policy, and for that purpose to establish the South African National Space Agency; to provide for the objects and functions of the South African National Space Agency and for the manner in which it must be managed and governed; and to provide for matters connected therewith.

Functions of Agency 5. (1) The Agency must—

(d) acquire, assimilate and disseminate space satellite imagery for any organ of state

Satellite imagery acquisition



Low Earth Orbit satellite

Processing and storage

Currently directly receiving

Landsat 8,9 CBERS 04, 4A, MODIS; Aqua and Terra

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Access to archive satellite imagery

SENSOR	SPATIAL RESOLUTION	COVERAGE	DATE OF ACQUISITION
Landsat: MSS,TM, ETM, 7,8, 9	15m-100m	Southern Africa	1972 - current day
SPOT1, 2, 4,5,6,7	1.5m-20m	Southern Africa	1994 – 2017
CBERS-04A	2m Pan, 8m MS	SADC	August 2023-current
CBERS 2B, 4	10m Pan, 5m Pan, 10m MS, 64m WIF	SADC(except, Mauritius, DRC, Madagascar and Seychelles)	2008 -current
MODIS, AQUA & TERRA	250m,500m, 1km	Africa	2000 - current day
RADARSAT 2	Multiple	Global	April2018 – early 2021
NOAA AVHRR	1.1km	Africa	1984
SAC-C	175MS	Global	2008 - 2009
RADARSAT 2	Multiple	Global	April2018 – early 2021
Sumbandilasat	6.25m	Global	2009 to 2011

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The map illustrates a bridge that has been washed away on the N2 road in Bot River area, Western cape, South Africa. The NewSat satellite imagery showing the aftermath of the floods was acquired on the 01 October 2023 and before the flood imagery Landsat9 acquired on the 26 April 2023.

Legend

- Affected area

0 90 180 360 540 720
Meters

N

Monitoring of agricultural activities- planted, expected yield

Synthetic Aperture Radar (SAR)

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Acquisition of very high spatial resolution

Human activities?
Impact of human activities?
Environmental conditions?

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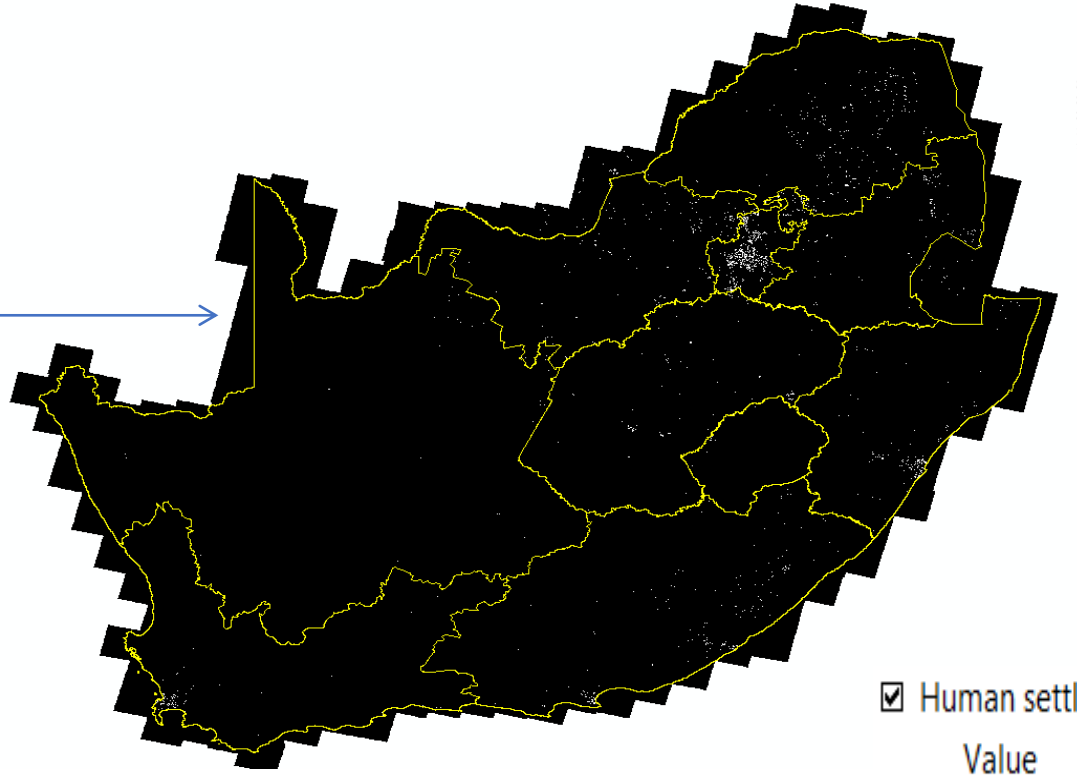
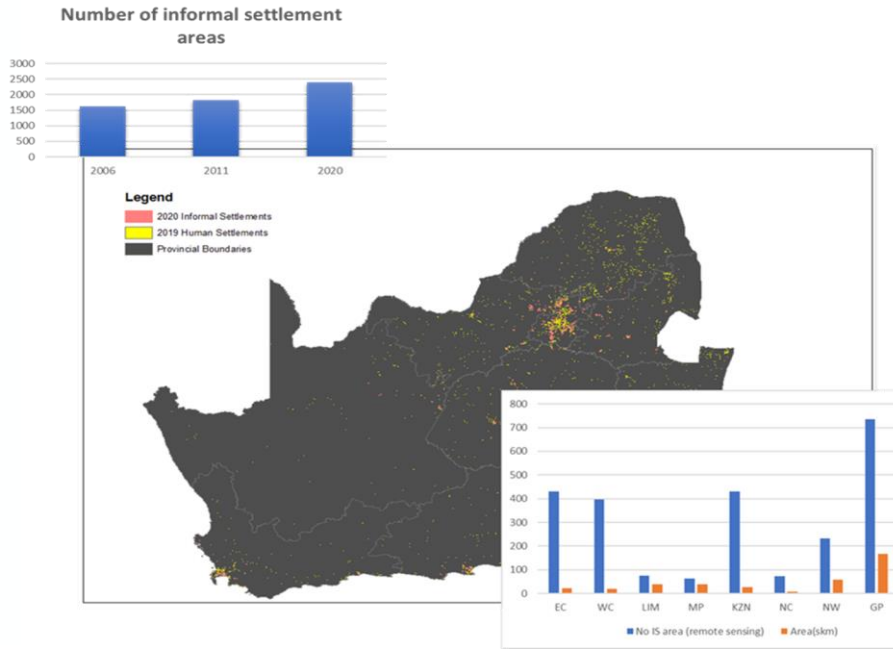
MAXAR
MAXAR

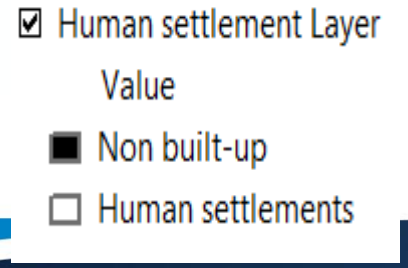
Understanding Human Settlement Development

National Human Settlement Layer

National mosaic







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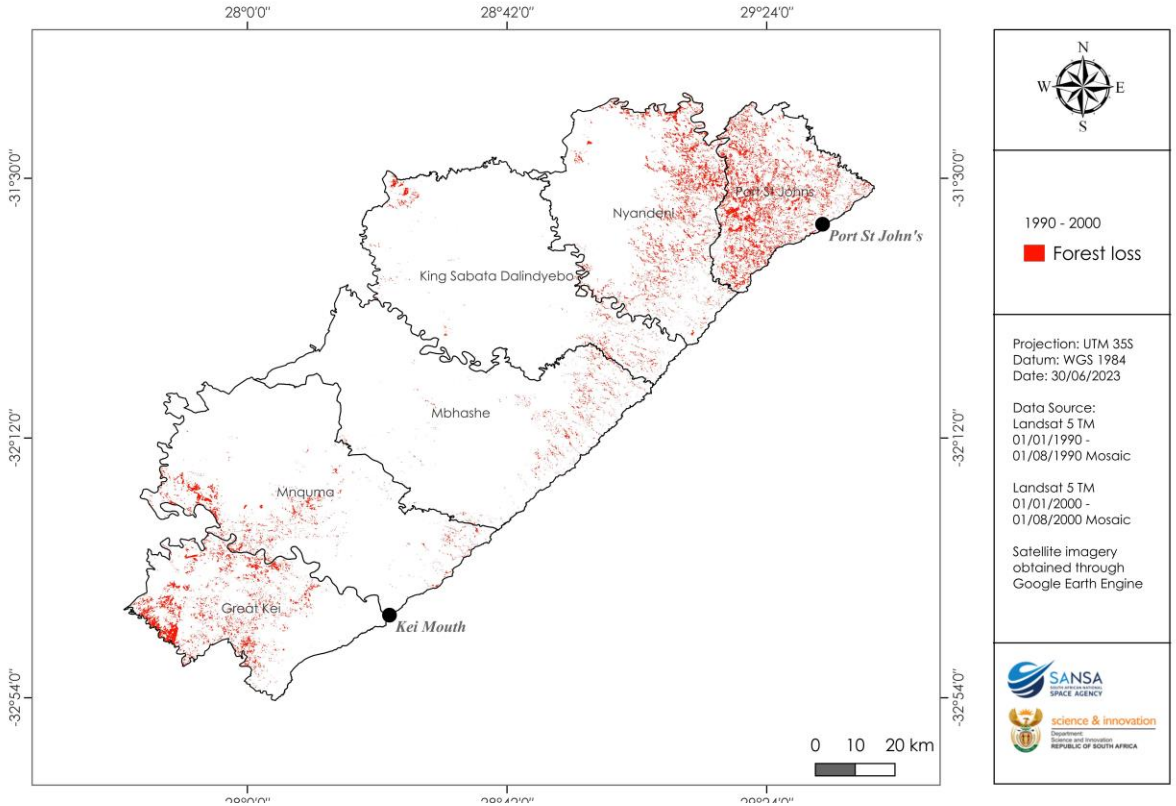
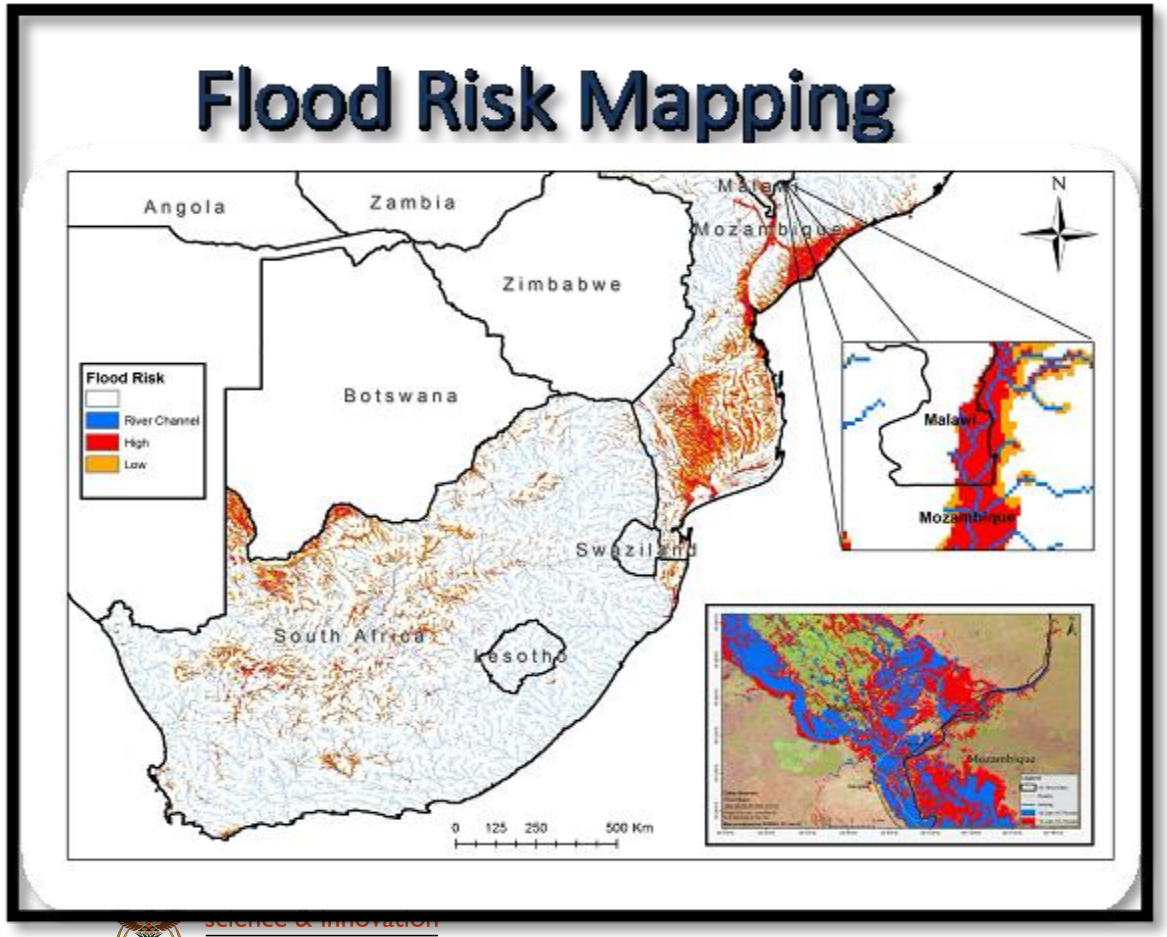
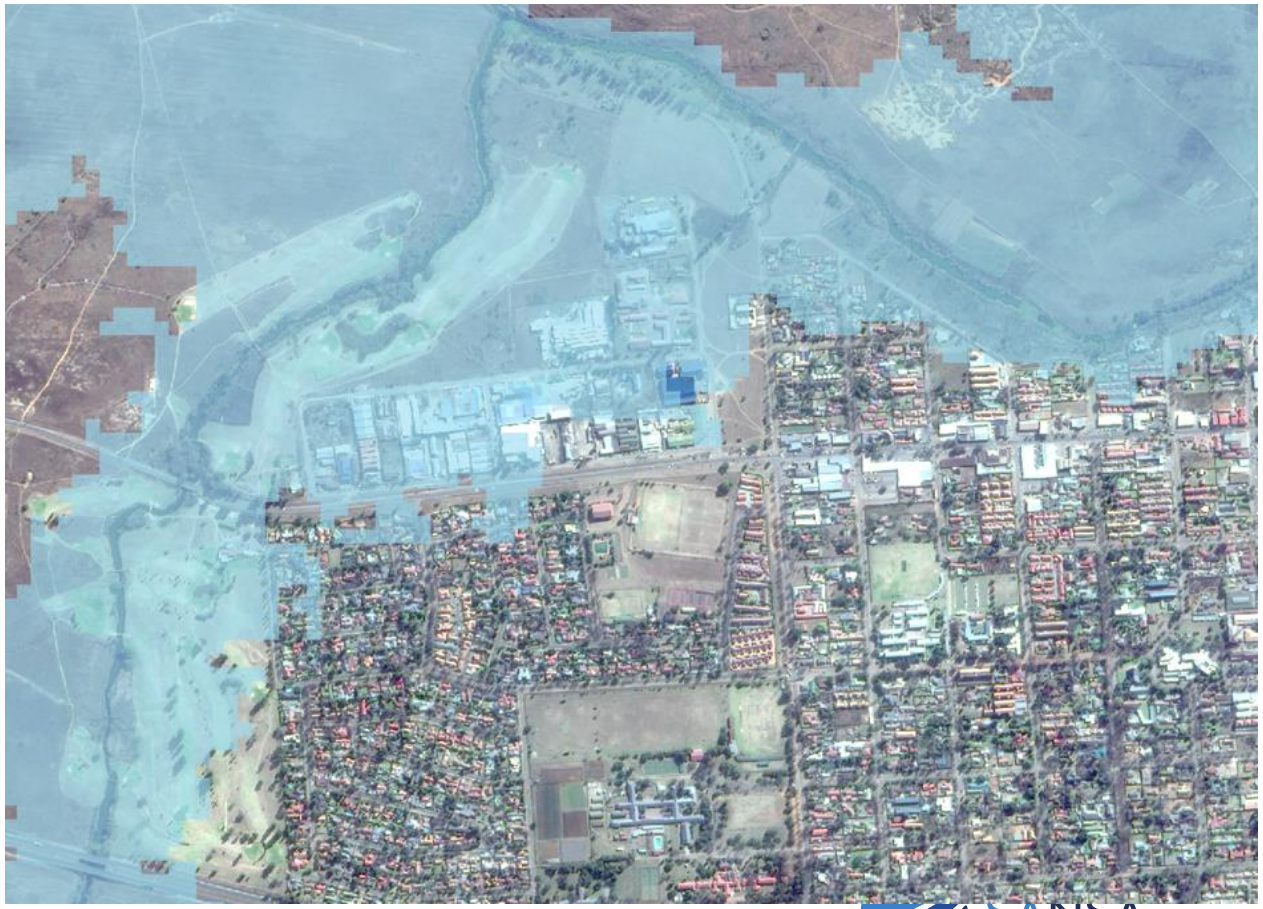
Deforestation, Biodiversity loss



Disaster management

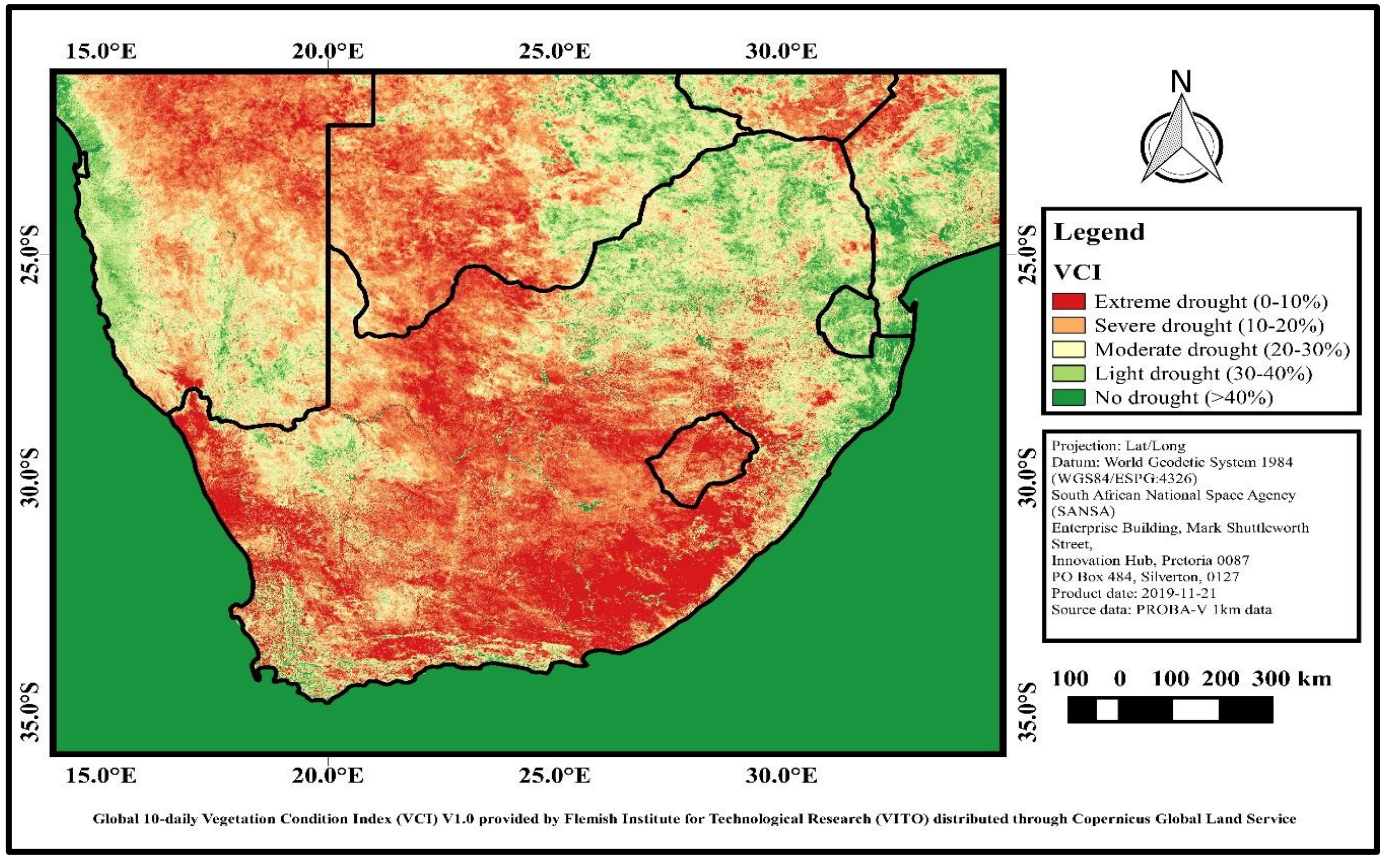
Flood disaster management





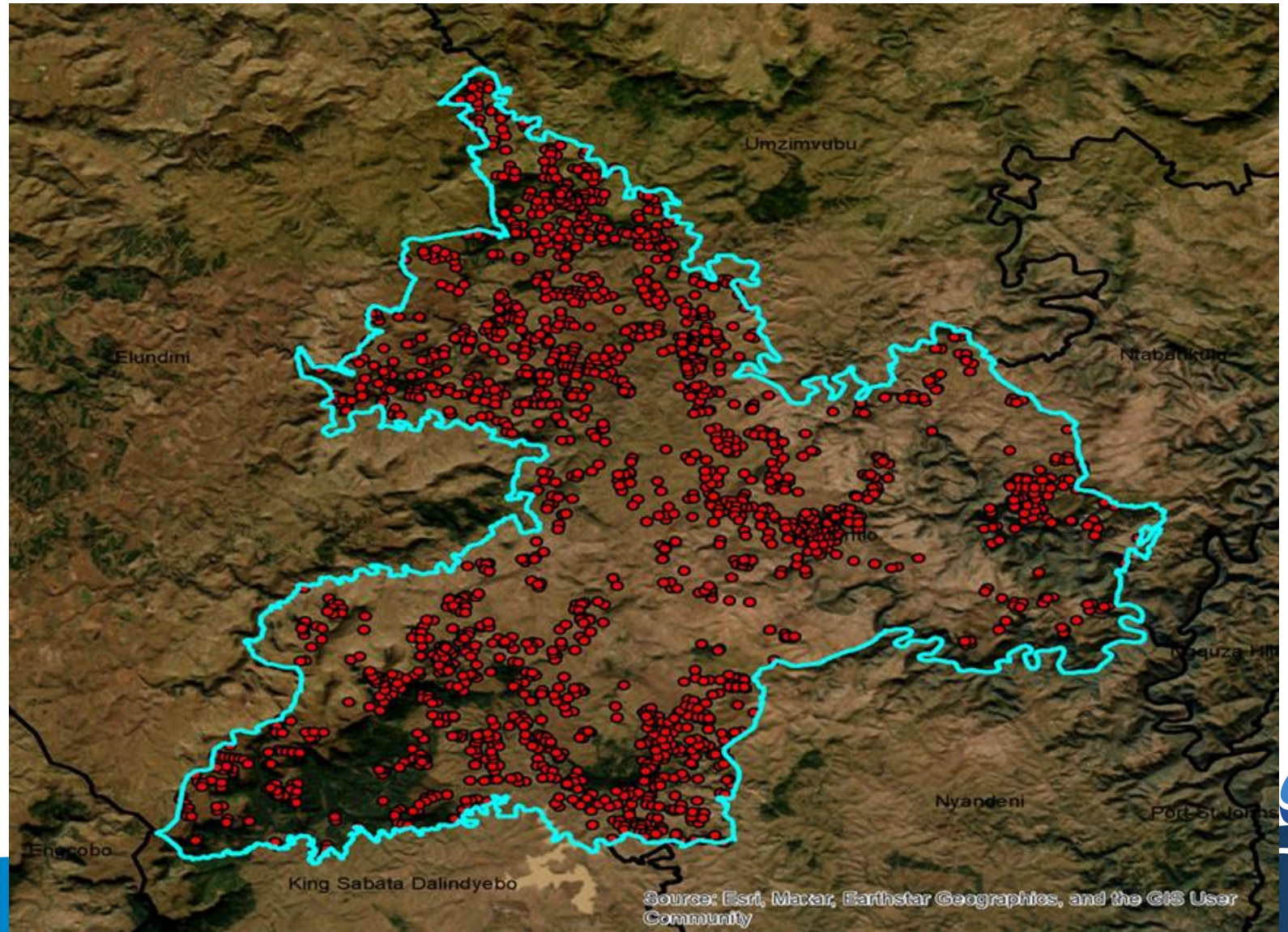
Disaster management

Vegetation condition Assessment

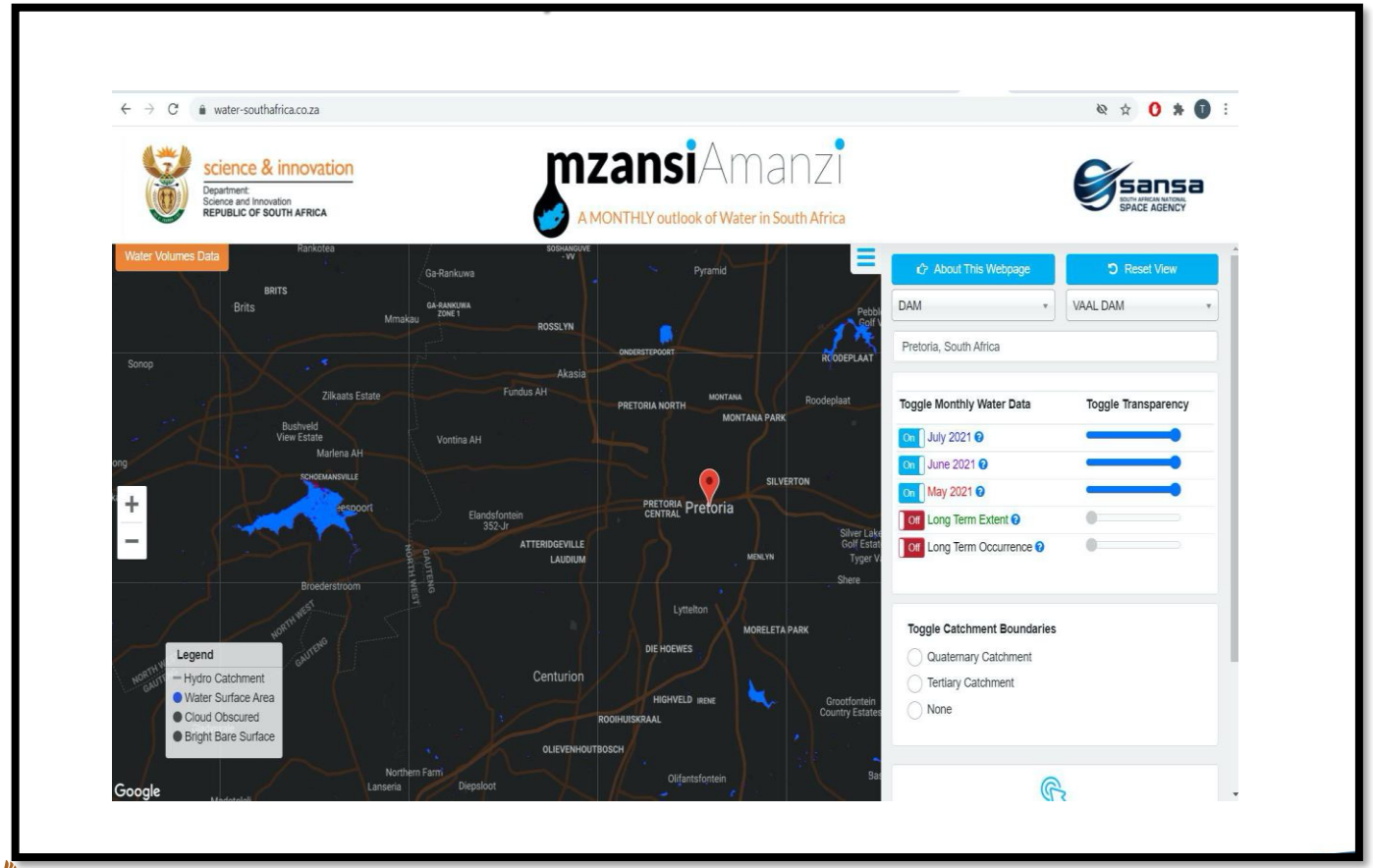


Disaster management

Fire occurrence analysis



Water Resource management

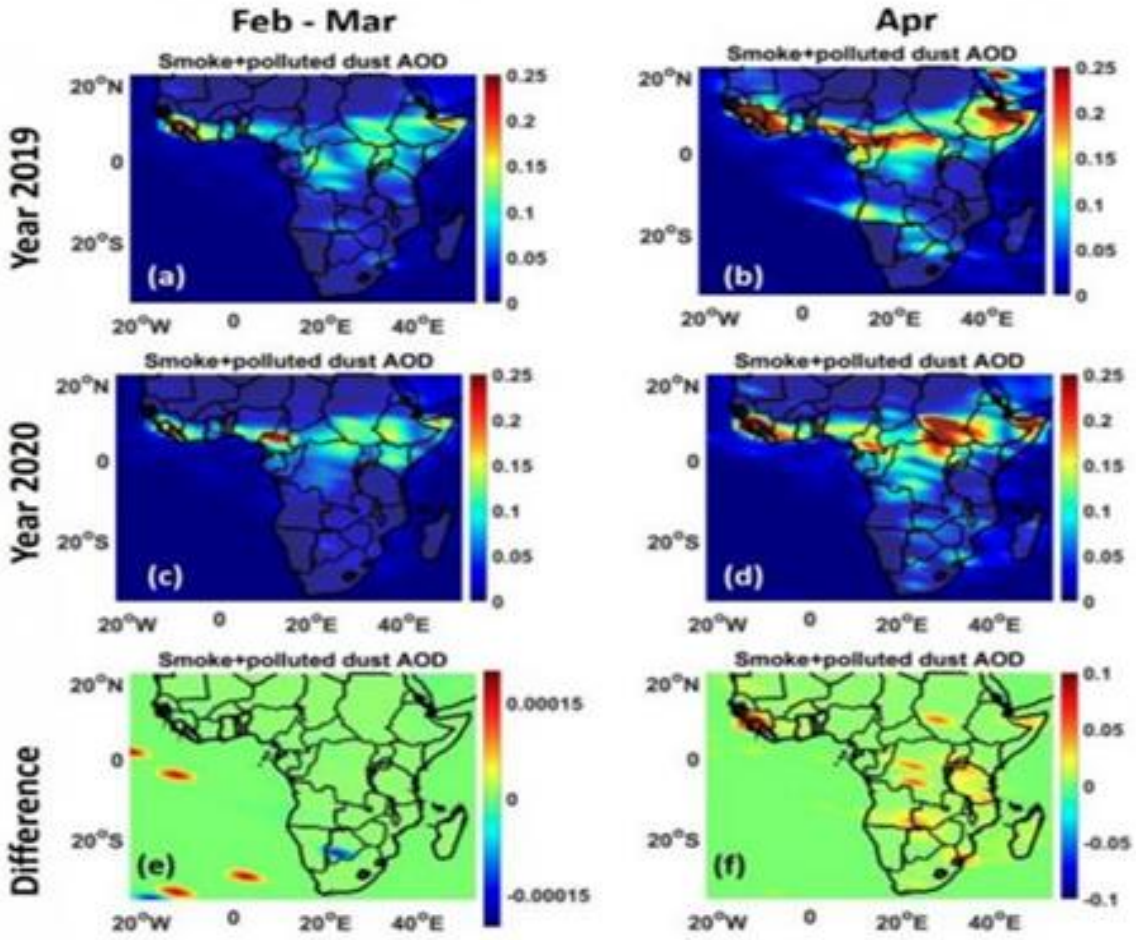


To assist with the management of hydrological drought:

Monthly Assessment of:

- extent
- volume

Air Quality and Green House Emission



- Assessment of air particles that may affect human health
- Emission enforcement
- Monitoring of adaptation efforts

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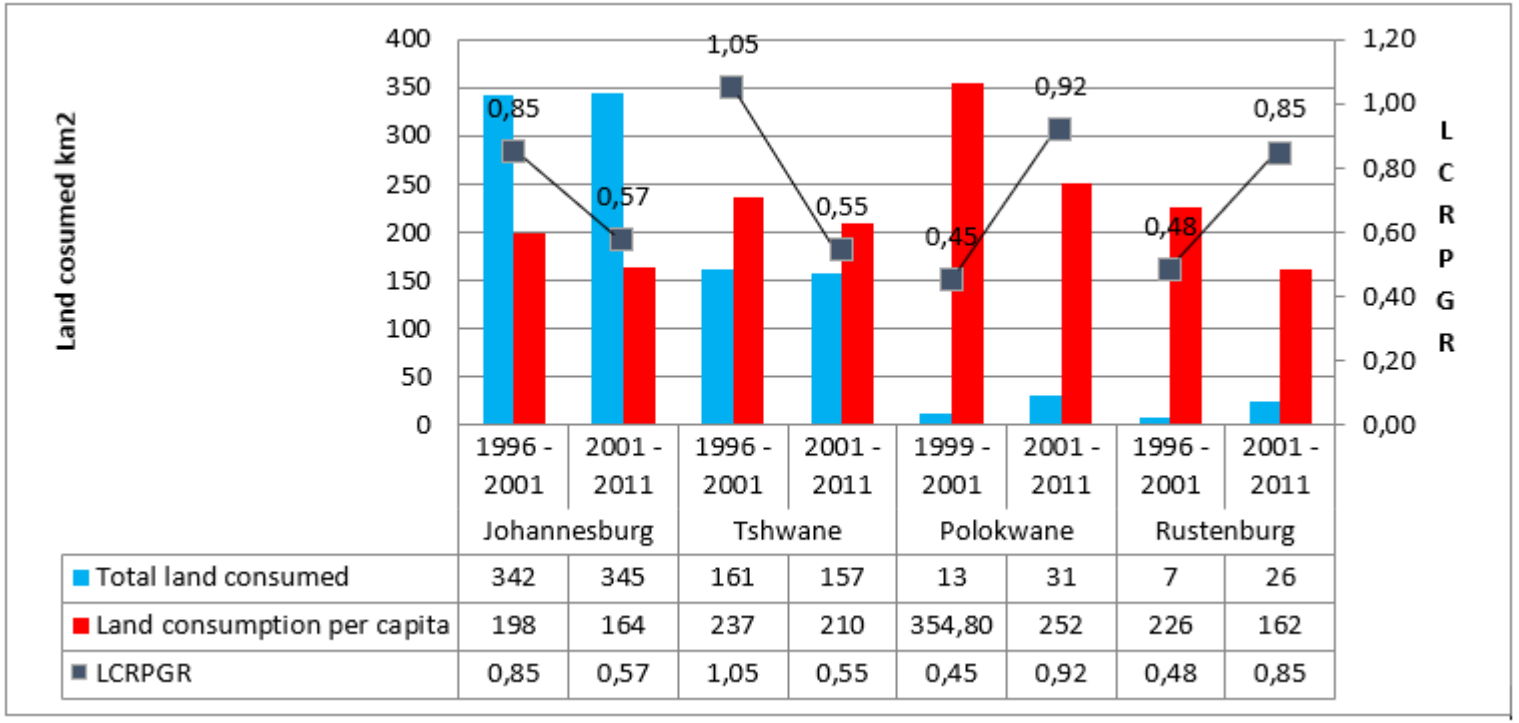
Plume of CO2 detected from a coal-fired power plant in Kendal, South Africa on September 19, 2024. Carbon Mapper's preliminary estimate of the emission rate is 600,000 kg CO2 /h. Planet Basemap courtesy of Planet Labs.

Using Earth observation data for reporting

SDG Indicator 11.3.1: Ratio of Land Consumption rate to Population Growth Rate (LCRPGR)

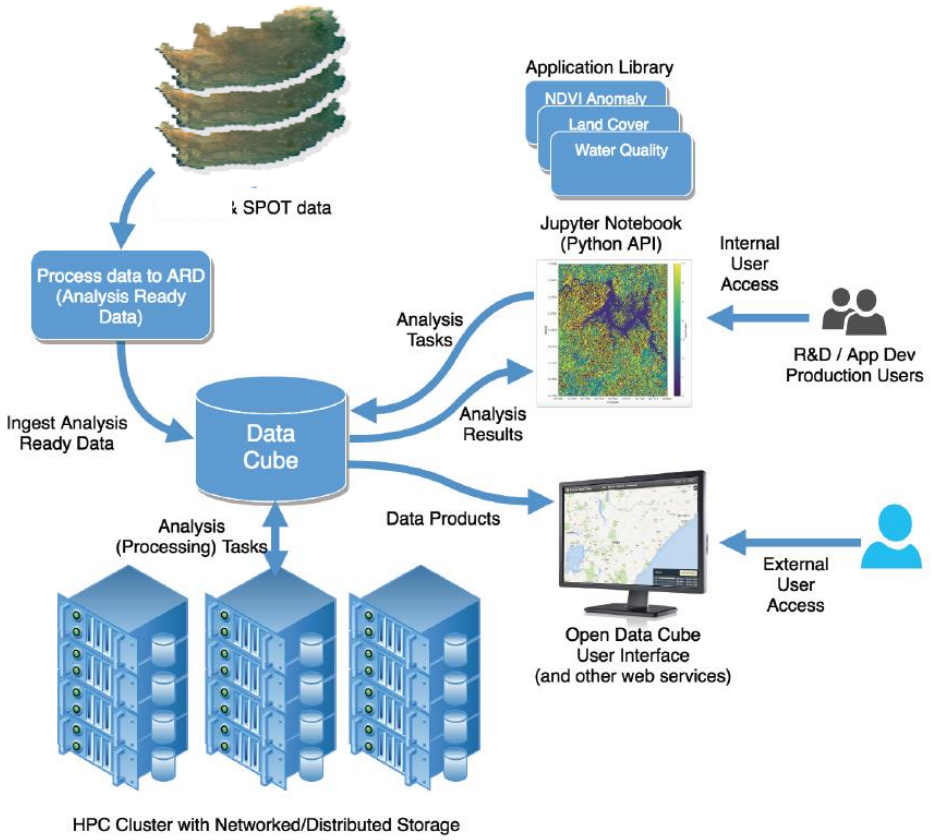


	1996 - 2001	2001 - 2011	1996 - 2001	2001 - 2011	1999 - 2001	2001 - 2011	1996 - 2001	2001 - 2011
	Johannesburg		Tshwane		Polokwane		Rustenburg	
Total land consumed	342	345	161	157	13	31	7	26
Land consumption per capita	198	164	237	210	354,80	252	226	162
LCRPGR	0,85	0,57	1,05	0,55	0,45	0,92	0,48	0,85

Ratio of LCRPGR of four major and smaller cities in South Africa

South African Datacube

- High spatial resolution data cube
- SPOT 5,6 & 7: 2006 – 2017
- Open to government, research and academia
- Access by private through a partnership framework
- Products free for non-commercial use



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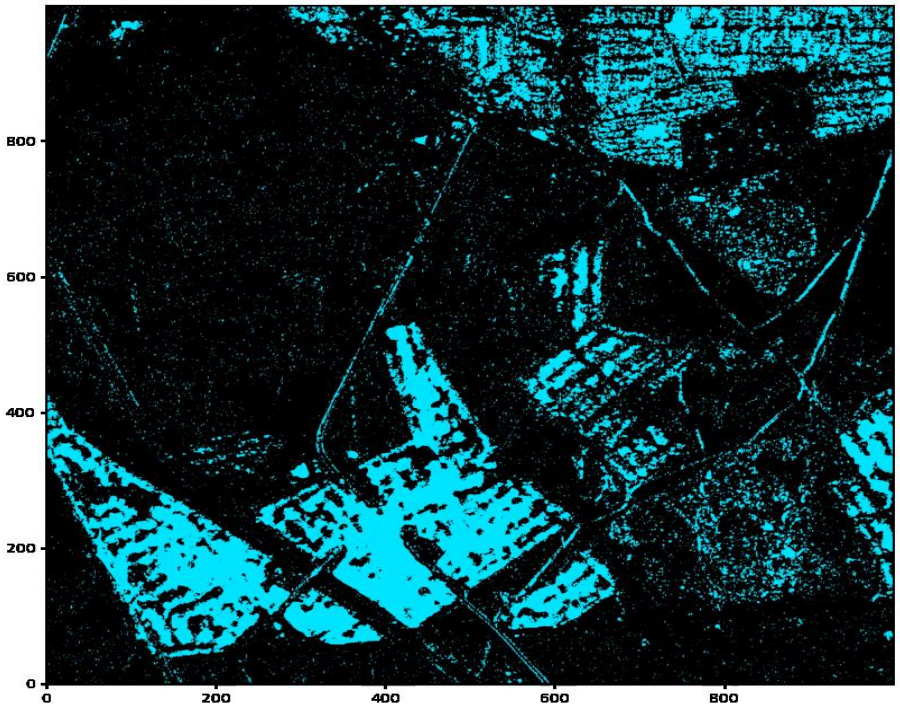
Data cube: Urban Change Detection

- **We used SPOT 6 & 7 datasets to examine the change in urban extent between a baseline period and a more recent period.**
- **Location of urban growth between the two periods is highlighted on a map**



Urban Change

Jan 2016 to July 2017

Thank you

Ngiyabonga

Ndi a livhuwa

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