



Role of natural science collections and biobanks in plant health

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Outline:

- What the NSCF and BBSA are and their objectives
- How the natural science preserved collections contribute to plant health
- How the biodiversity biobanks contribute to plant health
- The collections / plant health value chain
- Challenges facing the NSCF and BBSA – people and permits





 **Natural Science
Collections Facility**
SOUTH AFRICA

- A DSI's South African Research Infrastructure Roadmap project initiated early in 2017.
- Comprises a network of 16 institutions, including museums, science councils (SANBI, ARC, SAIAB) and 3 university herbaria.
- Co-ordinating Hub at SANBI.
- Focussed on preserved, non-living collections of plants, animals, fossils and fungi.



Biodiversity
Biobanks
South Africa

- BBSA also a SARIR project, but only really getting going now.
- Scope – frozen plant and animal tissues and DNA extracts, genebanks, microbial cultures, including agricultural biobanks.
- Core biobanks – those that exist for long term preservation of selected samples on behalf of the nation, and that allow access to other samples for research and development



BBSA – core facilities

- SAIAB, ex-NZG, SANParks – animals
- SANBI – **Millennium Seedbank, plant DNA bank**
- DALRRD – **Plant Germplasm collection** (mostly crops, but also some medicinal, crop wild relatives)
- UFS – yeast collection
- UWC – **microbial cultures**
- ARC – **crop / plant viruses; Rhizobium and other soil bacteria cultures; fungi cultures and extracted DNA; germplasm – tissue culture, various fruit and vegetable crops, some ornamental and medicinal plants**

What are the NSCF and BBSA trying to achieve?

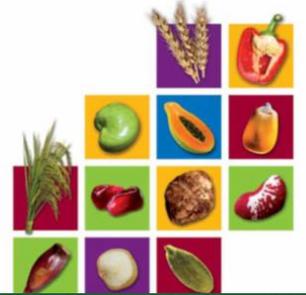
Both **networks** with the following main objectives:

- **Securing collections**, including rescuing orphaned collections
- **Upgrading** data sets and data management systems and making specimen **data accessible**
- **Increasing use** of collections for research, development, decision-making
- **Increasing awareness** of the collections and their value

To achieve these objectives:

- **Staffing and capacity development**; professionalising collection and data management
- **Transformation / change** – from operating in isolation to being part of a network, collections as infrastructure that should be used by external researchers
- Resourcing
- Navigating complex **legislation / permitting** requirements

Genebank Standards
for Plant Genetic Resources
for Food and Agriculture



As the leaders in the development of best practices for repositories, ISBER is pleased to announce the release of the

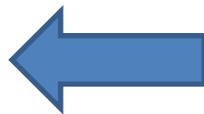
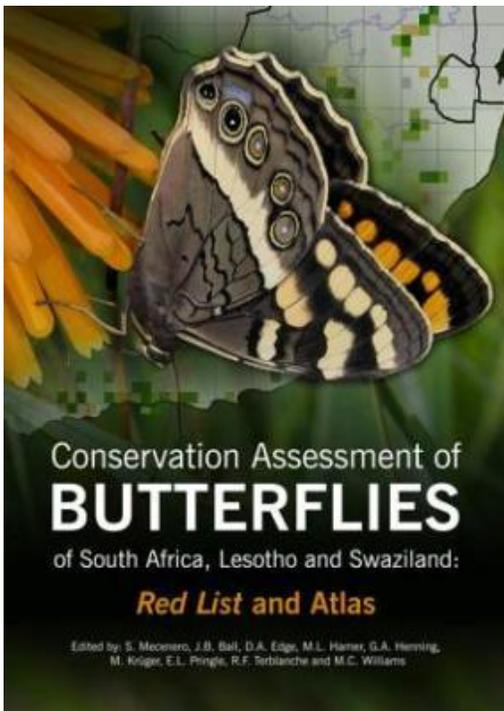
BEST PRACTICES:
Recommendations for



The NSCF and plant health?

- NSCF preserved collections - **what species we have, where they have been recorded, and how this has changed over time.**
- **Collections span almost 200 years - historical data** that allows changes in distribution over time to be mapped – whether this is for invasive species expanding their range, or threatened species that have a shrinking range; detecting origins of disease, pests
- Used as a **reference for the identification** of biological materials: soil organisms, pests, pollinators, indigenous and alien plant species – all relevant to plant health.

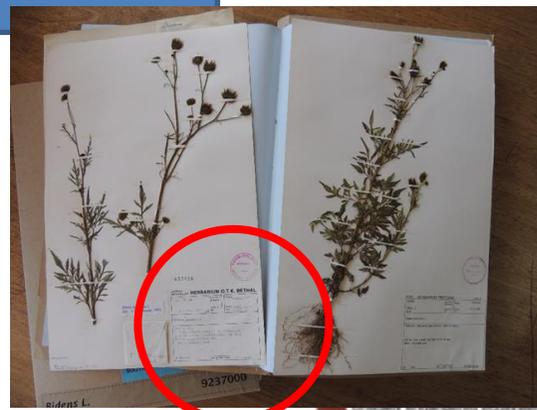




Specimen data

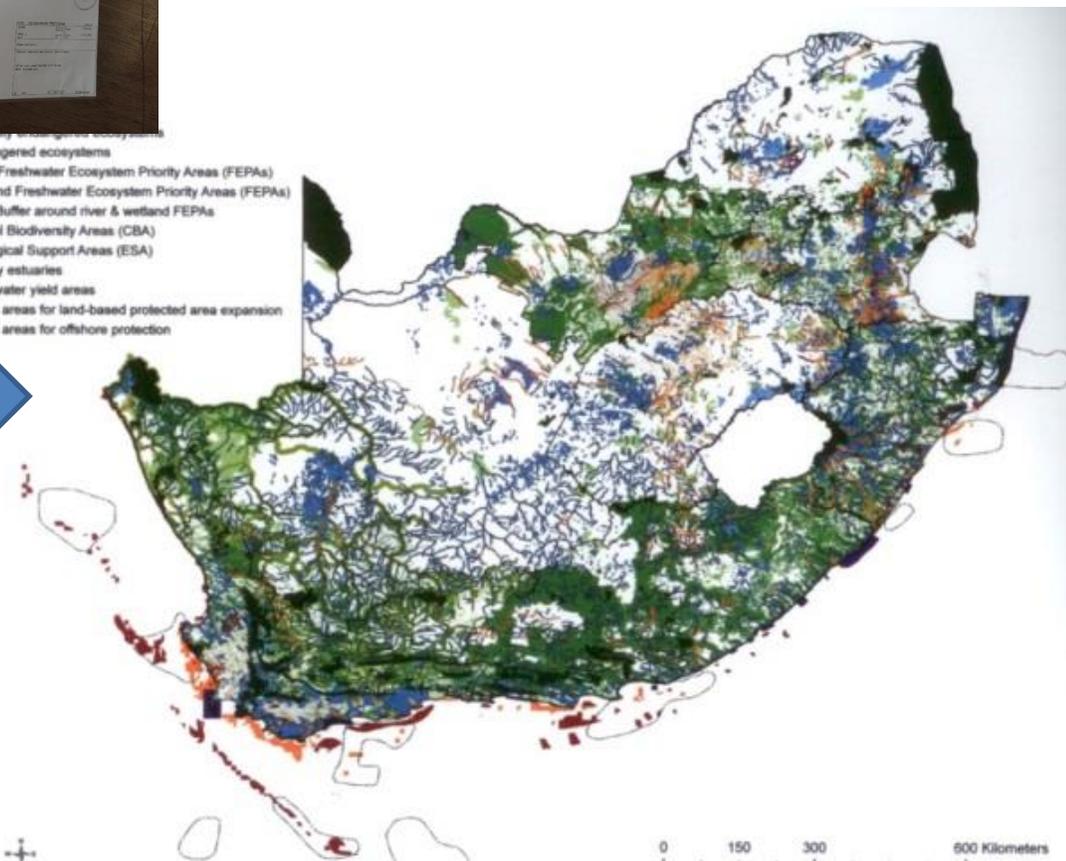


Information for Environmental
Impact Assessments,
development applications



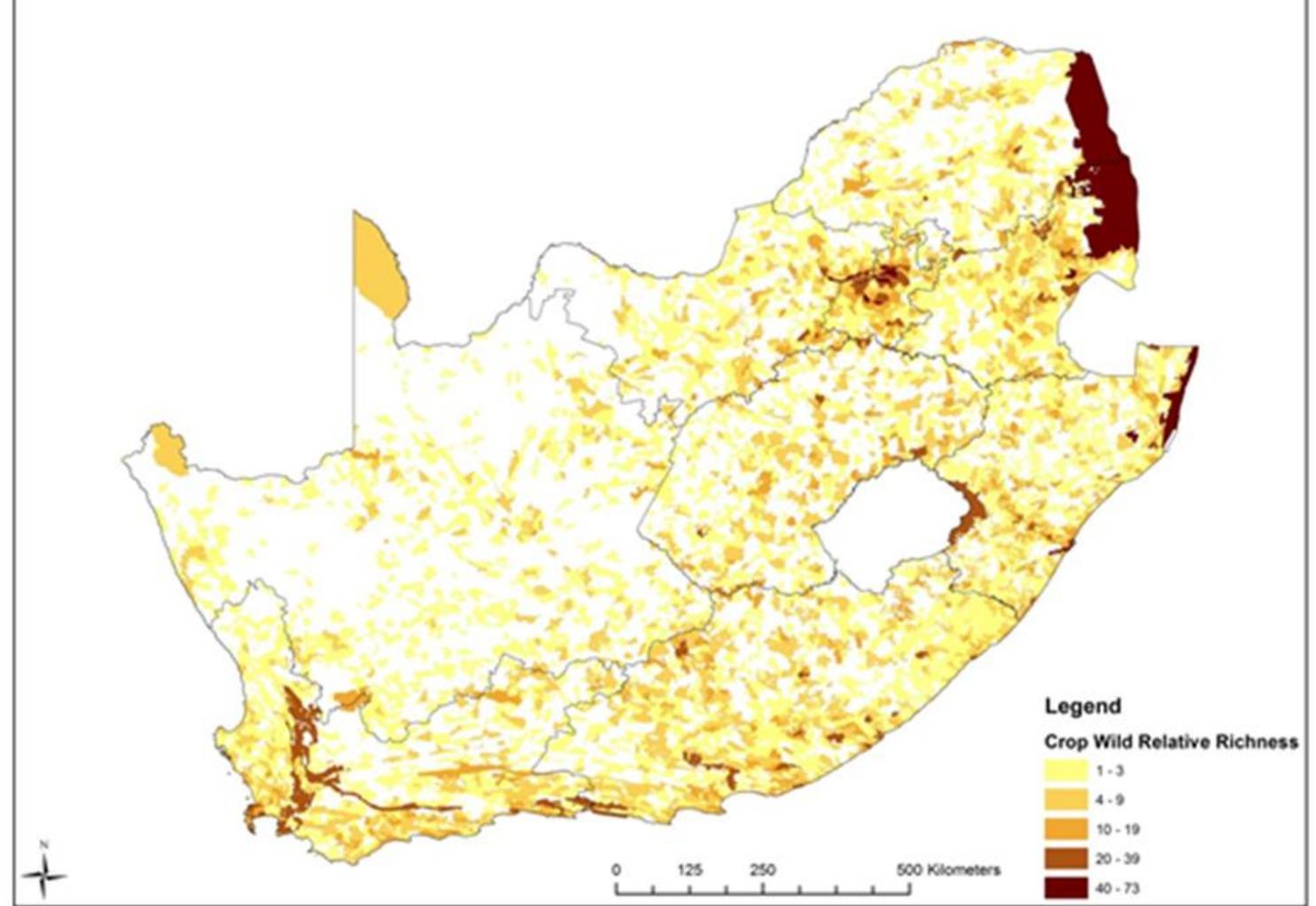
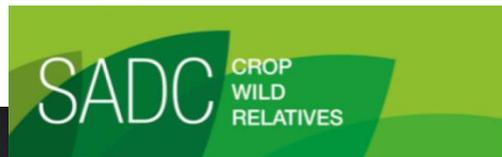
Protecting species
and ecosystems –
healthy plants
need healthy
ecosystems

- Endangered ecosystems
- River Freshwater Ecosystem Priority Areas (FEPAs)
- Wetland Freshwater Ecosystem Priority Areas (FEPAs)
- 1 km Buffer around river & wetland FEPAs
- Critical Biodiversity Areas (CBA)
- Ecological Support Areas (ESA)
- Priority estuaries
- High water yield areas
- Focus areas for land-based protected area expansion
- Focus areas for offshore protection



Crop Wild Relatives-
species with genetic traits
that could improve crop
viability.

- 1574 species in SA
- Plant specimen data –
identification of areas
important for
conservation
- Material collected for
genebanks

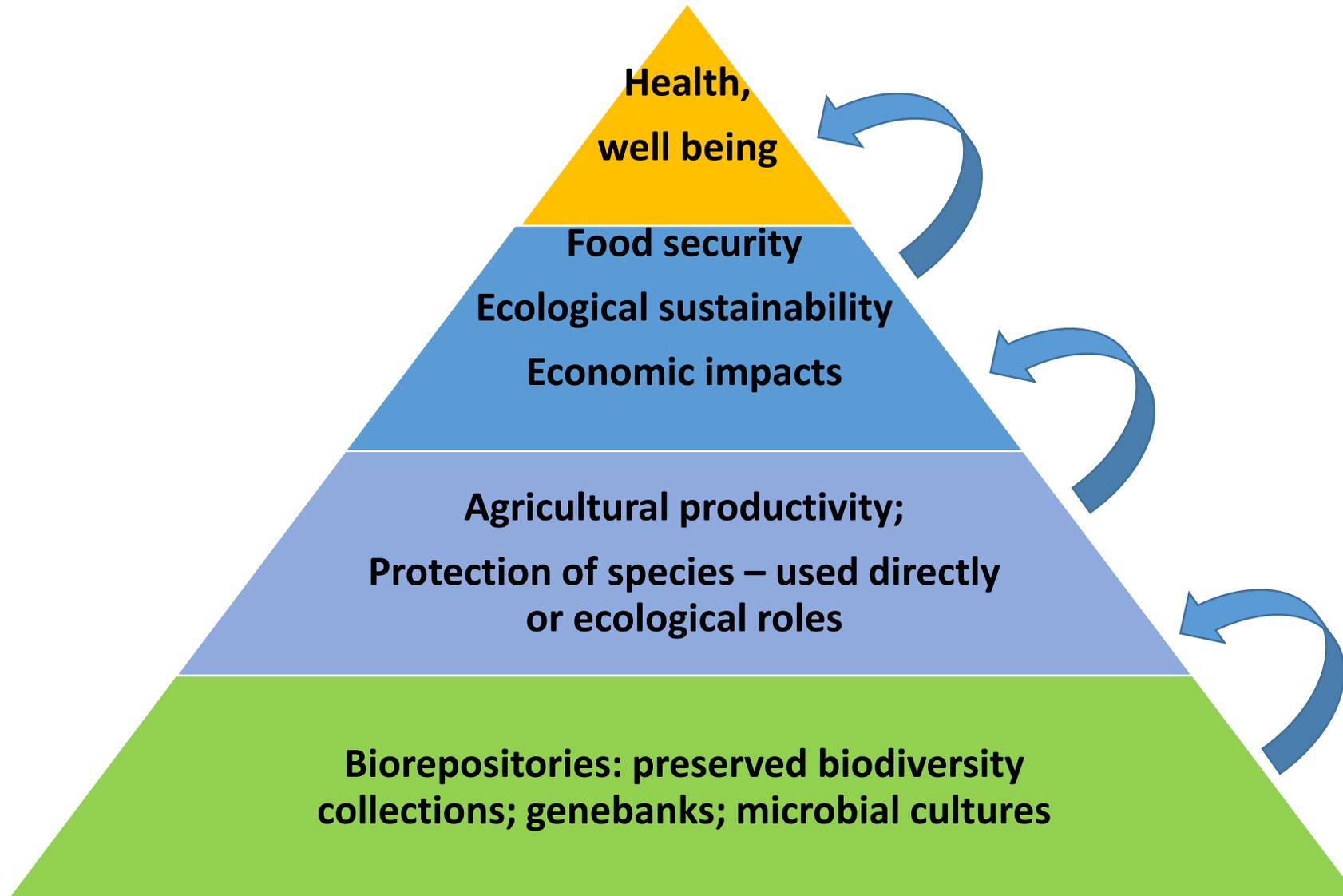


BBSA and plant health

- **Plant germplasm: seedbanks, tissue cultures:** plant and crop diversity
 - Research – range of fields, physiology, seed biology, genetics
 - Conservation of threatened species, rehabilitation of ecosystems
 - Agriculture - plant breeding, supply of stock for subsistence and commercial farming (crops, fodder), critical for development of new varieties, or when farmers lose existing stock to disease
- **Plant DNA bank: silica samples, DNA extracts:** mostly indigenous species
 - Taxonomy, genomics research – importance in understanding resilience
- **Microbial cultures:** bacteria, viruses and fungi diversity – plant pathogens, plant growth promoting forms ...
 - Research – taxonomy, diversity, plant pathology, biotechnology
 - Commercial development of products – e.g. inoculants for soils to promote plant / crop growth and resilience
 - Reference for identification of plant pathogens / diagnostics



“Biorepositories”



- Critical foundation
- But often indirect role
- Importance poorly understood by decision-makers, funding agencies, public and even the research community

~~Biorepositories~~

Limited, unverified identifications

No verifiable locality data / records

No ability to understand microbes changed

No reserves of seeds, tissue cultures for indigenous plants / crops

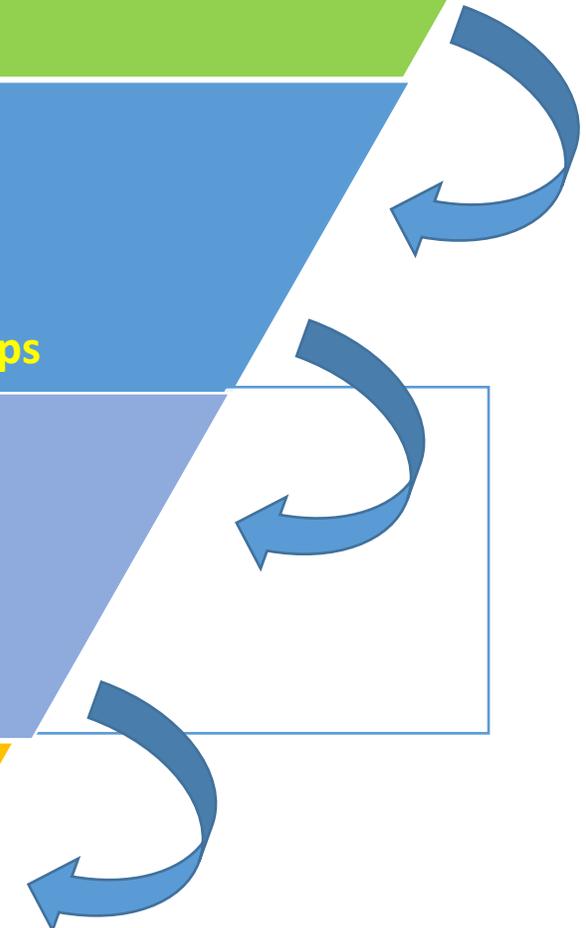
Inaccurate identifications – wrong diagnosis, wrong treatment; Import and export restrictions on agricultural products;

No reserve stock for farmers, or for conservation purposes

Food security

Economy

Environment



But the collections and biobanks remain at risk

- The DSI funding does not cover day-to-day operations of institutions
- Because the significance of the biorepositories is not always evident, they are at high risk of budget cuts or even closure at times of financial stress – not only in SA but globally
- Ongoing neglect of buildings and some collections



Challenges ... PEOPLE ISSUES

- **Communication** (what you say and how, to who, how often?)
- **Fragmented, isolated** individuals, collections, institutions – NSCF and BBSA working to address this but change is hard
- Individuals decide what research to do with agenda driven by number of publications –**weak alignment with national priorities**
- **Resistance to opening up access** to collections and data – sense of ownership by individuals / institutions rather than being for public good / national research infrastructure
- **New ways of operating** for increased efficiencies and professionalism – change process



Challenges ... PERMIT ISSUES ...

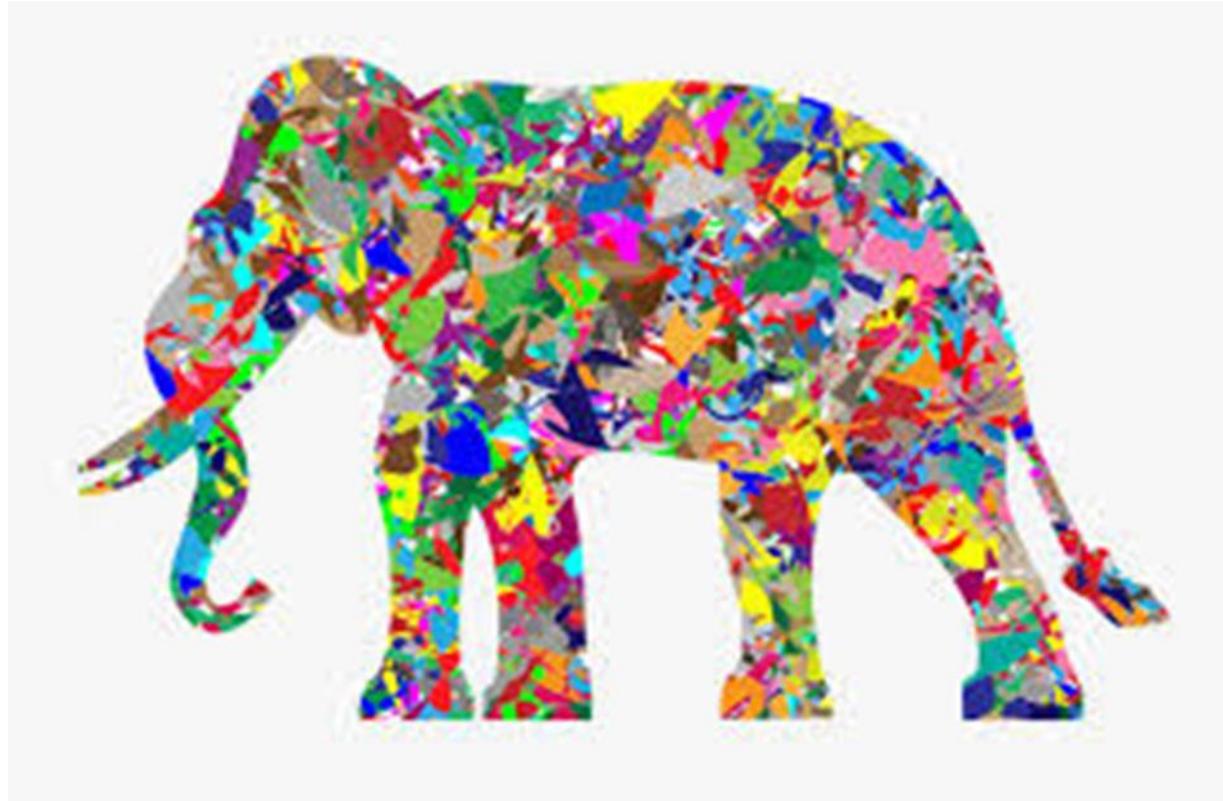


- Collection, holding and sharing of plant samples: **CITES or ToPS listed species**: registration as a scientific institution, standing permit, collecting permits
- Supply of samples: **access and benefit sharing legislation**. All material exported needs a permit, research in any way linked to commercialisation – even if downstream, requires that the material was collected with an exploration or discovery permit, which cannot be applied for retrospectively.
- Looming - Digital Sequence Information and proposal to restrict access to this.

BUT

- Challenges with aligning national legislation with EU interpretation of **Nagoya Protocol - export impacts**
- Microbial strains imported and released without understanding of impacts on natural communities / populations
- Many South African species / strains / varieties are already scattered across the world – in repositories or cultivation. Currently Millennium Seedbank at Kew holds all the SA seeds, and the only indigenous plant DNA bank is a duplicate of one at Kew (funded by Darwin Initiative).
- **Some balance and a clear, rational plan is needed ...**

So much potential to make a meaningful contribution to plant health, but lots of work to do ...



Thanks

- To all the institutions participating in the NSCF and BBSA
- To Department of Science & Innovation for recognising the importance of the collections and biobanks



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