Biodiversity Biobanks South Africa (BBSA)

Business Plan: 2020/21 – 2022/23: V02

1. Background

The Organisation for Economic Co-operation and Development (OECD) recognised the importance of having a wide network of *"Biological Resource Centers"* for the storage and sharing of biomaterials, essential raw material for the advancement of biotechnology, human health and research and development in the Life Sciences. This is especially relevant at this time, when molecular level investigations are being used in almost every field of biology to explore key questions about living systems and how they function, and the demand for novel foods, drugs and other products is increasing. The need for people to radically reduce their footprint on the earth's ecosystems, and at the same time adapt to rapidly changing climates present researchers, industry and society with major challenges.

South Africa is considered to be a megadiverse country, with exceptionally high levels of plant, animal and microbial species richness and endemism. Ensuring that this biodiversity is represented in national biobanks is important so that it can serve as a resource for research in a wide range of fields, including crop and livestock improvement, in the development of new medicines or foods, or industrial products, and in the conservation of iconic and highly threatened species. South Africa already has a wealth of biobank samples, many of which have been collected over a period of 20 or more years, and if these are appropriately secured, they could be used to create a time-series of biomaterials that will help us understand change, and allow us to predict how this change will play out into the future.

2. The Biodiversity Biobanks South Africa (BBSA)

The BBSA, as one of the projects under the South African Research Infrastructure Roadmap (SARIR) of the Department of Science & Innovation (DSI), will provide a co-ordinating structure across existing biodiversity biobanks, with the main aim of increasing the range and quality of samples stored and or distributed, and increasing and improving access for research and development through a single, centralised data portal, which will also allow more strategic collection of samples because gaps across biobanks can be identified.

The BBSA activities will result in increased cost effectiveness and efficiency for state investment and for researchers, and will accelerate the rate and improve the quality (more samples analysed increases confidence in findings) of research and postgraduate student training. As new data related to samples (eg. sequence data) are made available in an

integrated and co-ordinated way, new knowledge can be built on by others, and support innovation in a variety of disciplines.

The BBSA will provide a system of repositories of biologically relevant resources, including reproductive tissues such as seeds, eggs and sperm, other tissues including blood, DNA extracts, microbial cultures (active and dormant), and environmental samples containing biological communities; these biomaterials represent species, strains, varieties and breeds present in South Africa, including domesticated crops and livestock, that can be used to support research, capacity development and the development of new or improved products and practices in the fields of agriculture, human health and wellness, environmental management and conservation biology. This aligns with the DSI's Bioeconomy Strategy (2013) and the recently released Science & Technology White Paper (2019) in terms of improved coherence and coordination, and the principle of open science "*that allows people to re-use, redistribute and reproduce research and its underlying data and methods*".

Structure of the BBSA

The set up and planning phase for the BBSA involved consultation with a range of biodiversity biobanks and other stakeholders to develop the conceptual framework. The BBSA will be a distributed infrastructure, with two types of participation for biobanks:

i. *Core biobanks*, which support the concept of open access, that agree to implement the standards and procedures developed, that contribute to achieving the objectives of the BBSA, and that will be eligible for resource allocations through the BBSA, and

ii. *Affiliated biobanks* that participate in some BBSA activities and initiatives, but that will operate according to their own access policies and implement their own standards, and that will not be eligible for resourcing from the BBSA.

To date the following institutions have agreed to participate as Core biobanks:

- SANParks (Veterinary Wildlife Services biobanks at Skukuza and Kimberley),
- SAIAB (Aquatic biodiversity biobank),
- SANBI for the Plant Biobank (indigenous plant material for DNA extraction and DNA extracts, Herpetology biobank, Indigenous Plant / Millennium Seed Bank, and potentially also the National Zoological Gardens biobank),
- Department of Agriculture, Land Reform and Rural Development (National Plant Genetic Resources Center, Grootfontein Biobank for SA sheep and goat breeds),
- University of Free State's Department of Microbial, Biochemical and Food Biotechnology for the Yeast Culture Collection,
- University of Western Cape's Institute of Microbial Biotechnology and Metagenomics (IMBM),
- Agricultural Research Council for the following biobanks: Crop Protection, Plant Microbiology, South African Rhizobium Culture Collection, National Collections: Mycology, Entomology & Arachnology, Bacteriology; Vegetable & Ornamental Plants (Ipomoea (Sweet potato), Genebank for Indigenous Vegetables, Genebank for Commercial Vegetables, In vitro potato genebank collection, In vitro genebank collection of other vegetatively propagated crops).

The South African National Biodiversity Institute (SANBI) was identified as an appropriate institution to co-ordinate the BBSA.

Participation of biobanks in the BBSA will be formalised through Collaboration Agreements between SANBI and the institutions, and through internal agreements between the BBSA and the Division holding the biobank for biobanks within SANBI.

The University of Pretoria's Forestry and Agricultural Biotechnology Institute (FABI)'s Fungal Culture Collection (CMW), Forest Insects Collection, and Nematode Collection, and the University of Johannesburg's African Centre for DNA Barcoding (ACDB) may participate as Affiliated biobanks. There may be additional institutions that participate at either core or affiliated level.

The **user community** comprises individual researchers and industry who contribute material to the biobanks and various activities that promote engagement with them (eg. the BBSA Forum, participation in conferences, industry forums) are an important aspect of implementing the BBSA.

Governance structures

The governance structures of the BBSA include a **Management Committee** which comprises the managers of participating biobanks, which is responsible for planning and ensuring implementation within institutions, and **Working Groups** that each focus on a major work package and that include representatives from the institutions.

High level governance is through **SANBI's Executive and Board**, which is responsible for compliance with government regulations and overall delivery of the BBSA.

A **Steering Committee** includes representatives from relevant government departments (primarily DSI, Department of Environment, Fisheries & Forestry, Department of Agriculture, Land Reformation & Rural Development) and senior managers from participating universities (eg. Deans) and science councils (Executive level of SANParks, Agricultural Research Council, SANBI, NRF). This structure is responsible for providing strategic guidance and facilitating implementation of the BBSA Business Plan.

The BBSA reports to SANBI's Executive and Board, as well as to the DSI and its internal Advisory Committee for the SARIR.

A BBSA **Hub Team** will include staff who lead and co-ordinate the implementation of the business plan, manage the budget, contracts and collaboration agreements with institutions, report to both SANBI and the DSI, facilitate the networking and communication activities and meetings of Management and Steering Committees and Working Groups, organise the BBSA Forum and draft guidelines and standards.

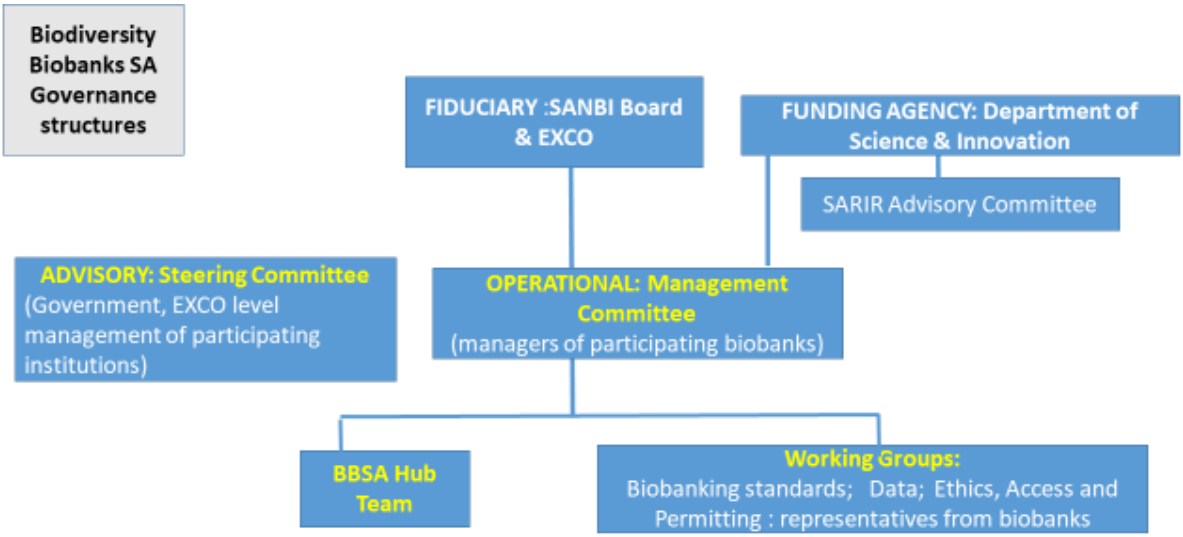

Figure 1: Governance and operational structures of the BBSA

3. Purpose and goals of the Biodiversity Biobanks South Africa

Purpose of the BBSA:

The BBSA serves as a co-ordinating and supporting mechanism across existing biodiversity biobanks, with the main aim of increasing the range and quality of samples stored and distributed, and increasing and improving access for research and development.

The BBSA has the following objectives:

1. To formalise the network of biodiversity biobanks in South Africa, in order to ensure that there is a co-ordinated and collaborative system representing all relevant components of biodiversity, including agri-biodiversity, and promoting their value amongst various audiences, including users and decision-makers in order to increase awareness of the importance to society and the economy and ensure sustainability;

2. To ensure a credible, legally compliant and ethical system for collecting, storing and providing access to biodiversity biobank samples by aligning with standards and procedures set by global and national initiatives and structures; and facilitating and monitoring implementation of these across participating biobanks;

3. To increase use of the biodiversity biobanks for storage and access to samples by researchers and industry by providing a centralised portal for accessing data on biobank specialisations and services offered, samples available and storage specialisations across the network;

4. To ensure that biodiversity biobanking services provided are professional and according to global standards by facilitating training opportunities for biobank staff and users, including students, accessing or donating samples to the biobanks;

5. To ensure that the BBSA contributes to and benefits from regional, continental and global initiatives and networks.

4. Milestones / deliverables for the BBSA: 2020/21 – 2022/23

2020/21	2021/22	2022/23
1. Formalise the network of biodiversity biobanks in South Africa and ensure that there is a co-ordinated and collaborative system representing all relevant components of biodiversity, including agri-biodiversity, and that this is promoted amongst the broader stakeholder community to increase awareness of the importance to society and the economy and ensure sustainability		
1.1. Formalising the network: ○ Governance structures with representation from biobanks established and functioning. Steering Committee and Management Committee set up, membership confirmed ○ Working Groups established, with membership confirmed: Data Working Group; Biobanking standards and procedures Working Group and Ethics, access and permitting Working Group ○ TORs for governance structures and Working Groups developed and approved ○ Development of 4 collaboration agreements for participating biobanks ○ Google Docs set up for sharing of documents and getting input from participants	○ 2 meetings of Steering Committee ○ 4 meetings of Management Committee ○ 2-4 meetings of each Working Group ○ Development of 2 collaboration agreements for participating institutions ○ Meeting documents available on Google Docs and where appropriate on BBSA website. ○ Hub Office established with priority staff and management systems documented	○ 2 meetings of Steering Committee ○ 4 meetings of Management Committee ○ 2-4 meetings of each Working Group ○ Meeting documents available on Google Docs and where appropriate on BBSA website
	○ BBSA Forum held; research symposium included to promote collaborative research on biobanking methods and innovations; ethics symposium included to promote ethics matters of relevance to biodiversity biobanks	○ BBSA Forum held; research symposium included to promote collaborative research on biobanking methods and innovations; ethics symposium included to promote ethics matters of relevance to biodiversity biobanks
1.2. **Promoting awareness of the BBSA and services offered**: ○ Website established to promote the BBSA and provide relevant information	○ Presentations at conferences and forums on the BBSA to promote services offered minimum 2 ○ Regular updates / additions to website	○ Presentations at conferences and forums on the BBSA to promote services offered: minimum 4 ○ Regular updates / additions to website

	○ Promotional materials developed for increasing awareness of the BBSA their value and services	○ Distribution of promotional materials at appropriate forums (minimum of 4 / year)
1.3. Ensuring the network represents relevant components of biodiversity	○ Gap analysis completed to identify need for expansion of existing biobanks to ensure that holdings represent priority elements of South Africa's biodiversity, including agri-biodiversity, and to ensure that there is adequate representivity / duplication for risk and disaster management ○ Expansion plan to address priority gaps in biobank holdings (eg. crop wild relatives, illegally traded plants and animals, commercially harvested plants and animal species, medically important species, endangered plant and animal species, economically important microbes, agricultural pests and pathogens, parasites and disease vectors, ex-types of microbes described in South Africa but only represented in overseas institutions ○ Additional infrastructure to accommodate expanded holdings and disaster planning in at least 3 biobanks	○ Samples / specimens representing 10% of priority gaps added to biobank holdings ○ Additional infrastructure to accommodate expanded holdings in at least 3 biobanks
2. A credible, legally compliant and ethical system for storing and providing access to biodiversity biobank samples by setting standards and procedures for the collection, accession, storage and supply of biobanked materials, and facilitating and monitoring implementation of these.		
○ Review of permitting and other legal requirements for compliance for different biobanking activities / practices ○ Review of requirements for biodiversity biobank accreditation according to Animal Disease Control Act, DAFF and ISO. ○ Review of accepted global standards and SOPs for various biobank types and activities	○ Development of access policy, with guidelines for access to different types of samples ○ Common standards and SOPs for biodiversity biobanking developed and implemented: • Review of existing plans, policies and procedures of biobanks, including risk and disaster management • Agreed on standards and SOPs, and changes required for implementation by biobanks • Assessment process developed	○ Assessment of standards implemented by participating biobanks and report produced

	○ Upgrading of at least three biobank storage facilities to meet standards ○ Additional capacity provided to ensure legal compliance for providing access to biobank samples	○ Upgrading of at least three biobank storage facilities to meet standards ○ Additional capacity provided to ensure legal compliance for providing access to biobank samples
3. Increase use of the biodiversity biobanks for storage and access to samples by providing a centralised portal for accessing data on samples available and storage specialisations across the network; promoting the services offered by the biodiversity biobanks to increase use of these by the broader research and development community; making information on the different biobanks and their specialisations publically accessible to inform donors and users of biobanked materials		
3.1. **Making information on biodiversity biobanks accessible to promote use**: Metadata for biobanks developed, including specialisations made accessible online	○ Expansion of inventory of biodiversity biobanks in SA including holdings and services offered made available on BBSA website	○ Inventory updated and expanded to ensure all biodiversity biobanks included and data current ○ Central portal for access to sample data including online system for requesting samples; central tracking of number of samples submitted to biobanks and number supplied to researchers / industry
3.2. **Improved sample data management, with upgraded and expanded data sets**: ○ Standard database structure and software for biobank samples agreed on	○ Data migration to software ○ Data upgrading and expansion of biobank data sets to address backlogs	○ Ongoing updating of data sets
4. Ensure that biodiversity biobanking services provided are professional and according to global standards by facilitating training opportunities for biobank staff and users, including students, accessing or donating samples to the biobanks		
○ Assessment of training needs and existing opportunities for biobanking staff and users of biobanks	○ Biobank data management training course run ○ Participation of three staff in international courses / workshops / learning visits for biodiversity biobanking	○ Two courses in biobanking procedures run ○ Participation of three staff in international courses / workshops / learning visits for biodiversity biobanking
5. Ensure that the BBSA contributes to and benefits from regional, continental and global initiatives and networks		
○ Contribution of SA biodiversity biobank metadata to GBIF's global catalogue of natural history collections ○ BBSA membership of the Global Genome Biodiversity Network (GGBN) finalized and metadata made accessible ○ Participation in the Specify Consortium for data management	○ BBSA membership of the Global Genome Biodiversity Network (GGBN) and participation in conference ○ Participation in the South African Barcode of Life activities to promote deposition of materials in biobanks ○ Participation in the Specify Consortium for data management	○ BBSA membership of the Global Genome Biodiversity Network (GGBN) and participation in conference ○ Participation in the South African Barcode of Life activities to promote deposition of materials in biobanks ○ Participation in the Specify Consortium for data management

○ Consideration of participation in International Society for Biological and Environmental Repositories (ISBER) and European, Middle Eastern and African Society for Biopreservation and Biobanking (ESBB), World Federation of culture collections (WFCC), European Culture Collections' Organisation (ECCO)	○ Collaboration in at least 3 projects relating to biodiversity biobanking at a regional / continental or global level	○ Collaboration in at least 3 projects relating to biodiversity biobanking at a regional / continental or global level

Notes to the Business Plan:

Deliverables in year 1 and the existing DSI-SANBI agreement

In year 1 (2020/21) there are some deliverables that must be completed by 30 June 2021 according to the existing agreement between DSI and SANBI. These include the following which are included in the table above mainly for year 1:

- The detailed inventory of biodiversity biobanks in South Africa, including scope, scale, resources, policies and plans (partly completed through assessment in 2019)
- Assessment report on options for data management systems (initiated)
- Website for the BBSA set up and populated (service provider contracted; materials to be developed)
- Setting up governance structures
- Set of common policies, standards and SOPS, planning for accreditation for some biobanks (not yet initiated, reviews will be done in 2020/21, but likely that this will be completed by end of 2021 only). A review of different accreditation systems is required to assess which is the most appropriate for the different types of biodiversity biobanks.
- Training programmes – we need a review of what is on offer already, where gaps are and how we can best address these. May be some that are offered towards the end of the year depending on the Covid-19 restrictions globally and nationally.

Staffing

- Successful implementation of the Business Plan requires appropriately qualified and experienced staff to both carry out and / or co-ordinate activities across the core biobanks.
- The current staff complement at several of the institutions is inadequate and in several cases the biobank staff have other responsibilities. In addition, upgrading of the standards for storage, data management and processes and meeting the requirements associated with increasing demand for samples will increase the workload of the existing staff. The host institutions all have budget constraints and will not be able to appoint additional staff in the near future. This means that the BBSA will need to fund additional contract staff in the core biobanks.
- It is proposed that more senior biobank managers be appointed through the BBSA for the larger facilities, where this level of staff is required, and that these staff be assigned responsibility for compiling standards and procedures for the different biobanking activities, including data management, and that they lead and co-ordinate collaborative research into biobanking methods. This means that these staff will co-ordinate the working group activities. They should represent different types of biobanks, for example microbial cultures, wildlife disease, DNA banks. These

posts would be expected to contribute 40% of their time to co-ordinating or producing BBSA deliverables.

- Biobank technicians are required for implementation of the standards for biobanks, for ensuring that samples provided are of appropriate quality, and that requests for access can be serviced in a reasonable time frame. Some institutions may be able to cover 50% of the salary for a technician, and the BBSA would then cover the balance of the salary.
- The demand for additional capacity needs to be balanced with the DSI's expectation that a large component of the budget is allocated to physical infrastructure rather than staffing. For this reason, the following staffing model is proposed:

Posts	2020/21	2021/22	2022/23
BBSA Lead (level 13)	50% post (existing)	100% post	
Project Manager (level 11)	Appointed for last 4-6 months (WG co-ordination, recruitment of staff, administration)	Appointed	
Outreach and Communication Officer (level 9)	0	Appointed	
Administration Officer (5/8th, level 6)	0	Appointed	
Biobank Manager (level 10): Microbial cultures	0	Appointed at Core biobank 1	
Biobank Manager (level 10): Plant DNA banking	0	Appointed at Core biobank 2	
Biobank Manager (level 10): Wildlife / animal disease	0	Appointed at Core biobank 3	
Biobank Manager (level 10):	0	Appointed at Core biobank 4	
Animal tissue / DNA banking			
Biobank Manager (level 10): Agricultural biobanks	0	Appointed at Core biobank 5	
Biobank technicians (salary 50% shared with institution) (level 6)	0	50% funded by BBSA x 2	
Biobank technicians – 100% funded by BBSA (level 6)	0	X 4 appointed at Core Biobanks	X 6 appointed at Core Biobanks

5. Deliverables, Outputs, Outcomes and Impacts for the Biodiversity Biobank SA for 2020/21 – 2022/23

Deliverables	Outputs	Outcomes	Impact
1. BBSA established with governance and operational structures set up and meeting, with TORS, Collaboration Agreements signed with core institutions	TOR for different structures; Minutes from meetings; Documents produced collaboratively by Working Groups; Signed Collaboration Agreements.	Collective and co-ordinated planning and implementation across institutions; Sharing of experience and knowledge.	Improved coverage of biodiversity represented in biobanks; Improved curation and security for SA's biodiversity biobanks.
2. BBSA Forum held for all stakeholders and	Symposia, and discussion groups – notes from these; Networks /	Shared knowledge and experience results in	Increased research outputs credibility of research, relevance of research:

role players in biodiversity biobanking	collaborations established.	improved storage, access and security for samples.	contributes to well- being of society, food security, biodiversity conservation and to economic development.
3. Outreach and communication products and dissemination of these, including through BBSA website	BBSA website with regular news updates and information about participating biobanks and holdings. Videos, brochures, presentations. Dissemination through various forums, including those of relevant industries.	Increased networking and collaboration, including between industry and academia; Increased use of biobank samples and facilities for depositing samples.	Increased research outputs in range of disciplines; Improved crops and livestock contribute to improved food security; Bioprospecting and product development result in economic development and improved health and well-being.
4. Gap analysis and expansion plan developed and implemented for different components of biodiversity and agri-biodiversity	Report on current holdings, gaps and priority areas for addressing gaps; Plan for sampling to address gaps; New samples added to biobanks in line with the gap analysis / expansion strategy.	Biobanks collectively hold materials representing South Africa's biodiversity, including agri-biodiversity which increases their value as national assets and research infrastructure.	Increased research outputs in a range of disciplines; improved food security into the future; increased contributions to the economy, health and well-being of society and conservation of species of special concern.
5. Risk assessment and disaster management documents developed by institutions and collectively as the BBSA	Reports at institutional level; Report at the national level across institutions.	Biobanks secured with plans for mitigating impacts of disasters or rescuing biobank holdings if an institution cannot continue to fund operations.	Investment in biobanks and future potential economic impacts not lost in the case of disasters, which has impacts in terms of global credibility in the fields of agriculture, wildlife disease management, and research in general.
6. Review of legal requirements, ethics, access and benefit sharing for biodiversity biobanks, and development of common policy and standards	Review paper produced with implications for biobanks; Review of existing policies and procedures of institutions; Development of BBSA policy and standards guidelines for ethics, access and benefit sharing.	Holdings of the biodiversity biobanks legally and ethically obtained and supplied to users at both a national and international level; Increased transparency and credibility; All required biosecurity requirements for collection, storage and supply of samples complied with.	Global credibility which has impacts in terms of export of South African products; South Africa benefits from the use of samples either in terms of financial benefits, or through non-monetary benefits such as capacity development or contribution to biodiversity conservation activities.

7. Development of national standards and policies for life cycle of biodiversity biobank samples and national accreditation / evaluation of biobanks	Review of global standards for life cycle of biobank samples; Review of different accreditation systems for biobanks and identification of appropriate one/s for participating biobanks; Document with policies, procedures and standards for collection, preparation, storage and supply of samples.	Improved quality of samples; Increased use of samples by R & D community.	Reduced spending on sample collection for R & D; Increased research outputs; Samples used for contributing to conservation of rare / threatened species / varieties of crops and livestock; or for bioprospecting / product development.
8. Assessment of biodiversity biobanks in terms of policy and standards implementation and production of report on status	Report on the status of biodiversity biobanks in terms of meeting global standards and national certification; Identification of strengths and weaknesses in the BBSA	Targeted interventions to address weaknesses; Improved credibility of biodiversity biobanks and holdings; Upgrading of infrastructure, consumables and capacity at biobanks to ensure standards met	Increased credibility of samples; Increased research outputs; Increased security of samples, resulting in savings; Increased food security, economic development.
10. Sample data in standard software; upgraded, and accessible online	Each biobank with all samples recorded in a database; All required fields of database populated; Database with sample data available online (where fields / sample records not restricted)	Improved management of samples; More strategic collecting of material by biobanking and research community; Increased use of samples for R & D.	More efficient use of resources for R & D; Increased R & D that contributes to human well-being and economic development.
11. Improved human capacity for biobanks through training workshops, attendance at international conferences and courses and learning visits to international biobanks	Existing courses relevant to biobanking identified and staff attend these; Curriculum developed and course run where no existing course exists; Staff attend international conferences, training courses and learning visits to international biobanks	Staffing of biodiversity biobanks professionalised; Improved practices and quality of samples; Increased use of the biobanks for R & D.	More efficient use of resources because staff are more competent and samples are prepared, stored and supplied in an appropriate way; Increased research that contributes to needs of society, improved food security and economic development.
12. Participation in global networks	Membership for BBSA of GGBN, Specify Consortium, IBOL and potentially ISBER	Strategy and operations of biodiversity biobanks in line with global trends; Able to share knowledge and resources globally.	Increased contribution to solving problems in conservation, human health and well-being and economic development at a global scale;

			Reduced expenditure because of ability to leverage international expertise and products.
13. Participation in collaborative research projects on biobanking methods	Collaborative research projects; Research publications and conference presentations.	Improved techniques and methodologies for biodiversity biobanking	Improved storage of samples, resulting in reduced expenditure on sample collection; Increased effectiveness of conservation efforts for samples of various types which contributes to biodiversity conservation, food security, well-being and health and economic development.

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