BIOSCAPE

Biodiversity Survey of the Cape

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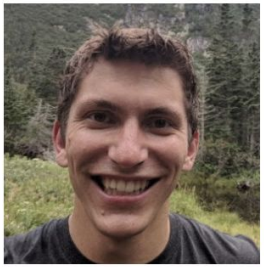

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1. Context: Why BioSCape Applications?




BIOSCAPE
Biodiversity Survey of the Cape

(https://www.bioscape.io/story)



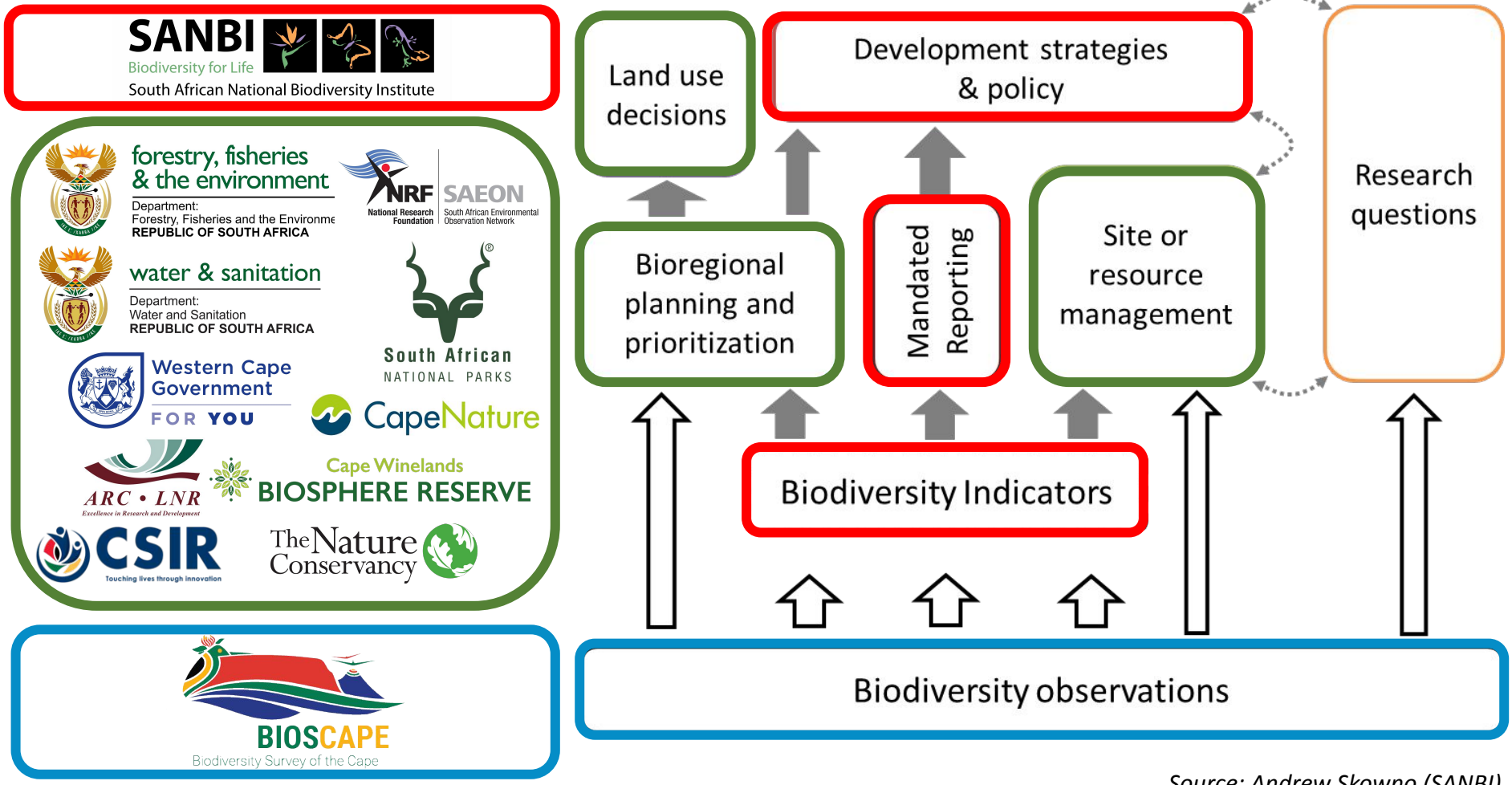









- Applications is **unusual** in airborne/field campaign;
- Aware of **parachute** science;
- **User-inspired** research;
- **Single time point data** = 'Proof of concept'

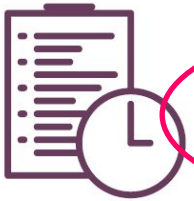


Source: Andrew Skowno (SANBI)

BRIDGING THE GAP BETWEEN RESEARCH AND PRACTICE: Key messages from researchers & practitioners (Shackleton et al. 2022)

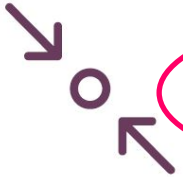
1. Understand the landscape / seascape **context**

2. Engage with **existing** living landscape **platforms, networks and groupings** – e.g. CFR Partnership, FynbosForum, Upper Breede Collaborative Extension Group (UBCEG), EFTEON, Boland-Groot Winterhoek Collective, Berg-Breede COP.

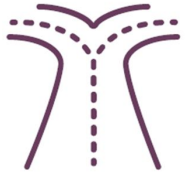


3. **Co-develop** research agendas and plans

4. **Formalise and fund** engaged scholarship



5. Create **neutral third spaces** for engagement and collaboration



6. Explore **new ways of partnering**

7. **Communicate** research findings **to enhance use**

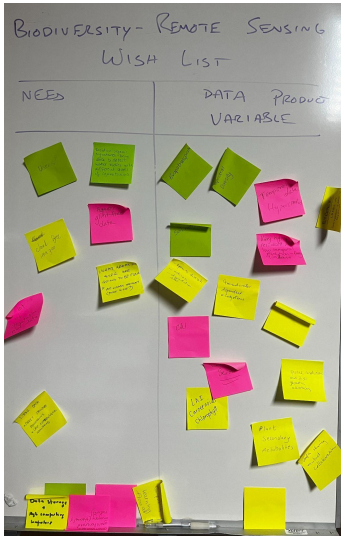
Website: https://sites.google.com/view/berg-breede/resources

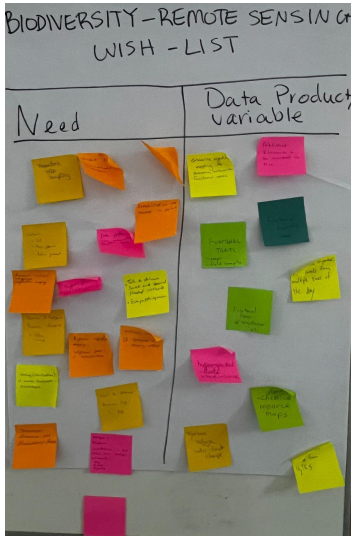
2. Stakeholder engagement: BioSCape Applications Workshop (22-26 May 2023)

'neutral third spaces for engagement' (Shackleton et al. 2022) = 5-day workshop for BioSCape Science Team + practitioners (end-users and boundary agencies); networking, cementing collaborations, enhancing goodwill, capacity building (esp. ECRs), **discussing science applications needs**.

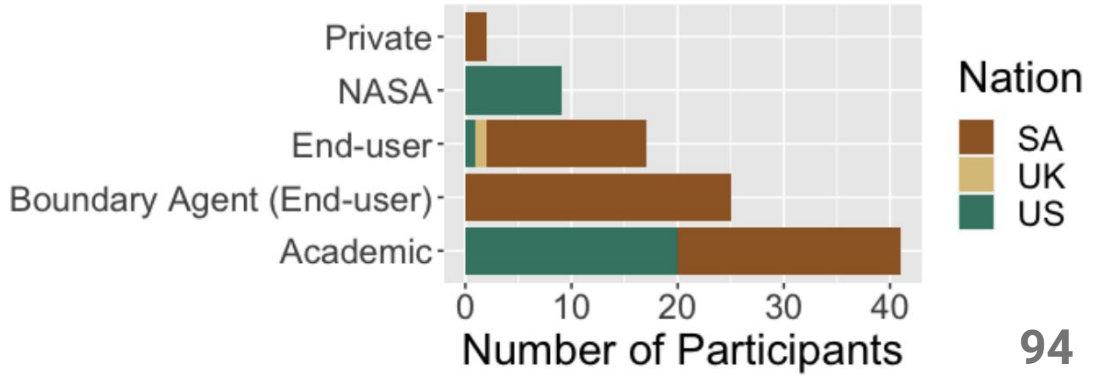
2.1. Remote Sensing of biodiversity **"Wishlist"**: What are your applied research needs and desired data products/variables?

Managing expectations and creating space to share our **hopes and dreams**! BioSCape as a **springboard** for the future (funding, collaborations, etc.)... thus exciting **cross-project collaborations** have emerged: Alien Tree Mapping Working Group + Water Quality collaboration.





2.2. Stakeholder engagement: Value Creation Framework (VCF) (Wenger-Trayner et al. 2020)



94 knowledge holders

SA **practitioners: 40 (43%)**
researchers: 21 (22%)

Dedicated time to reflect on the **"value" (importance, worth, or usefulness)** of RS data in relation to their application needs. **90 min**, 10 survey questions, 10 subject matter focus groups: Agriculture & Food Security, IAPs, Vegetation Monitoring & Disturbance, Land Use, Water Quality, Wetlands & Watersheds, Oceans, Climate Change, Botany & Plant Ecology, Birds & Amphibians

2.2. Stakeholder engagement: Value Creation Framework (VCF) questions / themes

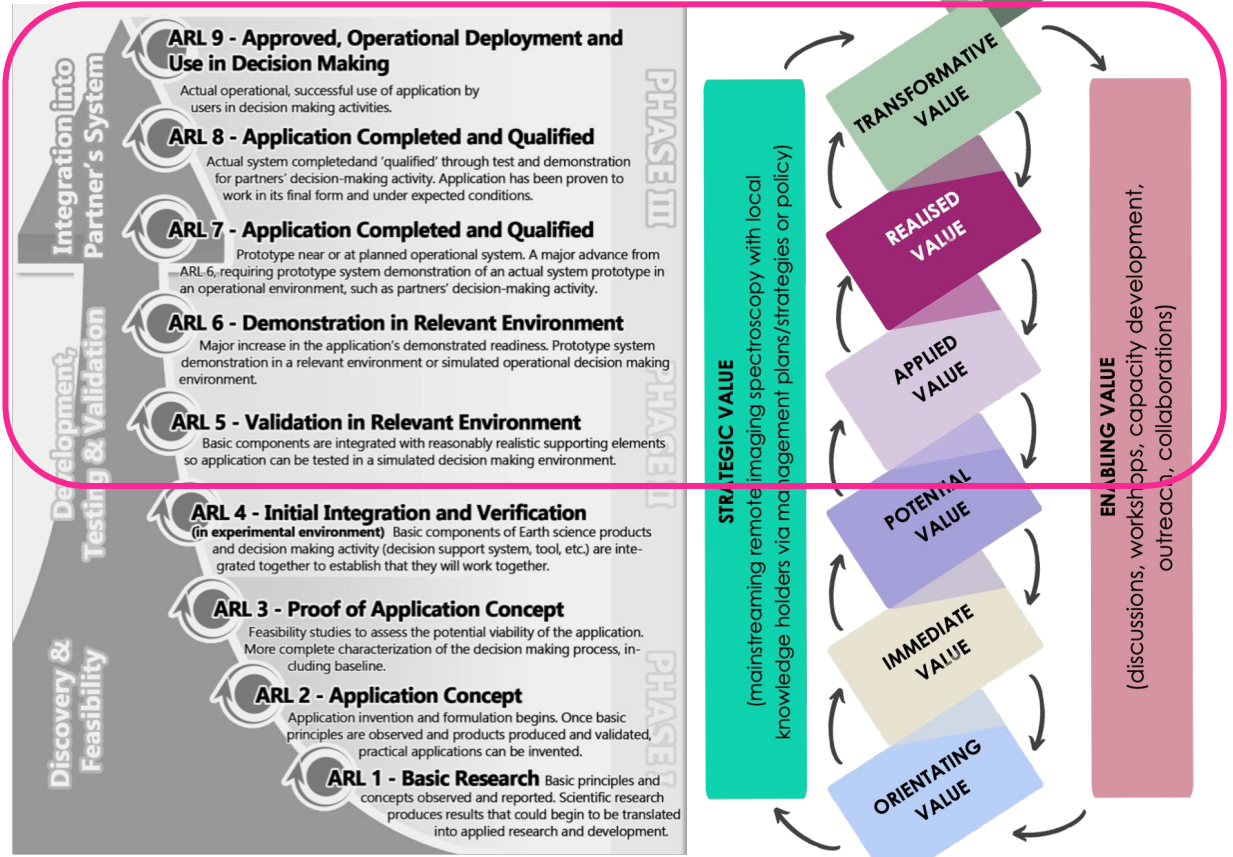
Value Creation Cycle (Theme)	Open ended questions asked of practitioners (Description)
ORIENTATING	What got you involved in your current work?
IMMEDIATE	What is your experience of using biodiversity RS/GIS data in your work?
POTENTIAL	What do you get out of including biodiversity RS/GIS in your work?
APPLIED	How do you apply/use it? (tools, products, reports, etc.)
REALISED	What was the result of using biodiversity RS/GIS in your work?
TRANSFORMATIVE	Did it transform anything, e.g. your view/behaviour? (broader or deeper impact) and did you feed this back to anyone involved in the activity/project/work you do?
STRATEGIC	Was there a significant connection to strategy (management plans/strategy or policy) and conversations with stakeholders?
ENABLING	What were the enablers that made this all possible? (discussions, workshops, capacity development, outreach, collabs, etc.) Do practitioners claim to use "participatory" or "community-based" approaches, including using co-design, management or planning or collaborative agreements?

+ Obstacles = **operational barriers** to using BioSCape-like data products

+ DEI = **diversity, equity and inclusivity,** particularly to promote all dimensions of equity (recognitional, procedural and distributional)

2.3. Stakeholder engagement: Using Value Creation Framework (VCF) to document possible BioSCape applications - **a "baseline assessment" prior to use of BioSCape data products**

Application Readiness Levels (ARLs)

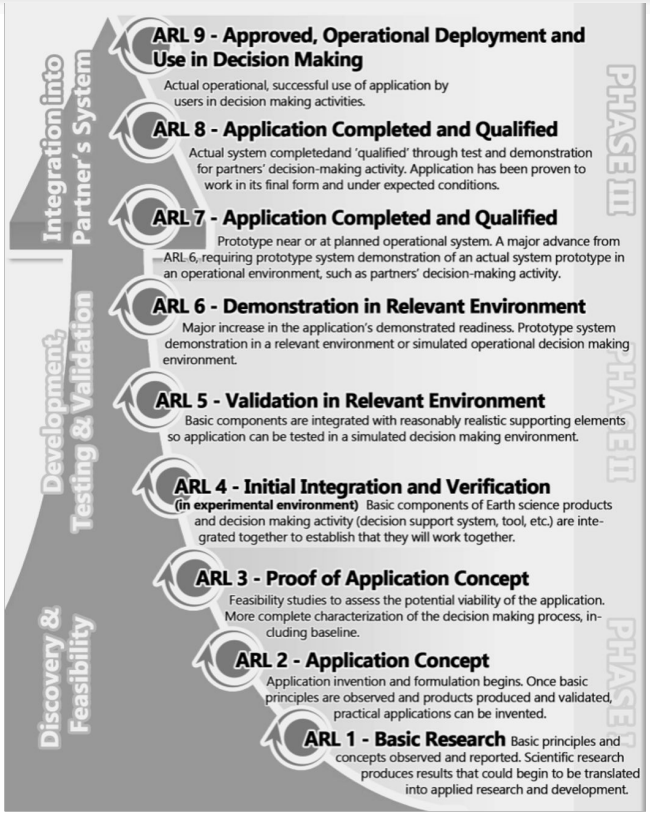


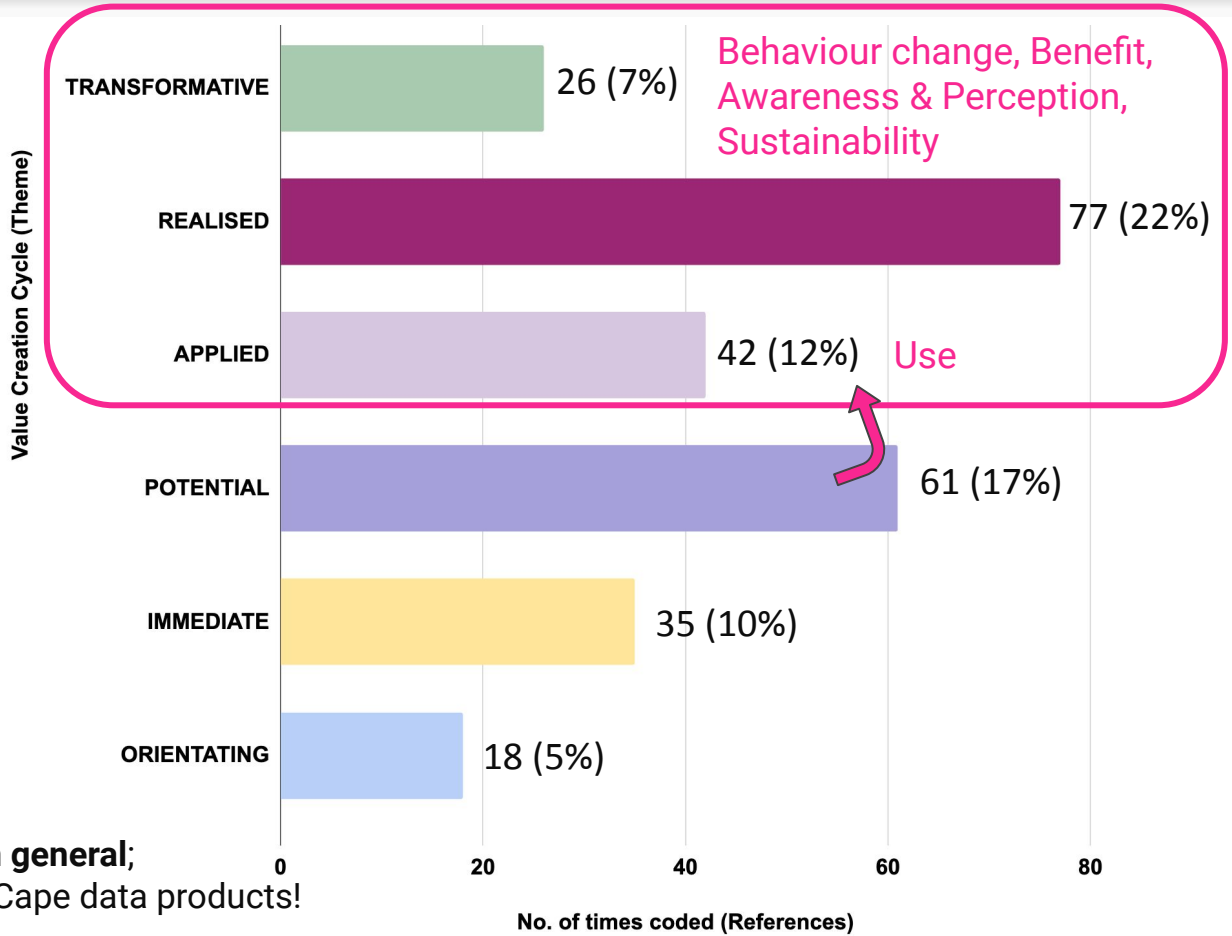
(Wenger-Trayner et al., 2020)

= **integration, operationalization and sustained use** of BioSCape applications-relevant data products.

The power of VCF =
(1) **10 open-ended** reflexive questions, no preconceived ideas, practitioners define what is valuable to them;
(2) Map out **8 value cycles** in relation to the ARLs; identify leverage points or as practitioners apply RS data in decision-making = **"indicators"** for monitoring outcomes/**impact**.

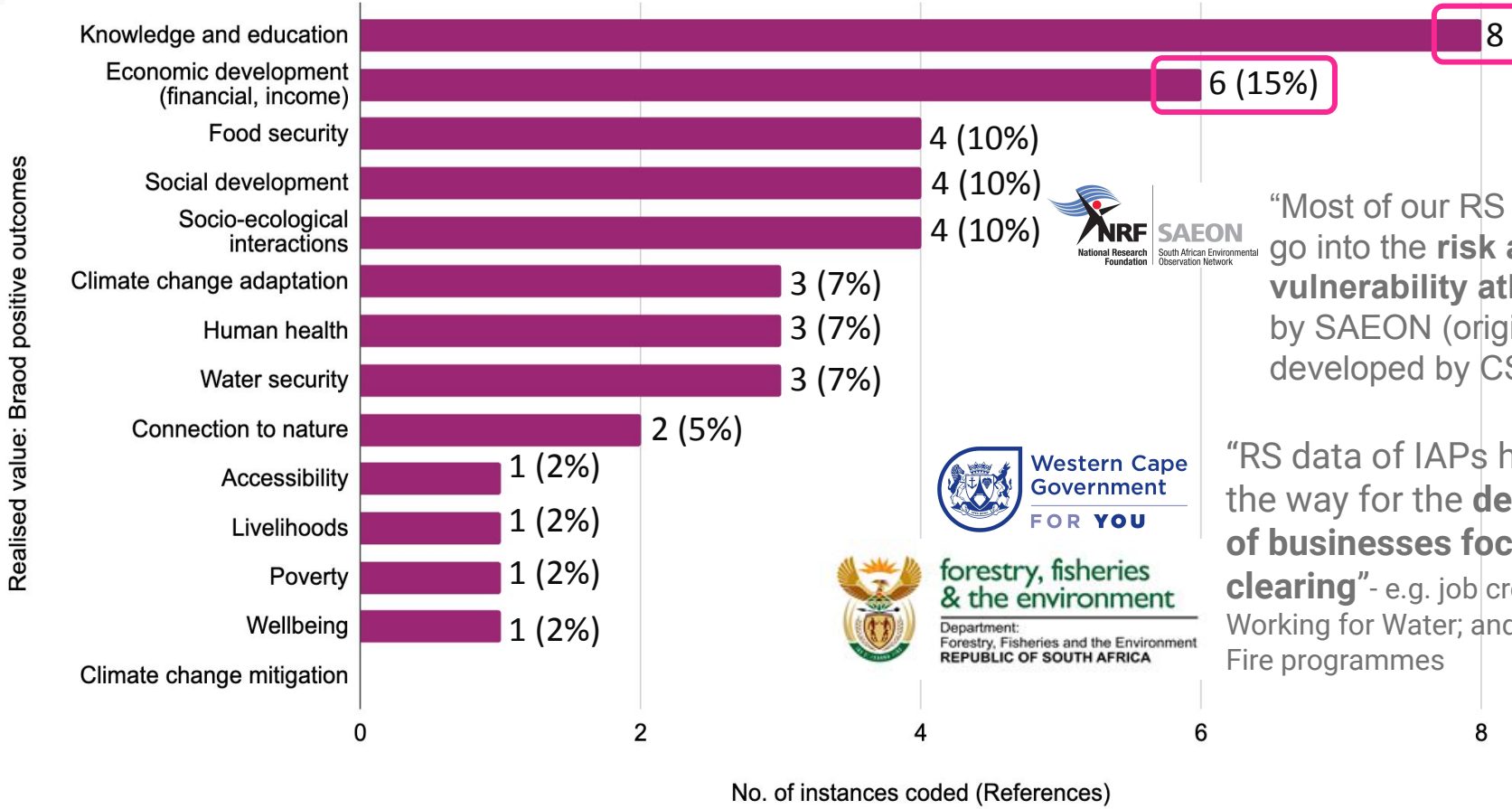
2.4. Preliminary results: Value of RS data in general, as perceived by SA practitioners





NOTE: VCF results on the use of **RS data in general**; **"baseline assessment"** prior to using BioSCape data products!

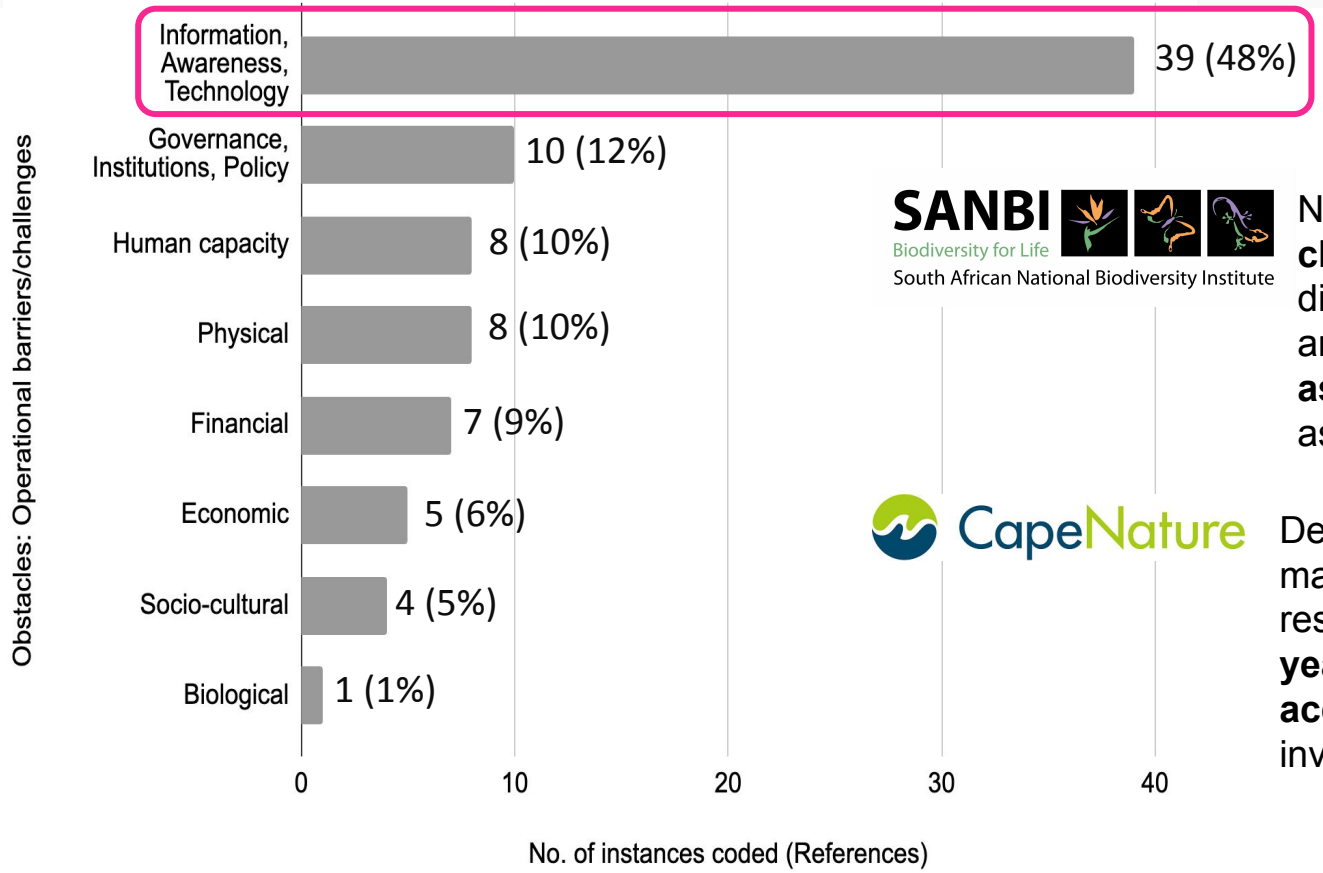
2.5. Preliminary results: Realised value - Positive outcomes of utilizing RS data



"Most of our RS data will soon go into the **risk and vulnerability atlas** managed by SAEON (originally developed by CSIR)."

"RS data of IAPs has paved the way for the **development of businesses focused on clearing**"- e.g. job creation in Working for Water; and Working on Fire programmes

2.6. Preliminary results: Obstacles - Operationalizing RS data sustainably is difficult; need to make sure it is not only a one-time product for a specific application



SANBI
Biodiversity for Life
South African National Biodiversity Institute

National mandated **monitoring channels** for vegetation, distribution, and ecosystem trends are **not meeting end-user assessment goals** due to poor assessment of change.

CapeNature

Despite implementing a method for mapping IAPs since 2010, the resulting data is **only gridded on a yearly basis**, making it **difficult to accurately assess changes** in invasive species over time.

Obstacles: Operationalizing RS data sustainably is difficult; need to make sure it is not only a one-time product for a specific application

South African NATIONAL PARKS

SANParks has made efforts to use drones for remote sensing but their spatial coverage remains limited.

CSIR
Touching lives through innovation

If you take the global surface water explorer product, the SA map actually has 87% more wetlands, and still think they are under estimating by 50 % (based on old aerial photography and ground campaigns)

Western Cape Government
FOR YOU

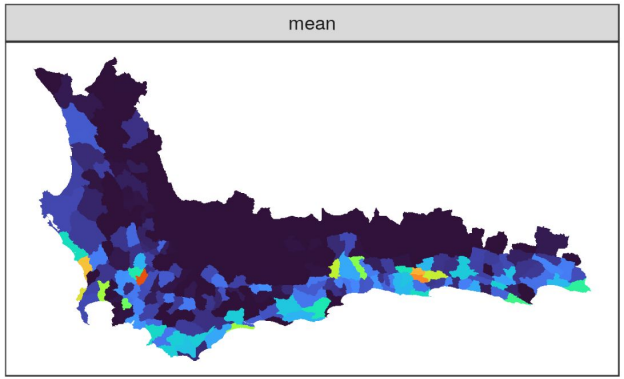
By utilizing biodiversity data and remote sensing/geographic information systems (RS/GIS) **in our resource-constrained government work, remote sensing allows officials to maximize returns on investment** (i.e. economic development - financial/income). Furthermore, the new knowledge **promotes collaboration**, for example, with The Nature Conservancy (TNC) taking the lead role in deciding which data and platforms to use.

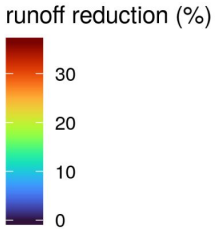
3.1. End-user needs related to (a) Invasive Alien Plants (IAPs) management

APPLICATIONS PROBLEM

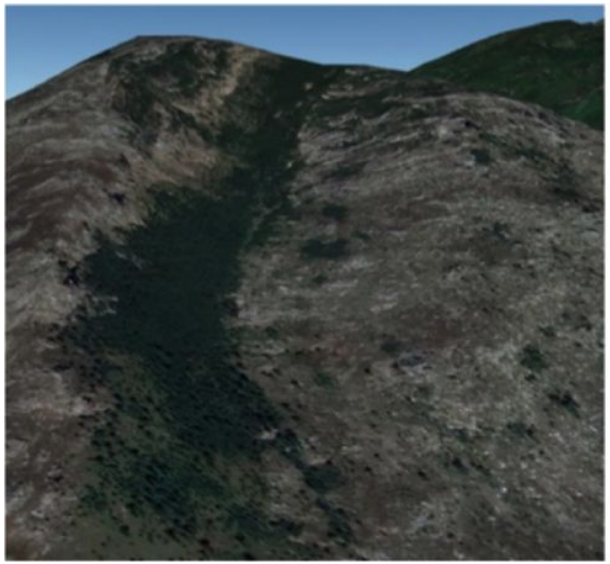
Invasive alien plants (IAPs) outcompete local flora, alter fire regimes and reduce runoff impacting on water provision, thus posing threats to biodiversity conservation and nature's contributions to people.

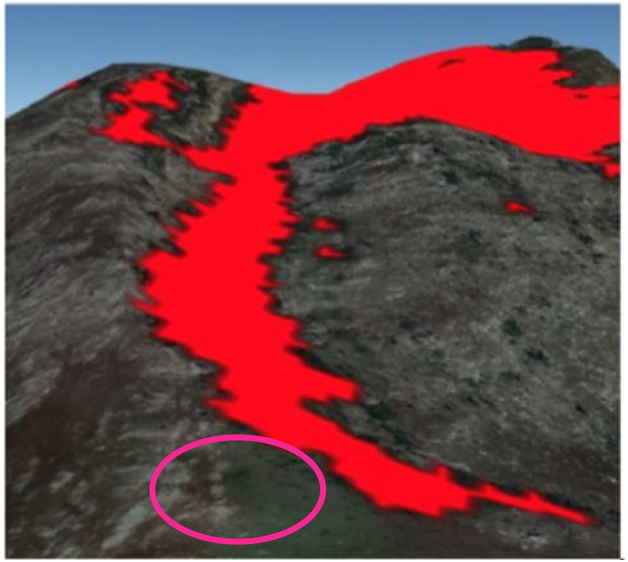
A wildfire on the Garden Route fuelled by invasive alien trees. File photo





BIOSCAPE'S VALUE-ADD: Once-off data products but a **'proof-of-concept'** that helps distinguish between IAPs (genera specific, e.g. *Acacia*, *Eucalyptus* and *Pinus*) and **detect subtle changes at a broad scale** that can **help manage cleared sites** from reverting to their original state or worsen without follow-up clearing and restoration. ***See Adler et al. project + Alien Tree Mapping WG (representatives from another five BioSCape PI-led projects: Fitzpatrick et al., Townsend et al., van Aardt et al., Cawse-Nicolson et al., van Niekerk et al.)***





Current state of play: Land cover classification at 10m (Sentinel data)
from Holden, Rebelo et al. 2021. *RSASE* https://doi.org/10.1016/j.rsase.2020.100448.

What about the scattered pines?

3.1. End-user needs related to (a) Invasive Alien Plants (IAPs) (from VCF analysis)

SANBI
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South African National Biodiversity Institute

South African
NATIONAL PARKS

CapeNature

CSIR
Touching lives through innovation

Some landscape changes may be subtle and require in-situ data for accurate understanding + **higher resolution hyperspectral RS data (like BioSCape) used to monitor plant community shifts and map layers of disturbance** to vegetation units, providing practitioners with a more comprehensive view of biodiversity changes.

SANParks utilizes plant biodiversity data and recording the proportions of invasive species to inform their **annual reporting** on IAPs eradications. Similarly, Comprehensive **wall-to-wall IAPs maps provided by CapeNature have proven essential in conducting catchment level clearings** for full eradication of invasive species in sections of national parks.

IAPs mapping for agriculture, **specifically the monitoring and management of eucalyptus and pine plantations**, has been greatly aided by the use of LANDSAT and Sentinel data in the past. Furthermore, the integration of **remote sensing data has proven crucial in the development of fire management plans,** allowing for more informed decision-making in this area.

3.1. End-user needs related to (a) Invasive Alien Plants (IAPs) (from VCF analysis)

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NEW: DEA&DP's GIS viewer similar to CapeFarmMapper, BioSCape portal (biodiversity spatial plan, riparian maps, water quality mapping, etc.) will be included.

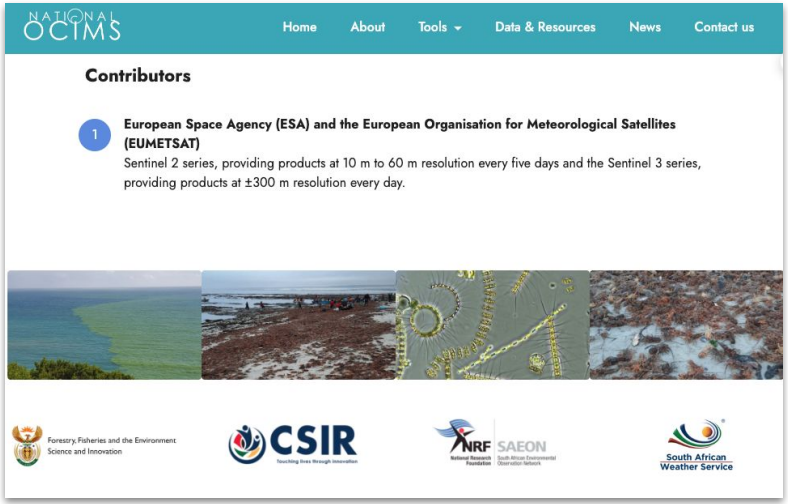
Ecological Infrastructure Investment Framework (EIIF) uses remote sensing (RS) to map accessibility and biomass recovery. Mainstream channels for ground truthing and accessing willing landowners are limited. Spatial data in Tableau is used for implementation updates and identifying prioritization areas for IAPs clearing. Also, economic studies used RS to map and **assess hydrological features** in wetlands and estuaries with many practitioners using it for **risk mapping of IAPs in wetlands**.

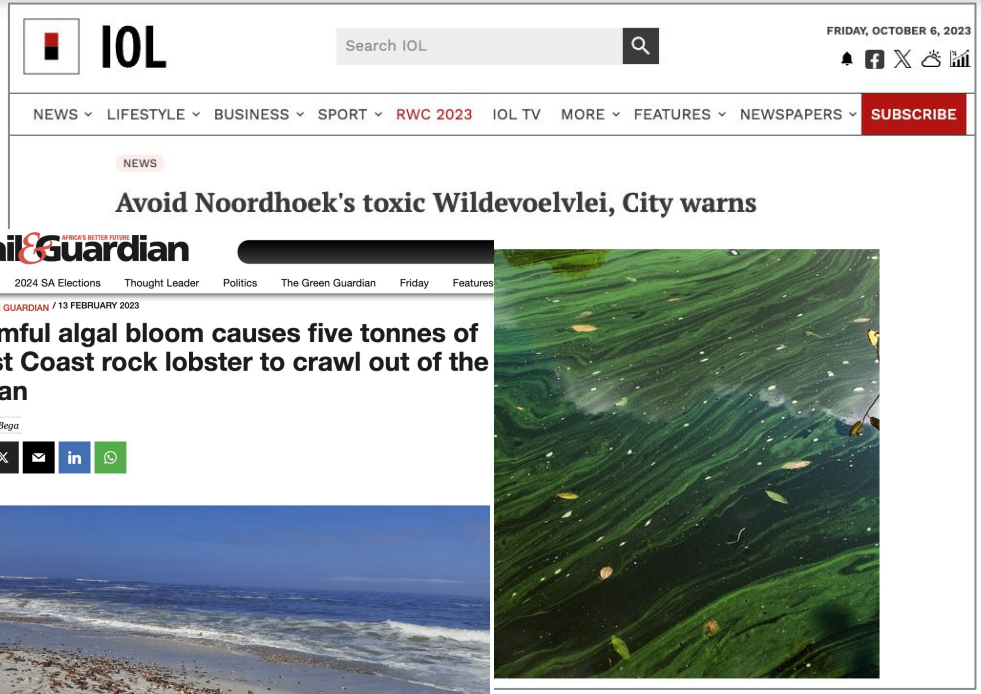
3.2. End-user needs related to (b) Water Quality monitoring for improving risk assessments

APPLICATIONS PROBLEM

Nutrient enrichment of both inland freshwater dams and marine ecosystems trigger algal blooms, killing aquatic biodiversity and affecting amenity value (drinking water, irrigation water for agriculture and fisheries, and shellfish industries).

National Oceans and Coastal Information Management System (OCIMS)





3.2. End-user needs related to (b) Water Quality (from VCF analysis)

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

"For the first time in our records, **unprecedented levels of harmful cyanobacteria have been reported in the Berg River**, which has implications for the protection of wildlife, livestock, and human populations."

forestry, fisheries & the environment
Department:
Forestry, Fisheries and the Environment
REPUBLIC OF SOUTH AFRICA

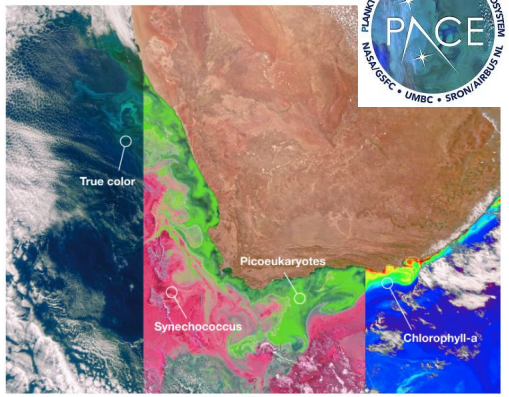
"I am frequently tasked with providing advice on the suitability of potential aquaculture sites and their potential impact on the environment. My prior experience in working on **Harmful Algal Blooms (HABs) provides me with valuable insights into how they may affect aquaculture**…The use of Remote Sensing technology plays a crucial role in determining the carrying capacity of these environments, particularly in shellfish farming operations. Through analyzing the productivity of the ocean, we can ensure sustainable practices and avoid depleting essential resources, promoting responsible and sustainable aquaculture practices that long-term health and productivity."

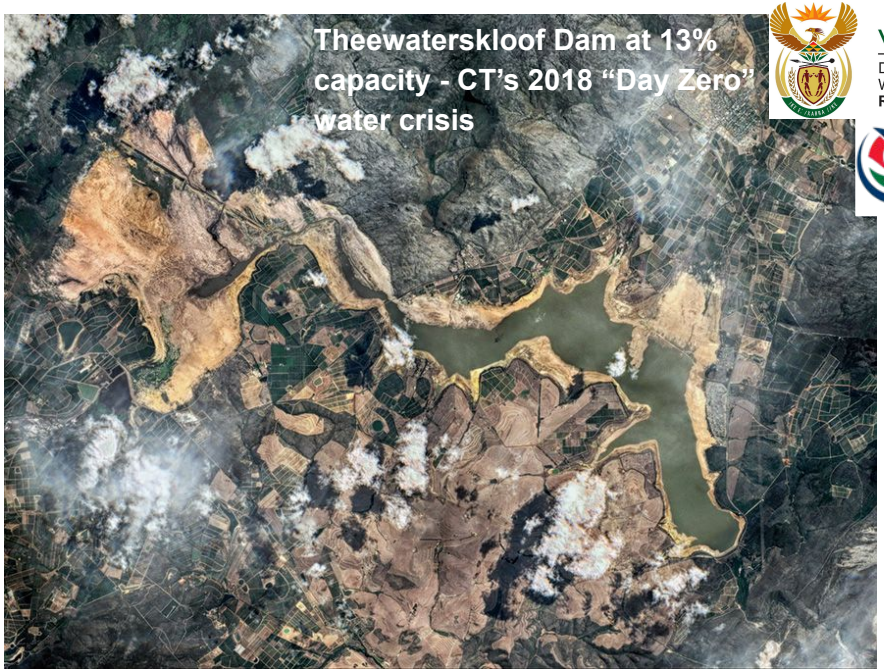
Western Cape Government
FOR YOU

"I heavily depend on remote sensing data, especially for land use allocations and exclusively for program development. **I employ models to prioritize watershed/ catchment basins based on water quality and quantity,** utilizing ESRI."

BIOSCAPE'S VALUE-ADD: More bio-optical data with improved algorithms + DWS in-situ database = **more accurate maps** (chl a concentration, "good" vs "bad" phytoplankton, rainfall, temperature, seasonal trends, and turbidity) **to develop a eutrophication index** (e.g. Theewaterskloof Dam)**.** Generally assist with scaling up (e.g. EMIT and PACE), repeatable monitoring inform an **early warning system** to help end-users. ***See Guild et al. (freshwater) + Wu et al. (marine) projects.***

NASA's PACE Data on Ocean, Atmosphere, Climate Now Available





water & sanitation
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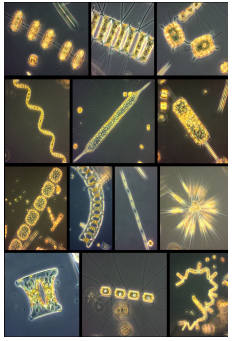
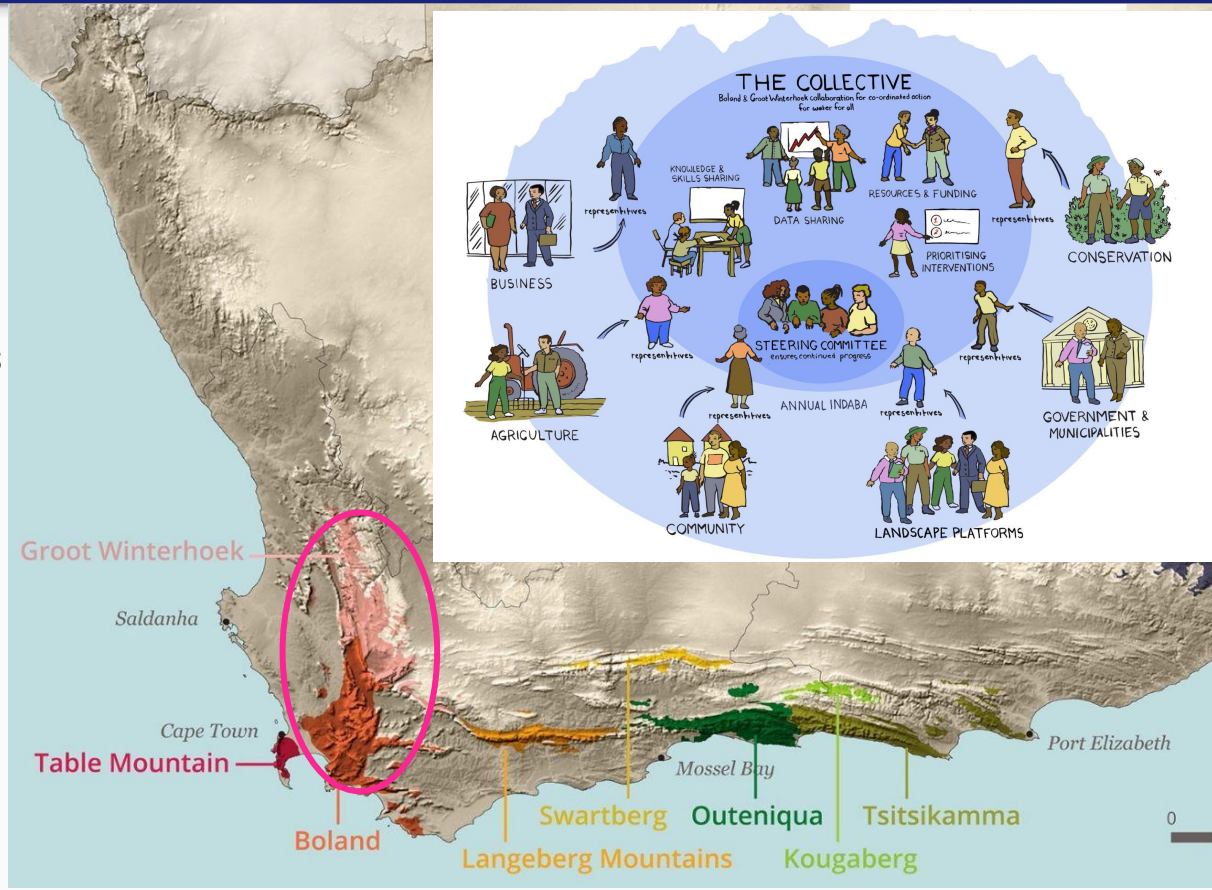


4.1. Concluding remarks: SA end-user buy-in and ‘readiness/preparedness’ for ‘research to applications sovereignty’ and increased impact

Perfect timing = High resolution maps of IAPs and water quality parameters that add to efforts in developing a **strategic spatially explicit, web-based, accessible information** management system for the strategic water source areas (SWSAs) - i.e. **Boland-Groot Winterhoek SWSA Collective**.

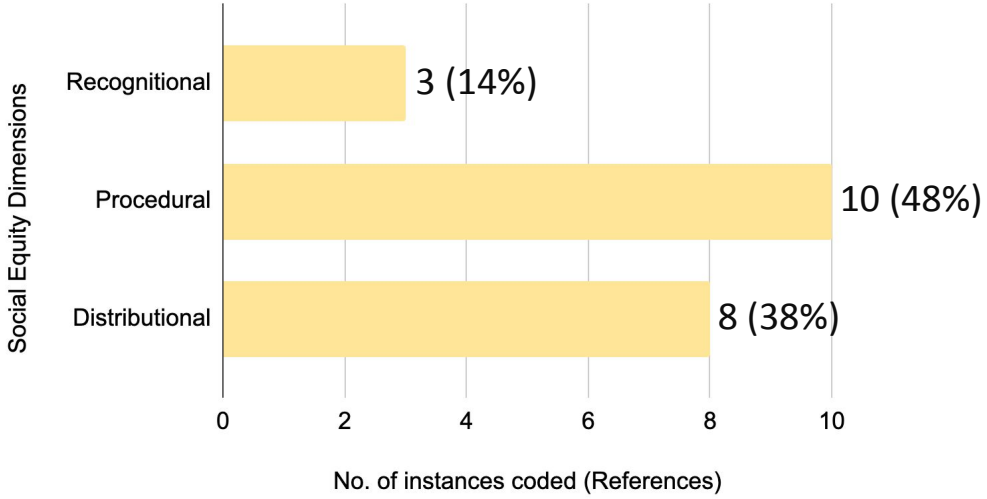
DEA&DP’s GIS viewer with BioSCape portal (biodiversity spatial planning, riparian & water quality mapping, etc.)



SWSAs = 22 surface water source areas (some pictured here), 37 groundwater source areas

4.2. Concluding remarks: SA end-user buy-in and ‘readiness/preparedness’ for ‘research to applications sovereignty’ and increased impact

We cannot have BioSCape Applications without diversity, equity & inclusion!



- **Awareness-raising**
  - Western Cape Government’s ‘BioSCape Applications Showcase’ for government officials (date TBC).

- **Capacity development**
  - CSIR’s ‘Earth Observation in support of Water Monitoring Training and Capacity Building Course’ for DWS government officials (25-26 June 2024)
  - ARSET and ORNL DAAC’s (using BioSCape SMCE) workshop for SA end-users and researchers (7-11 Oct 2024)

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APPLIED REMOTE SENSING TRAINING PROGRAM
TRAIN - EMPOWER - ADVANCE

ORNL DAAC

Transition to BioSCape project talks…

Thank you to everyone who made this possible