

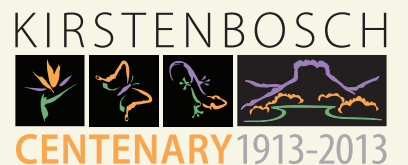
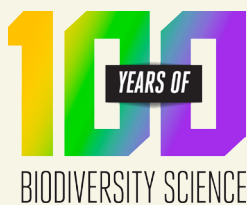


2004 ● 2013 a decade of

science



New knowledge,
new ways of thinking
... supported by
scientific research





SANBI: A Decade of Science 2004–2013

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Foreword

SANBI's oldest National Botanical Garden, Kirstenbosch, celebrates 100 years in 2013 and provides a fitting showpiece for a key part of SANBI's mandate to manage botanic gardens and promote awareness of South Africa's exceptional biodiversity.

At the same time, SANBI enters its 10th year of existence in September 2013 and this publication, *SANBI: A Decade of Science* celebrates the achievements and impacts of our scientific work and the people who have carried out this work at SANBI.

“This book gives a glimpse of the richness of scientific work we have done since 2004, in fulfilling our legislative mandate, and illustrates its relevance, impact and contribution at home and internationally.”

Our contributions in this arena have made SANBI a leading force in the generation of knowledge, its application to policy and decision-making, and in making biodiversity links to development for our country, and therefore a sought after partner for collaborative projects nationally and internationally.



Dr Tanya Abrahamse

CHIEF EXECUTIVE OFFICER

South African National Biodiversity Institute

ABOUT US

Where SANBI comes from: Our history

Biodiversity science took on new directions in South Africa in the early 2000s when government recognised the need for more scientific evidence to support its decision-making relating to biodiversity.

A focussed, coordinated and well-funded institution was needed to support the new legislation relating to biodiversity that was being contemplated, and which ultimately came into effect as the *National Environmental Management: Biodiversity Act*, 10 of 2004.

The South African National Biodiversity Institute (SANBI) was the resulting institution, established in September 2004 with one of its functions to strengthen the science for policy and decision-making. The new institute required a transformation from the National Botanical Institute (NBI), which had itself been established in 1989 from the merger of the former National Botanical Gardens and the Botanical Research Institute. This gave the new institute a strong science foundation but whereas the previous botanical focus of NBI had been to conserve and study the exceptionally rich southern African flora, SANBI's new mandate required it to extend the focus from just plants to include all aspects of biodiversity.

As important, SANBI was expected to play a leadership role in generating, coordinating and interpreting the knowledge and evidence required to support policies and decisions relating to all aspects of biodiversity. A challenge indeed!



Where we focus our work: Our mandate

The Biodiversity Act and other documents that determine the national policy direction for biodiversity research require SANBI to focus our scientific efforts on:

- monitoring and reporting on the status of South Africa's biodiversity;
- coordinating and promoting taxonomy and looking after the collections that underpin this work;
- generating knowledge to understand trends within the context of global environmental change and that supports

decision-making relating to the protection and sustainable use of biological resources;

- determining biodiversity conservation needs and priorities;
- assisting in the development of a biodiversity framework, bioregional plans and strategies; and
- disseminating information on biodiversity and maintaining relevant data bases.

How we deliver on our mandate: Our value chain

Our work at SANBI can be conceptualized as a value chain in which our science forms part of a continuum that starts with very basic information on biodiversity and builds on these foundations with classification systems, assessments, experiments, models and tools to get to a point where we can provide focused advice to policy makers and contribute to Government's higher objectives of poverty alleviation, job creation and improving human wellbeing.

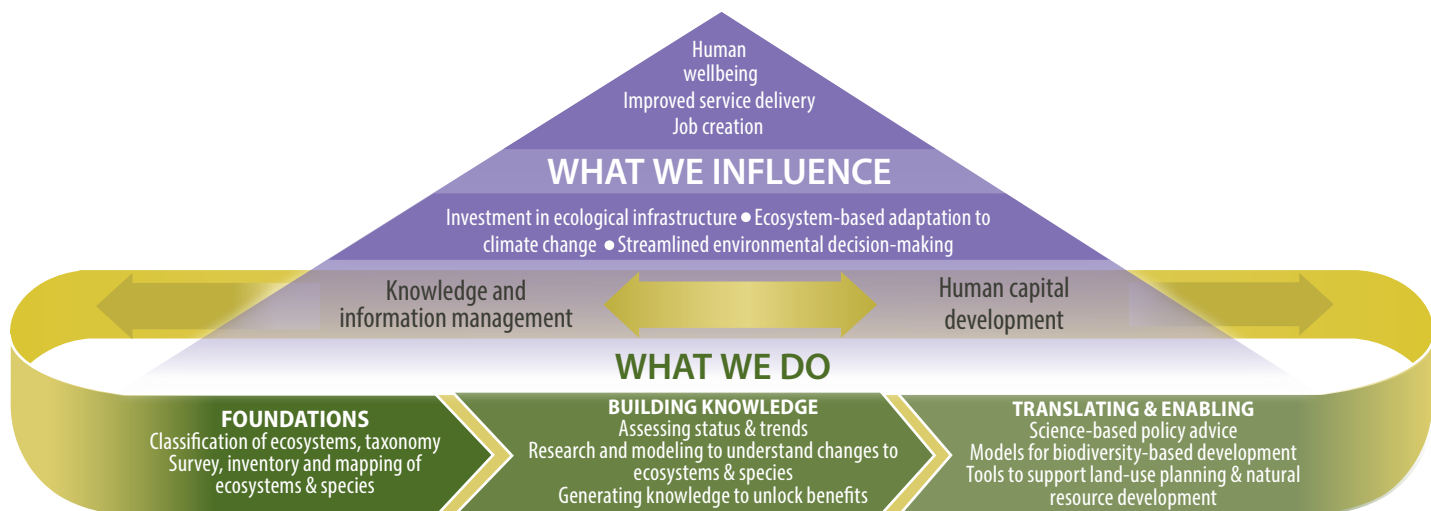
We begin with a strong foundation of mapping and surveying South Africa's ecosystems and species. We answer questions like: What is out there? Where is it located? How many are there?

Then, because we can only use biodiversity information effectively if it is ordered in a systematic way, we name and classify our biodiversity according to international systems. In the case of species, we have done this for a long time but we are always looking for new tools to improve our systems. Classification systems for ecosystems are quite new and we have been experimenting and testing systems that we can use to better understand our biodiversity.

We build on this foundation, through analyses, experiments and modeling to answer questions about the status of our biodiversity, the best ways to protect it, and its benefits to society. Having this knowledge we can look at different scenarios, e.g. for development or climate change, and create tools that assist those who make decisions about land use and natural resources.

We combine this knowledge to help government to make science-based decisions aimed at improving human wellbeing. How can we develop our economy without losing natural resources? How can biodiversity help us adapt to climate change? What ecological infrastructure is needed for ecosystem services? How can biodiversity contribute to our dire need for jobs for the unemployed?

And finally, we have two golden threads that run through all our work – the need to manage biodiversity knowledge and information so that it is accessible and the need to build human capacity so that there is an ongoing flow of knowledge.



How we deliver on our mandate: our network of partners

SANBI's mandate is broad and ambitious. From the beginning, the SANBI Board agreed that we should achieve our goals through close partnerships with other organisations in the biodiversity sector. As a result, we seldom work alone – by leading or partnering with a diverse range of organisations, universities and citizen scientists, we are able to generate biodiversity information and knowledge that contributes to the value chain.



Our work today: SANBI's footprint in biodiversity science

The range of SANBI's work has extended considerably from its inception in 2004. Today, SANBI's scientific work includes work on: plants and animals (birds, reptiles, insects); indigenous threatened species as well as invasive species; terrestrial, freshwater and marine ecosystems; ecosystem services; the impacts of climate change on biodiversity; the role that biodiversity can play in enabling us to adapt to climate change; as well as the social and economic aspects of securing a sustainable future. In all our work, we want to make an impact and we are constantly responding to new scientific demands, or initiating new directions in biodiversity science.



**Our
work
today**



WHO WE ARE

We are about 62 science researchers, who mostly form part of SANBI's Biodiversity Research Knowledge Management Branch.

SANBI is a multifaceted organization with garden programmes, horticulture, environmental education, policy and planning as well as science programmes. Within this bigger context, we have about 62 scientific staff who contribute to the spectrum of our scientific work from surveys and monitoring, assessments, undertaking and coordinating research, synthesizing knowledge for decision-makers and making knowledge accessible to users.

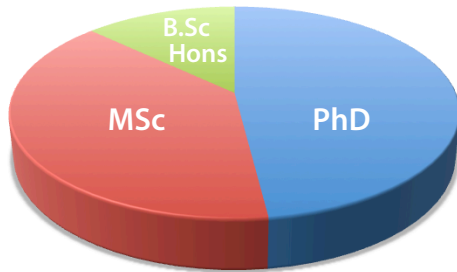
Most of our research is carried out in three divisions that focus on biosystematics and taxonomy, applied biodiversity science and climate change, but our horticulturists also contribute to knowledge generation, especially about the flora of South Africa. One of the unique attributes of our work is that, in addition to generating knowledge, we have a strong focus on translating science into policy and we have programmes and staff dedicated to developing tools, synthesizing scientific knowledge, and engaging with policy and decision-makers.

Here we highlight some of the outstanding features of SANBI's scientists.



We have excellent scientists

SANBI's position as a leader of biodiversity science in South Africa, as well as our international standing, is strongly dependent on the quality of our people. Almost half of our scientists have PhDs (48%), a further 39% have an MSc and 13% have an Honours degree.



University of Pretoria

Prof Gideon Smith



Prof Neil Crouch
Associate Prof Michelle Hamer
Prof Guy Midgley
Prof John Manning

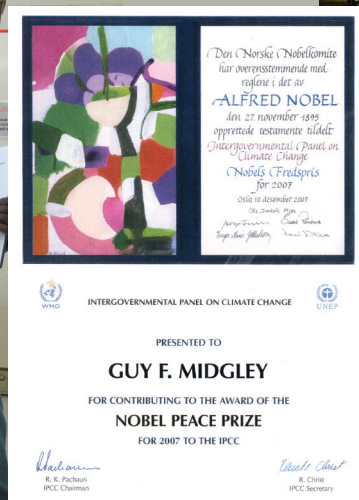


Prof John Donaldson
Associate Prof Res Altwegg
Prof Brian Huntley (retired)



UNIVERSITY of the WESTERN CAPE

Prof Charles Musil (retired)



Our scientists have been recognised at home and internationally

The quality of our scientists has been recognized by the universities we work with. Nine of our scientists have been appointed as honorary professors and associate professors at four South African universities.

Dr Anthony Magee: Senior Scientist, Compton Herbarium, SANBI



There is still so much work to be done in taxonomy... and SANBI is an ideal place to do it from.

Naming, describing and classifying plants according to a common system underpins all biodiversity research. We would not be able to identify invasive alien species or assess the threatened status of our plants if we did not have names and a classification for them. We would not, in turn, be able to understand their ecology and geographic distribution, evolutionary history, or what makes them successful.

South Africa is the third most megadiverse country in the world with a whopping 10% of the world's plant biodiversity

and up to 100 new species described each year. Estimates suggest that 10-20% of plant species still remain undescribed and most of these are likely to be threatened with extinction.

Much of South Africa's plant biodiversity is found in the winter rainfall areas of the Western Cape, where SANBI's Compton Herbarium is situated. One of the most prestigious herbaria in the country, the Compton Herbarium currently houses approximately 750,000 specimens.

So joining the Compton Herbarium in 2009 was as close to taxonomic heaven as Dr Anthony Magee could get. Despite his early plans to become a marine biologist, having started scuba diving with his dad pretty much as soon as he could swim, an astute lecturer steered him towards taxonomy during his undergraduate degree. This soon led to a *MSc cum laude* (Botany) in 2007 and two years later, in 2009, a PhD (Botany), both from the University of Johannesburg.

With his PhD in hand, he was ready to move down south.

Anthony's initial research interests were centred on the taxonomy and systematics of the early, largely African, lineages of Apiaceae. This large family of mainly aromatic plants with hollow stems, commonly known as the carrot or parsley family, is spread worldwide. Many of the plants are a source of food for humans, and therefore of economic value. These include carrots, fennel and parsnips. Some plants are used for spices, such as coriander and cumin. Other plants in this group are toxic to humans, and as Socrates knew, some, like hemlock, kill.

Anthony's work contributed to the growing body of evidence showing that the roots (*sic*) of the largest and most important lineage of this family originate not in the Northern Hemisphere as previously thought, but in Africa. Its evolutionary spread began here, moving to Europe, the East and the Americas. The conclusions drawn from studying the evolution, diversification and biogeographical history of the African Apiaceae have highlighted the importance of the African and Malagasy taxa and resulted in considerable changes to the new emerging classification of the family. His research has also positioned Anthony as an authority on the subject.

Only 31 years old, he has published 30 scientific articles, all in international ISI accredited journals, presented over 20 papers at national and international conferences and has been awarded the Junior Medal for Botany from the South African Association of Botanists as well as the Bronze Medal from the South African Academy for the Advancement of Science.

Anthony's interests now lie with the Asteraceae, or daisy family, and more recently with the flora of the Nama Karoo and its origins and diversification.

Asked whether the discipline requires a slightly 'obsessive' personality, Anthony laughs. *"You certainly have to have good pattern recognition skills. And you have to have a love of order and arrangement, because when you start the work, it's often a complete mess. And of course, accuracy and attention to detail are crucial. Ahem, as I was saying ..."*

Our science has been recognized through many prestigious national and international awards:

The National Science and Technology Forum award for institutions (2004) was awarded to the Kirstenbosch Research Centre for outstanding contributions to science and technology.

The Marloth Medal from the Botanical Society of South Africa was awarded to **Prof John Manning** (2005) for producing scientific and popular literature to stimulate public interest in the indigenous flora of southern Africa.

The University of KwaZulu-Natal Convocational Award (2006) was given to Prof John Manning for outstanding contributions to science, industry and technology.

The Silver medal of the South African Association of Botanists (2006) was awarded to **Prof Gideon Smith** for significant contributions to the advancement of botany.

The South African Academy for Science and Arts awarded its Medal of Honour for Natural Sciences and Technology (2007) to **Prof Gideon Smith** for outstanding research and other contributions to the advancement of science.

The South African Academy of Science medal for scientific merit and leadership (2007) was awarded to Prof Gideon Smith.

The Nobel Peace Prize (2007) was awarded to the Intergovernmental Panel on Climate Change and **Prof Guy Midgley** was recognized for his contribution to the IPCC's work that led to them receiving the award.

Fairchild National Tropical Botanical Garden (USA) (2008) elected **Prof John Donaldson** as a research fellow in recognition of his work on cycads.

The Society for Conservation Biology (Africa section) awarded the Young Women's Conservation Biologists' Award for Professional Women to **Ms Kristal Maze** for her role in national biodiversity planning, management and policy advice (2007).

The Silver medal of the South African Association of Botanists was awarded to **Dr Sarie Perold** (2010) for her contributions to botany in South Africa.

The Royal Academy for Overseas Sciences of Belgium appointed Prof Gideon Smith as a corresponding member of the Academy (2010) in recognition of his work in plant systematics.

CEO Magazine (2011) named **Dr Kerry Sink** as one of the most influential women in business.

The South African Association of Botanists awarded the Junior Medal for Botany (Bronze) to **Dr Anthony Magee** for the best PhD Thesis (2011).

The United Nations Convention on Biological Diversity accepted SANBI as the 16th member of the Consortium of Scientific Partners of the Convention (2011).

Green Matter Fellowships were awarded to **Tuli Jaca, Tanya Lane** and **Prideel Majiedt** (2012/2013).



Tlou Masehela: PhD Researcher: Pollination & Ecosystem Services

(Honeybee Forage Project) – a joint project between SANBI and the University of Stellenbosch's Department of Conservation Ecology & Entomology.



To be surrounded by quality individuals, people whose names you have often just seen in books and papers, you start to realise that you are going somewhere as a scientist . . .

Like most of us, Tlou Masehela grew up afraid of bees. He knew quite a lot about indigenous plants, their fruits and medicinal properties, as his grandfather was a traditional healer. But bees were just things that stung you and made you sore. So when the opportunity arose to pursue a PhD about the ecosystem services that the South African beekeeping industry depends on, Tlou had to put aside his fears and rise to the challenge.

'Ecosystem services' is a term scientists use to describe some of the tangible benefits that biodiversity gives to humans. Worldwide, honeybees represent only a small fraction of known bee species. They are however easy to manage on the scale needed to supply the commercial pollination service for large scale crops and are therefore recognised as the most dominant and important commercial insect pollinator.

About a third of the food we eat daily relies on insect pollination, with honeybees being the major pollinators. Without honeybees, there would be limited pollination, resulting in decreased food variability for human diet . . . eventually impacting negatively on human life. So increasing our knowledge of the needs of honeybees for viable foraging resources assists us to maintain this ecosystem service.

Tlou's relationship with SANBI's science programmes began after he graduated with a BSc Honours from the University of Limpopo in 2008. As a young man, he had hoped to be a paramedic, saving people, but had not realised how stiff the physical exam was . . . and was not successful. He turned to the world of plants, and eventually 'fell in love with it'.

After his Honours, he applied for an internship at Kirstenbosch, and 'to his surprise', he says modestly, was accepted as an intern, working under Dr Colleen Seymour and Dr Ruan Veldtman, both of whom were interested in agricultural crop pollination at the time.

With the support of his SANBI mentors and full funding from SANBI, Tlou later completed his Masters degree at the University of Limpopo, looking at how the vegetation of a particular set of koppies in his home province provides ecosystem services to the local people. Now he has progressed to doing his PhD through Stellenbosch University.

He describes his five and half years so far with SANBI as 'wonderful'. *"SANBI invests a lot in its researchers, sending you on all sorts of courses to improve your work and build your confidence. You become part of a large network, and have great links and support."*

We grow excellence in others, and contribute to South Africa's transformation needs

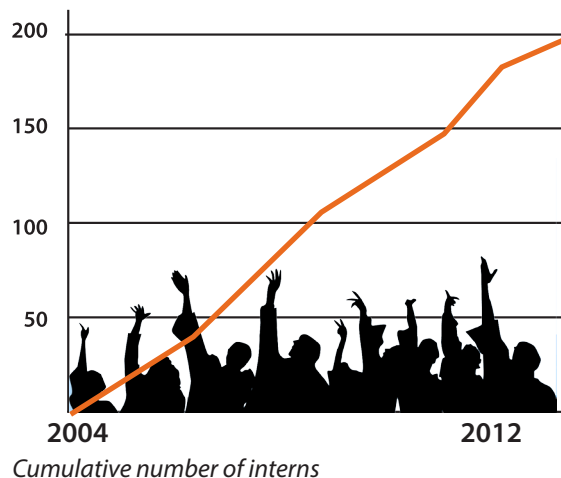
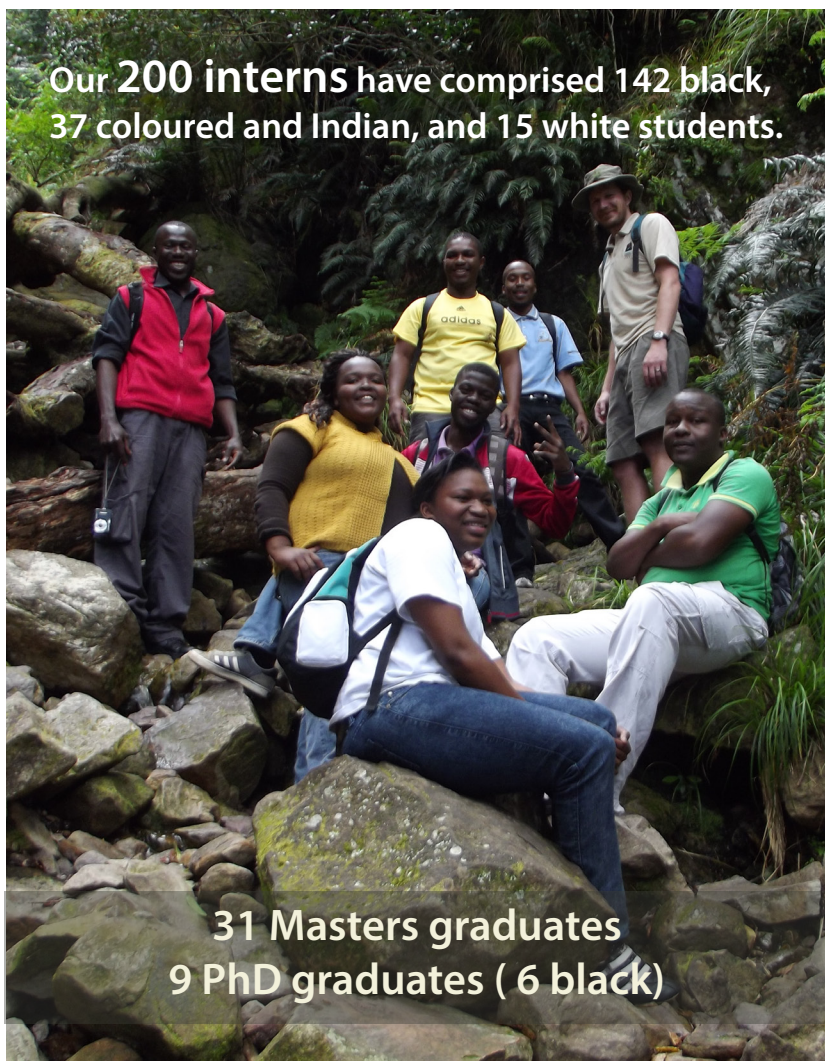
Building human capital in the biodiversity sector is one of the golden threads that runs through all SANBI's activities. We are especially proud of the role we have played in developing the careers of young scientists, particularly black scientists.

One of our success stories is our science internship programme – we have appointed 200 interns since 2004. The programme started in 2000 specifically to attract young black scientists and expose them to a career in biodiversity science. We started with two applications for internships and we now receive more than 100 applications for our internships.

Our focus has been on training a group that reflects the demographics of our society and our 200 interns have comprised 142 black, 37 coloured and Indian, and 15 white students.

Our scientists have co-supervised higher degrees with various universities, resulting in 31 Masters and 9 PhD graduates since 2004. Six of the 9 PhD graduates were black scientists.

For us, the ultimate success is when our interns continue to build their careers in SANBI either through higher degrees or by taking up positions within our various programmes. One such example is Tlou Masehela.



Domitilla Raimondo: Manager: Threatened Species Programme, SANBI



SANBI has been a very enabling environment for me to carve a career in conservation, especially in assessments . . . it is very much part of our mandate and function.

Joining SANBI in 2003 was perfect timing for Domitilla Raimondo. A recent University of Cape Town BSc Honours graduate with a love of rare and weird plants, she was looking to forge a career in science that was not purely academic.

The following year, the new National Environmental Management Biodiversity Act was promulgated, which mandated SANBI to do applied research, such as conservation, as well as pure research.

"It was pretty exciting because we were really thrown in the deep end," recalls Domitilla about that time. "At that point, only a few SANBI scientists were working in conservation, such as Prof John Donaldson, who was doing conservation farming. I was lucky enough to join his new project that was aimed at conserving the Western Cape's threatened and rare plants."

Called **Custodians of Rare and Endangered Wildflowers (CREW)**, the project brought two new challenges for SANBI, which aligned perfectly with its new applied science mandate.

Firstly, it introduced the concept of working with 'citizen scientists', and secondly, it moved away from pure research to the actual implementation of conservation programmes.

The CREW project in the Western Cape was a success, leading to a national project that Domitilla headed until 2006, when she began the mammoth task of creating the **Red List of Threatened Plants** in South Africa. Working in collaboration with hundreds of scientists and non-scientists, the Red List took three years to compile and represents an up-to-date assessment of South Africa's entire flora.

You would think that after such a big task, Domitilla would next opt for a slightly less onerous project. *"Unfortunately, my mentors at SANBI have mastered the art of getting us to be very productive," she mock sighs. "Taking a rest is not an option . . ."*

Domitilla is now engaged in making sure that the plants on the list are actually conserved. *"And oh, yes, I'm also working on compiling Red Lists of Animals . . ."* she adds as an afterthought. *"We're publishing one on butterflies and reptiles this year."*

We strive for equitable representation of women and black scientists

We want our science programmes to reflect the demographics of our society. Women have consistently made up >50% of our scientific staff from 2004 onwards.

Our proportion of black scientists has grown from 21% in 2004 to 34% in 2013 and we would like to see this improve as we continue to grow.



Where we work

Our scientists and support staff are spread throughout the country. Most are based either in Pretoria or Cape Town where our key facilities are located, but we also have research facilities in Durban and some research also takes place in our network of botanical gardens. Some of our key facilities for supporting science are:

- The **National Herbarium**, that contains more than a million plant specimens and is the largest herbarium in Africa and the fourth largest in the southern hemisphere.
- The **Kirstenbosch Research Centre** in Cape Town, that houses the Compton Herbarium (with approximately 750 000 specimens), the Leslie Hill Molecular Laboratory, and physiology and GIS facilities.
- The **KwaZulu-Natal Herbarium** in Durban.
- The **Mary Gunn Library** in Pretoria and the **Harry Molteno Library** in Cape Town.
- Greenhouses with scientific equipment (such as for climate change studies).
- Databases, including the largest computerised botanical database (PRECIS) in Africa and all the vegetation records.



What we have done

- our outputs from 2004-2013

Our outputs from 2004 to the beginning of 2013 have been substantial and it is not possible to discuss them all here. We present just the highlights of some of our products and projects. To find out more, visit www.sanbi.org

We produce reports of various kinds, for example, assessment reports on the national state of biodiversity, on natural history collections, on the status of species such as cycads and rhinos;

We produce tools, such as online checklists and red lists (of plants, insects etc), and other biodiversity interactive websites;

We coordinate and produce atlases and maps, such as the *Vegetation Map of Southern Africa*, marine maps, animal atlases;

We coordinate strategies and policy inputs such as research strategies for biodiversity and biosystematics, conservation strategies, and inputs into policies for threatened species, fisheries, stewardship, climate change, and the management of natural resources;

We publish widely, including scientific and popular books, booklets and articles, conference proceedings . . .

and much more.

This selection of our work showcases the diversity of our outputs. Included are some statistics on publications as well as examples of our major products.



Our publications

Publications are an important output from our work and every year we publish checklists, red lists, popular books and booklets, scientific articles, popular articles, maps, technical reports, and assessments. All are important – what we publish in popular media (magazines, websites) makes biodiversity knowledge more accessible to the general public; our scientific work can be subjected to peer review and thereby strengthen the knowledge base for decision-making, and our policy-level publications make information accessible to policy makers.

From 2004, we have written 2700 articles, including 1115 peer-reviewed scientific papers, 807 papers in ISI rated journals, 81 books and more than 1000 popular articles.

Books

Our staff have produced 81 books between 2004 and 2013.

36 Field guides and popular books

21 Taxonomic treatments

24 Applied Books



Zuzi Jonas: Climate Change Conservation Planner, SANBI



SANBI gives me the opportunity to be a scientist and still stay in touch with the world of technology . . .

"My father was always showing us which plants were indigenous, which had to be cleared out, which could be used as medicine . . ." is Zuzi's way of explaining how she went from a very rural childhood in the Eastern Cape to doing a PhD on climate change and ecosystem services as a basis for ecosystem-based adaptation at an integrated catchment management level.

Given her home-grown background in botany, Zuzi's decision to do a BSc seemed to flow naturally. After graduating in 2001 from the University of the Western Cape with Honours, Zuzi, then 25, joined SANBI's Succulent Karoo Ecosystem Project as an MSc student registered at University of Cape Town. Here, she was able to continue her interest in botany, researching how to conserve the unique landscapes of this biome. Within the first five years of its life, the project had doubled the amount of land under conservation, improved the management of land, reinforced seven ecological corridors, created jobs and involved the wine, rooibos and potato industries in conserving and developing this area.

After completing her MSc degree, in January 2004, she joined SANBI's Research Division as an intern in the Conservation Planning and GIS unit led by Dr Mathieu Rouget.

Zuzi explains that she joined SANBI because it gave her the dual opportunity to follow two of her deep interests: science and technology. *"I'm referring specifically to using the geographic information system (GIS) tool, which is a tool we scientists play with to collect geographic data and analyse it. I was lucky enough to be part of the First National Biodiversity Assessment in South Africa in 2004, under supervision of Dr Mathieu Rouget, now Professor at the University of KwaZulu-Natal, where I led the vulnerability assessment of vegetation types in South Africa. Prof. Mathieu really had a passion for working with interns, and I learned a lot of technical skills from him."*

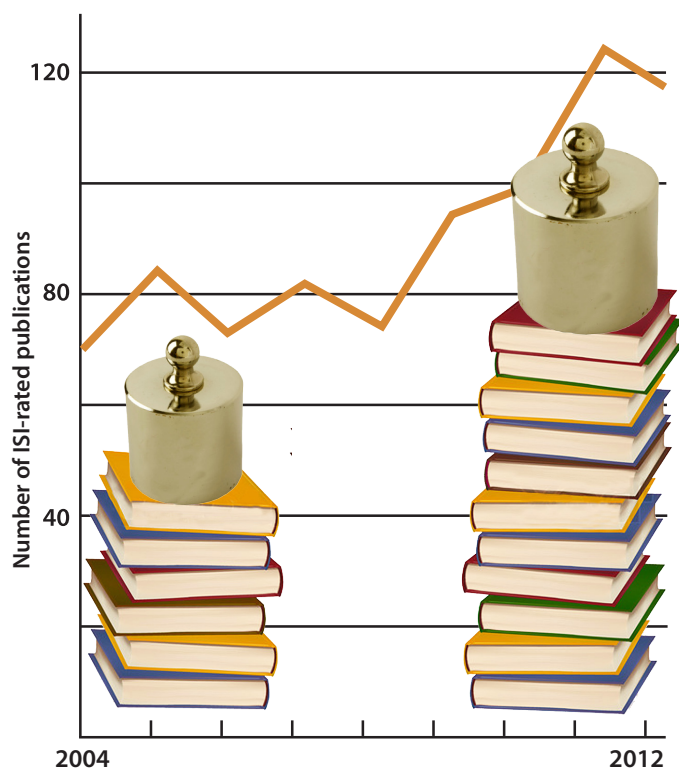
Zuzi is also passionate about how research translates into policy and then into implementation. Developing policy is one of the legislative requirements that SANBI must fulfill. Zuzi has been involved in various aspects of this work under the supervision of Prof. Guy Midgley, and is currently doing research and co-ordinating projects on ecosystem-based climate change adaptation.

Research papers

We measure our productivity and impact in a variety of ways. One measure is the number of peer-reviewed scientific articles and SANBI staff published 1 115 peer-reviewed papers from 2004-2012. Our objective is also to increase the impact of our work and one measure is the impact factor of the ISI rated journals we publish in, based on the number of times articles in these journals are cited. During this period, we published 807 papers in ISI rated journals, of which 290 papers were in journals with an impact factor >2 and 21 were in highly ranked journals with an impact factor >10, including *Science* and *Nature*.

Our impact can also be measured in the number of times our work is cited. As an example, our publications on climate change are being cited more than 1 500 times a year.

We have seen a general increase in our peer-reviewed publications since 2004 with a noticeable growth in contributions to ISI rated journals and to journals with a high impact factor. As an example, in 2004, we published 66 articles in ISI rated journals compared to 125 in 2011.



The combined impact factor of all our publications has increased.

Other major products

African Plant Checklist and Database

The *African Plant Checklist* and Database provide the first ever complete checklist of flowering plants together with a database of these plants for the continent. The sub-Saharan component of the checklist was published as part of the SABONET Report series (No. 42, 2006), resulting in a 892 page book. The complete database is available online at <http://www.ville-ge.ch/musinfo/bd/cjb/africa> in a searchable platform hosted by CJBG and is regularly updated.

It currently comprises 191 762 names of African plants with their nomenclatural status, synonyms, bibliography, ecology and distribution, a distribution map and links to other online resources related to the name.

This huge project was a collaboration between SANBI and the Conservatoire et Jardin Botaniques de la Ville de Genève, Switzerland (CJBG), and later also Tela Botanica and the Missouri Botanical Garden.

Why is it important?

This first global checklist and database for the flowering plants of Africa provides a single repository for information on the flowering plants of the continent. For the first time, accurate baseline statistics for the flora of Africa is available, indicating that the continent (including Madagascar) is host to over 76 000 plant taxa, of which over 50 000 occur in sub-Saharan Africa.

Who can use it and what for?

The online database contains important information about each flowering plant in Africa and it is an indispensable tool for everybody involved in botanical, taxonomic or ecological research on the continent.

Barney Kgope: Director: Carbon Sinks Mitigation in the Climate Change and Air Quality Branch, Department of Environmental Affairs

As raw as I was straight from university, SANBI carved and sharpened me, gave me confidence, created the networks I work with today... I will always have a weak spot for SANBI.



Barney Kgope's journey with SANBI began with a chance interview that he saw on the environmental TV programme '50/50'. Barney, then 24, was an MSc student at Rhodes University working in plant ecophysiology. The person being interviewed was Prof Guy Midgley, then an ecologist at SANBI, and now one of the world's experts in global climate change-related ecological research.

Barney's parents had always wanted him to be a doctor (or a lawyer, failing that). Not a scientist. So a short-term compromise was for him to register for a BSc with the possibility of pursuing a medical career later.

Fascinating lectures on the ecology of grasslands, the role of fire in Africa and plant physiology sparked Barney's imagination, confirming for him that his heart lay in the sciences, much as he would have liked to please his parents. Seeing Guy talk on TV about the effects of high carbon dioxide levels on grasslands inspired Barney to write to Guy, telling him of his shared passion. So began a correspondence that eventually saw Barney being invited to be a researcher under Guy's mentorship at SANBI.

Barney recalls: *"I realised immediately that this was the kind of work I wanted to pursue. I didn't want to be a doctor at all. I also knew that working at a research institute would give me the kind of experience I needed to create a career in science. At first, I was terrified to be working with so many brilliant scientists. Guy Midgley, Mike Rutherford, John Donaldson, Tim Hoffman, William Bond, Charles Musil and Bob Scholes, to mention a few. It was intimidating to look at their achievements, but then I realised how willing they were to share their knowledge with me, to mentor me and help me grow.*

I was also at SANBI at the time that South Africa was compiling the first National Climate Change Strategy. SANBI provided major inputs to that strategy, and I was really lucky to be part of that."

Barney left research to follow his next passion: conscientising the business sector about the challenges of climate change. Although business is a major source of the problems and impacts and despite sincere individual efforts to deal with it, there was no consolidated forum for addressing these issues.

Using many of the networks and strategic people he had met through SANBI, Barney, together with colleagues at the National Business Initiative, set up South Africa's first business workshop on climate change. He also worked with the National Business Initiative, the CSIR, University of Pretoria and some major South African companies to facilitate a pilot study on the relationship between climate change and health, the findings of which could assist the medical aid industry, for example, in planning for the future.

Today, a decade after joining SANBI, Barney is based at the Department of Environmental Affairs in Pretoria, heading up the carbon sinks mitigation programme.

The Red List of South African Plants (2010)

This is a comprehensive, up-to-date book giving the status of 20 456 plant species in South Africa, including 13 625 endemics. The Red List is now available online at <http://redlist.sanbi.org>.

This massive project took several years and the participation of hundreds of scientists to compile. South Africa is the first megadiverse country in the world to fully assess the status of its entire flora using the International Union for the Conservation of Nature's (IUCN) Red List system, widely regarded as the gold standard for Red Listing. To get a sense of the impact of this project, our list from South Africa doubles the number of plants currently listed on the IUCN global Red List.

Why is it important?

It is the first complete picture of the status of South Africa's indigenous plants.

It shows that 2 577 of South Africa's wild plant species, or 13%, are threatened. A further 2 232 plant species are listed under other categories of conservation concern. We urgently need to conserve 24% of our total species, or one in every four species. Five species have been listed as extinct for the first time in this list.

Who can use it and what for?

The tool helps government to make policy decisions about land-use, and critical biodiversity areas to protect. It is widely used by EIA practitioners.



Yashica Singh: Curator at the KwaZulu-Natal Herbarium, SANBI



There's a shortage of young scientists in biosystematics today . . . so the opportunities are huge.

Yashica Singh likens her work at SANBI's KwaZulu-Natal herbarium to the investigations of forensic scientists on TV crime programmes.

"I love the detective work," she says. Like the CSI scientists who conduct forensic research on humans to unveil mysteries, scientists at herbaria look for the same clues in plants: Where do they come from? Which family do they belong to? Is this a new species? Has this been found in this region before? What is the evolutionary history of this plant?

Answering questions such as these becomes possible when plants are systematically documented over time. While not the oldest herbarium in the world – those date back to 1570 – the KZN herbarium was established in 1882 by John Medley Wood. His foresight laid the basis for the 120 000 specimens currently collected and housed at the herbarium.

Yashica laments the lack of young scientists going into biosystematics. Many BSc students are rather opting for careers in conservation. Perhaps they are not aware of the international nature of biosystematics: herbaria staff are part of a global network, exchanging knowledge and specimens year round.

"It's been wonderful to be part of this supportive family around the world for the last twenty years," she says.

The Vegetation Map of South Africa, Lesotho and Swaziland (2006), and the accompanying book

South Africa's last major publication of a vegetation map for the country was Acocks Veld Types from 1953 – a work that became the backbone of much of the ecological work in the country. In 2006, we published a substantially revised version of this important work, the culmination of 10 years of work, co-led by SANBI scientist Dr Mike Rutherford and Professor Laco Mucina of the University of Stellenbosch.

The book, called *The Vegetation Book of South Africa, Lesotho and Swaziland*, has maps and text referring to the 435 vegetation types in the region. An online interactive map and report is available on <http://bgis.sanbi.org/vegmap/project.asp>.

Around 100 scientists, drawn from South Africa, Lesotho, Swaziland, and around the world, contributed to this massive project.

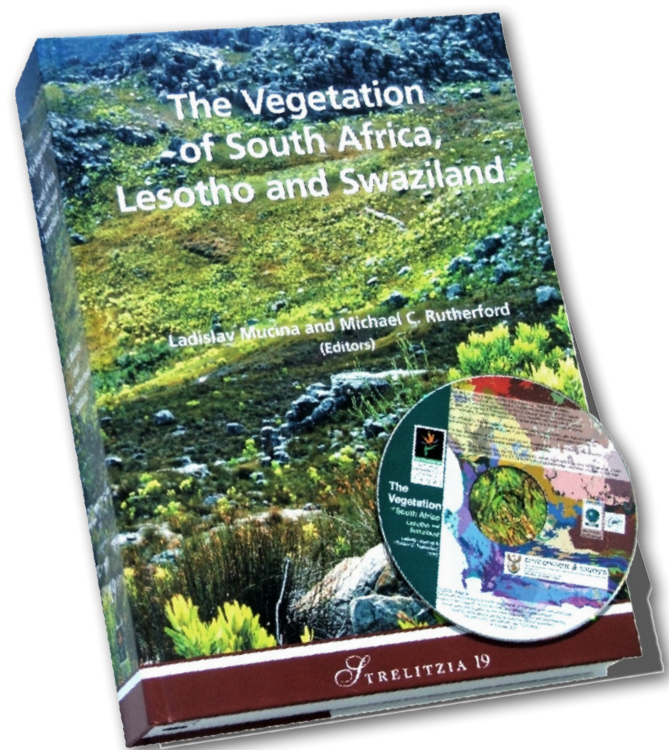
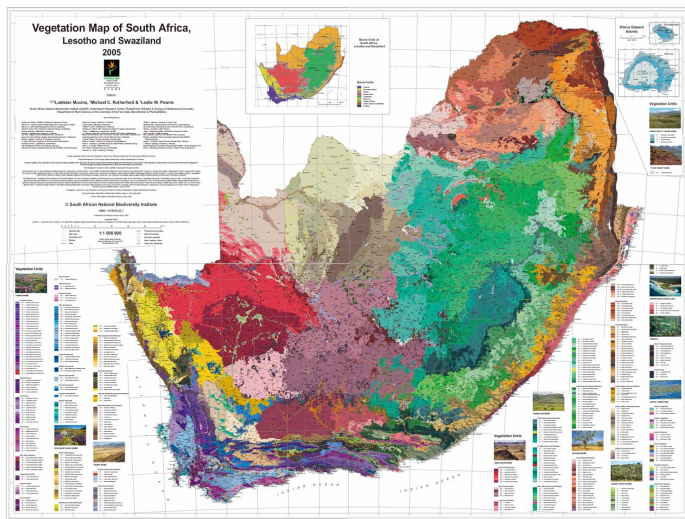
Why is it important?

This work effectively provides the first form of ecosystem classification for the terrestrial part of the country and is essential for biodiversity planning and conservation. It comprised collating and analysing vegetation information at a national scale and provides a much finer scale of resolution than previous maps. The map is scaled at 1:1 million, which allows much more detail to be shown.

The map includes the Prince Edward islands for the first time.

Who can use it and what for?

Both the map and book are invaluable as basic resources for ecological research, conservation and land-use planning, resource assessments, and ecotourism. The vegetation types form the basis for the assessment of terrestrial ecosystems and the demarcation of threatened ecosystems in the country.



National Biodiversity Assessment (2011)

The National Biodiversity Assessment, jointly published by the Department of Environmental Affairs and SANBI, is a follow up to the National Spatial Biodiversity Assessment, which SANBI led in 2004. This is a comprehensive assessment of South Africa's biodiversity and involved more than 200 scientists and practitioners from around 30 organisations and took three years to complete. SANBI led the assessment in partnership with the CSIR, SANParks and the Department of Environmental Affairs.

Tool produced

A detailed report, maps, synthesis reports, technical reports, jpegs of maps, graphs and diagrams and spatial data that provide an up-to-date assessment of our terrestrial, freshwater, estuarine, coastal, marine and wetland environments, as well as areas that are important for climate change resilience, species of special concern and invasive alien species.

Available on <http://bgis.sanbi.org/nba/project.asp>.

Why is it important?

The assessment provides the foundation for ecosystem-level assessment, monitoring, planning and management and represents huge progress in mapping and classifying ecosystems.

It extends South Africa's mapping of vegetation types to include marine, coastal, river, wetland and estuarine ecosystem types.

Who can use it and what for?

The scientific data collected and analysed in the National Biodiversity Assessment is a key input for the National Biodiversity Strategy and Action Plan, which is being prepared for publication in 2013, and the subsequent National Biodiversity Framework. These documents all aim at improving biodiversity management in South Africa. They are also used in spatial management decision-making and EIA reporting, ensuring sustainable development in industry.

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National Biodiversity Assessment 2011
An assessment of South Africa's biodiversity and ecosystems
Synthesis Report

Department of Environmental Affairs
SANBI

The Biodiversity Advisor

This is an online facility that provides a single access point to all biodiversity information held by SANBI or managed by SANBI on behalf of our partners. It includes information on species and ecosystems as well as a range of tools to integrate information and make it accessible to different user groups. (<http://biodiversityadvisor.sanbi.org>)

Why is it important?

It provides an authoritative source of scientific information on biodiversity to support a wide range of activities including policy and decision-making, research, environmental impact assessments and spatial planning.

Who can use it and what for?

The information is accessible to anyone. It can be used for the whole continuum of activities from monitoring and assessments, research, through to management and decision-making. It includes tools specifically aimed at EIAs, land-use planning and education, and a large percentage of users come from academic institutions.

South Africa's Second National Communication on Climate Change (2011)

As a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), South Africa is required to submit regular reports. SANBI was instrumental in compiling this report, as well as coordinating research, in support of the Department of Environmental Affairs' activities undertaken to meet its obligations under the convention.

SANBI scientists were among the first in South Africa to conduct climate change research, beginning in the 1990s with small-scale pilot experiments. These early studies were published in high-ranking journals and resulted in SANBI being considered one of the leading research groups studying climate change in South Africa.

As SANBI's mandate changed in 2004, SANBI strengthened its climate change programme to provide greater science support to national and international science policy initiatives.

Tool produced

This report (or communication) informs the international community about climate change issues affecting South Africa. The issues discussed include emission and removal of greenhouse gases, vulnerability assessments, technology transfer, education, training and public awareness on climate change issues, and information on policies and adaptation measures. (see <http://unfccc.int/resource/docs/natc/zafnc02.pdf>).

Why is it important?

South Africa needs to be in a position to manage the possible harmful effects of climate change. The report provided key information for government to draft a White Paper on a National Climate Change Response Policy, which aims to:

- mitigate our contribution to greenhouse gases and emissions, and
- enable us to transition to a climate-resilient and low-carbon economy and society, and
- enable adaptation strategies to combat adverse climatic effects such as increased food insecurity and disease resulting from changes in rainfall patterns and increasing temperatures.

Who can use it and what for?

The report formed part of the Department of Environmental Affairs key international submission to COP 17. In addition to government, it provided important guidance for anyone involved in urban planning, water management, energy, agriculture, and business. The report also forms the basis for subsequent reports that will build on this information.

Some of our major projects over the past decade

Foundations of Biodiversity Science

The SABONET project (Southern African Botanical Diversity Network) started before the advent of SANBI but continued until ~2006. Its objectives were typical of what is needed to build the foundations of biodiversity science – to develop a strong core of professional botanists, taxonomists, horticulturists, and plant diversity specialists within the ten countries of southern Africa, to equip them with the skills to inventory, monitor, evaluate and conserve the botanical diversity of the region and to respond to the technical and scientific needs of the Convention on Biological Diversity. The reviewers of the project noted that it was a model for developing science in the region.

The African Plants Initiative (API) kickstarted work on the entire continent. The difficulty with identifying and naming organisms is especially acute in African countries where resources and facilities for taxonomic research are limited. In addition, natural history collections from Africa are often located in developed countries so they are not easily accessible to African scientists.

The API overcame this obstacle by scanning the type specimens in collections of African plants and then disseminating images so that researchers in Africa had access to this important material. SANBI has delivered over 30 000 images to JSTOR, which houses content delivered by over 270 herbaria from 70 countries to the Global Plants Initiative (<http://about.jstor.org/global-plants>).

The South African Bird Atlas project 2 is a good example of our working collaboratively with universities, NGOs and citizen scientists. We have been working with the Animal Demography Unit, based at the University of Cape Town, and BirdLife South Africa on this project, which involves hundreds of citizen scientists throughout the country.

The bird atlas provides us with a continually updated 'snapshot' of the range (extensions, reductions and shifts) and the relative abundance of birds in a particular area and enables us to see changes affecting other kinds of biodiversity (such as the effects of agricultural land use or climate change). This provides us with an important tool to support conservation planning, policy and management.
<http://sabap2.adu.org.za/>

iSpot southern Africa shows how we can work with citizen scientists using the internet to increase biodiversity knowledge. This is a joint project of SANBI and the Open University UK and provides a citizen science portal for southern Africa that allows people to learn about all our species. It is an interactive website, where people can post pictures, request identifications or information and run formal and informal courses on taxonomy and identification of plants, animals and fungi. It provides a virtual museum of information, verification hubs for surveys, atlasing and backyard biodiversity projects and a tool for biodiversity education. It provides a platform for recording interesting, unusual and range-extension observations on the national database. <http://www.ispot.org.za/>

CREW – the Custodians of Rare and Endangered Wildflowers – is another success story of working with citizen scientists. This project, now in its 10th year, is a partnership with the Botanical Society of South Africa and the KZN Biodiversity Stewardship Programme, and involves volunteer groups around the country who survey and monitor plant populations. Through CREW, we have discovered 24 new species, rediscovered 14 species thought to be extinct and collected data on 1 030 species. We have also produced a book on the Medicinal and Charm plants of Pondoland together with healers from Pondoland.

Building Knowledge for Managing Biodiversity

National assessments of spiders, reptiles and butterflies

is an example of collaborating with the managed network. We have been working with the Animal Demography Unit at the University of Cape Town, the Agricultural Research Council and other partners (e.g. the Lepidopterists Society) to survey and assess South Africa's arachnids (spiders and scorpions), reptiles and butterflies. We expect the conservation assessments for butterflies and reptiles to be published in 2013.



Developing a monitoring framework to assess the environmental impacts of Genetically Modified Maize

involved significant collaboration between SANBI, the Department of Environmental Affairs, several South African Universities, and colleagues in Norway with funding from the Norwegian government. The project focused on GM maize to explore how SANBI should respond to its mandate to monitor and report on the environmental impacts of genetically modified organisms released into the environment.

The **Early detection and rapid response** to invasive species illustrates a significant partnership between SANBI and the Natural Resources Management unit in DEA. The concept has far-reaching consequences for South Africa, i.e. if we can locate, assess and deal with invasive species before they spread and increase in abundance, we can save millions of rands in control costs. As part of this project, we are developing new tools for monitoring, assessing risks and for controlling species in the early phases of invasion.

The **Pollination Ecosystem Services** project forms part of a global collaboration to understand the contribution of natural pollinators and ecosystems to crop pollination. It is coordinated by the UN Food & Agriculture Organisation with funding from the GEF. We are leading the South African component and identifying what ecological infrastructure is required to support sustainable pollination services.

Exploring the impacts of raised CO₂ on South African ecosystems

– this is an excellent example of how our science can inform understanding. We carried out a series of experimental and field-based projects, together with academic colleagues, looking at responses of indigenous plant species to elevated CO₂. The results have changed how we interpret changes in vegetation, such as the increasing levels of bush encroachment in our savanna ecosystems, which seem to be at least partly driven by rising CO₂. As a result, bush encroachment will need more active management in future.

Translating & Enabling

The **ProEcoServ project** is an example of our work in strengthening the science policy interface regarding biodiversity and ecosystem services. This is a global project and the South African component is a partnership between the CSIR and SANBI, with the Department of Environmental Affairs chairing the project steering committee. The aim is to enhance the integration of ecological infrastructure and ecosystem services into national development planning and policy through building capacities for assessing trade-offs and development choices and for developing and applying relevant management tools.

Our **Support for the Scientific Authority** illustrates the role we play in collating and translating knowledge on plant and animal populations, and their role in the wildlife economy, into tools (sustainable use assessments), guidelines, and support for regulations.

Looking to the Future

The first ten years has seen the consolidation of science within SANBI, the continuation of important projects on plants, as well as the transition to an institution that can work with the entire biodiversity sector. The growth in our biodiversity projects, the increase in our science outputs and the increasing impact of our products are good signs for the future. We have several new initiatives which will contribute to our ongoing growth.



Growing our zoological work

In 2012, the SANBI Board approved a strategy to strengthen our zoological work. The immediate impact is that SANBI advertised five zoology posts to expand our work on animal checklists, wildlife trade, animal Red List assessments and population biology. We expect to see a rapid growth in outputs from these areas of work in the next ten years.



Growing our skills base

Growing our skills base is important as SANBI depends on a well capacitated sector to operate effectively. SANBI, with support from the Lewis Foundation, partnered with stakeholders to develop the Human Capital Development Research Strategy, now called GreenMatter, which drives transformation in graduate level skills for biodiversity. Looking to the future and our commitment to growing numbers of black scientists, SANBI also initiated Groen Sebenza, a Jobs Fund project involving 33 partner organisations. SANBI will host 106 young unemployed graduates and matriculants who will work with experienced biodiversity professionals to learn, grow and eventually gain the competence and confidence to embark on rewarding and meaningful biodiversity careers. This includes, developing careers in biodiversity science.

Increasing the impact of our work

We want to increase our impact across the entire value chain. SANBI is working with DST/NRF to build a Foundational Biodiversity Information Programme. We have led the development of a national biodiversity research strategy and we are consolidating our research, monitoring and assessment activities to align with this strategy, and we are engaged with various sectors to ensure that our knowledge informs policy and decision-making.

We see opportunities to mainstream best biodiversity management practices into strategies for building societal resilience to climate variability and climate change. These are increasingly called 'Ecosystem-based management approaches' to climate change.

We are developing several research themes along these lines, including a better understanding of the role that ecological infrastructure and services play in the economy and people's lives.

Our work will support an exciting new area of on-the-ground adaptation activity being developed by SANBI, in its role as South Africa's National Implementing Entity to the international Adaptation Fund.



Building science careers

To attract and retain good scientists, SANBI has developed a structured career path specifically for scientists. This means that our scientists can develop their careers by focusing on what they are good at without having to take on administrative or management responsibilities in order to get promotion. Our science career path takes into consideration, qualifications, experience and leadership as well as important outputs such as students, publications and contributions to policy.

Learning from our retired experts

We have had the privilege of some excellent scientists over the past decade and we don't want to lose their vast knowledge and expertise when they retire. This is especially important when our objective is to train a new generation of scientists. As a result, we have established a SANBI Fellows programme where our retired scientists can continue to contribute to the ongoing work of SANBI and the development of our young scientists.





