Biodiversity protection

National Biodiversity Assessment – Testing the integrity of our freshwater ecosystems

The current, nationwide drought has not only underlined the importance of water to South Africans, it has also emphasised the need to protect our freshwater ecosystems. The Third National Biodiversity Assessment – to be completed in 2018 – is assessing the threatened status and protection level of South Africa's freshwater and estuarine ecosystems.

Article by Heidi van Deventer, Lara van Niekerk, Lindie Smith-Adao, CJ Poole, Jeanne Nel, Chantel Petersen and N Collins.

Intact freshwater and estuarine ecosystems sustain food and water security to many people and organisms in South Africa. Degraded ecosystems, on the other hand, result in an increase cost for water filtration and purification as a result of eutrophication and chemical pollution or because of an increase in suspended solids, and in general can result in a loss of income and sense of aesthetics and value. In fact, in light of the recent drought, the President of the Republic of South Africa, President Jacob Zuma, issued a Cabinet Statement on 9 June 2016 that "Team South Africa is encouraged to participate in the cleaning up of rivers, streams and wetlands on 18 July, as part of South Africa's annual Mandela Day activities."

But how do we know how we are faring as far as the general health of our freshwater systems are concerned? Securing the ecosystem services that freshwater and estuarine ecosystems provide, requires a proper inventorying, assessment and monitoring of these ecosystems over time.

A National Biodiversity Assessment (NBA) recognises the need to efficiently conserve a representative sample of ecosystem types and species in a natural or near-natural state as well as the ecological processes that allow them to persist over time. The assessment of the Ecosystem Threat Status as well as the Protection Levels of these ecosystems is essential for sustaining the benefits of these ecosystems and reducing the risks of losing ecosystem services.

The NBA of South Africa evaluates the status and changes in ecosystems at regular intervals and serves as the primary informant of National Biodiversity Framework, prepared and gazetted by the Department of Environmental Affairs (DEA) under the National Environmental Management: Biodiversity Act (10/2004); and of the National Biodiversity Strategy and Action Plan, prepared by DEA under the International Convention on Biodiversity.

The NBA2018 is currently under way, preparing for the

assessment across four environments comprising freshwater, estuarine, marine and terrestrial. In the first National Spatial Biodiversity Assessment only the quaternary main-stem rivers were assessed, whereas the 2011 assessment included main-stem rivers, their tributaries and wetlands.

For the estuarine ecosystems, the 2004 assessment evaluated estuaries based on available data, while the 2011 assessment developed a national health assessment method and a National Estuaries Biodiversity Plan for nearly 300 systems. Pressures such as flow modification, pollution and habitat destruction are systematically evaluated as part of the assessment.

The NBA2018 will include a focus on the status and genetic diversity of species, alien invasive fauna and flora, and impacts of climate change (Figure 1). Where possible, trend analysis will ascertain whether changes in the status of ecosystems or species occurred over time.

Realms→			Realms			
Themes↓						
Describe the range of Benefits of Biodiversity						
		Ecosystem				
	Describe Biodiversity	Species				
		Genetic				
	Describe Pressures on Biodiversity and their Trends over time					
	Assess the Status of biodiversity (Ecosystem Threat Status and Protection Level)		Terrestrial	Freshwater (Wetlands & Rivers)	Estuarine	Marine & Coastal
	Determine the Trends in biodiversity Threat Status over time					
Describe the range of Responses to Biodiversity Pressures						

Figure 1: Components of the National Biodiversity Assessment of 2018.

Any biodiversity assessment is dependent on the foundational data gathered during an inventory of the characteristics of the different ecosystem (Figure 2). The NBA2018 team is currently finalising the update of information related to the National Freshwater Inventory and attempting to address the tremendous underrepresentation of wetlands in the National Wetland Map.

For freshwater and estuarine systems, the classification system for wetlands and other aquatic ecosystems in South Africa will be used, which distinguishes between inland and marine aquatic ecosystems at the highest levels and further divides ecosystems into types at the lower levels. Similarly, information is also being collated on estuarine features and variables that will enable the refinement of the typing of South Africa's estuaries.

The NBA2011 stressed that a major gap was the lack of reliable information on the occurrence and state of South Africa's freshwater wetlands. Therefore, a major focus of the NBA2018 will be to improve on the occurrence, typing and condition assessment of the wetlands of South Africa.

As part of the inventory and classification process, artificial wetlands will be removed from the typing prior to dividing the natural wetlands into seven functional types including rivers, floodplain wetlands, depressions, channelled and unchannelled valley-bottom wetlands, wetland flats and seeps at Level 4A of the classification system. Further divisions include the regional settings and four landscape types (benches, slopes, plains and valleys) at Levels 2 and 3 respectively.

A situation assessment is currently being finalised that identifies various data sources that have been published since the 2011/2 projects for inclusion in the National Freshwater Inventory. The initial results show that less than 12% of the country's surface area has fine-scale wetlands data. These fine-scale data would be used and categories cross-walked to the national classification system with guidance from the respective ecologists.

Wetland occurrence will be predicted for data-poor areas from a model developed by Dr N. Collins from the Department of Economic, Small Business Development, Tourism & Environmental Affairs of the Free State. The ability to predict the occurrence, type and condition of wetlands will be investigated in a project funded by the Water Research Commission (WRC), project K5/2546, with the project lead being Namhla Mbona (SANBI). The WRC Research Manager on this project is Bonani Madikizela.

South Africa has a great diversity of river ecosystems which will be represented by classifying the 1:500 000 river network into subtypes. These river ecosystem types can be regarded as coarse-filter surrogates of biodiversity, conserving the diversity of many common and widespread species, and their associated habitats. They are components of rivers with similar physical features such as climate, flow and geomorphology which under natural conditions, are expected to share similar biological response potential.

They will comprise of distinct combinations of Level 1 ecoregions, flow variability descriptions and slope categories. Specifically, delineation will include 31 Level 1 ecoregions and four slope categories (mountain streams, upper foothills, lower foothills and lowland rivers). For the NBA2011 flow variability was broadly described using two categories: permanent (perennial and seasonal rivers) and not permanent (ephemeral rivers) from the Department of Rural Development and Land Reform: National Geospatial Information. During NBA2018 the team is attempting to improve upon these descriptions.

For the NBA2018 Estuaries component data have been collated from a number of regional-scale studies: WRC K5/2187 Desktop provisional EcoClassification of the Temperate estuaries of South Africa (Orange to Mbashe), Mvoti to Mzimkulu Water Management Area (WMA) Classification, the Gourits WMA Reserve, the Usutu WMA Reserve; the Lower Orange WMA Reserve, and a Desktop assessment of the Ecological Condition of South Africa's Temperate – Subtropical Transition Zone Estuaries based on a Provisional EcoClassification.

All but four estuaries (Thukela, Siyaya, Mhlathuze/Richards Bay, Nhlabane) have been systematically re-assessed in the last five years, with the decline in condition of the Thukela Estuary being the key unknown as a result of the major barrage recently constructed just upstream of the estuary. In addition, the CSIR, in partnership with the Nelson Mandela Metropolitan University (NMMU) and the Oceanographic Research Institute, is collating habitat data on all the estuaries in the country as input to a revised classification system.

To be included in the updated classification system is the large number of micro-estuaries currently excluded from assessment

The National Biodiversity Assessment will include an increased focus on South Africa's wetlands.

and planning processes. Information on the micro-estuaries are being collected by the South African Institute for Aquatic Biodiversity (SAIAB), NMMU, Ezemvelo KZN Wildlife, the Department of Agriculture, Forestry and Fisheries (DAFF) and the CSIR.

Building on the NBA2011, the CSIR in partnership with a range of institutions have compiled a National Estuary Management and Monitoring register. The register links management measures (e.g. Estuary Management Plans and Freshwater flow requirement studies) and monitoring activities to the key parameters being evaluated as part of estuary health assessments, as well as the present and desired future state of South Africa's estuaries.

INVENTORY
- Extent and type of ecosystems (estuarine or freshwater including rivers, wetlands and springs)
- Extent of threats and indicators of degradation (invasive species, connectivity)
- Mapping indicators of condition of ecosystems
- Data collection, sampling bias and red data listing of species information
- Accurary assessment and validation of data sets

31 March 2017

ASSESSMENT
- Assessment of ecosystems, species and genetic diversity; identify key biodiversity areas
- Headline indicators: threat status and protection levels
- Trend compared to previous years (possible back casting)
- Responses

28 February 2018

PLANNING
- Prioritisation/conservation planning

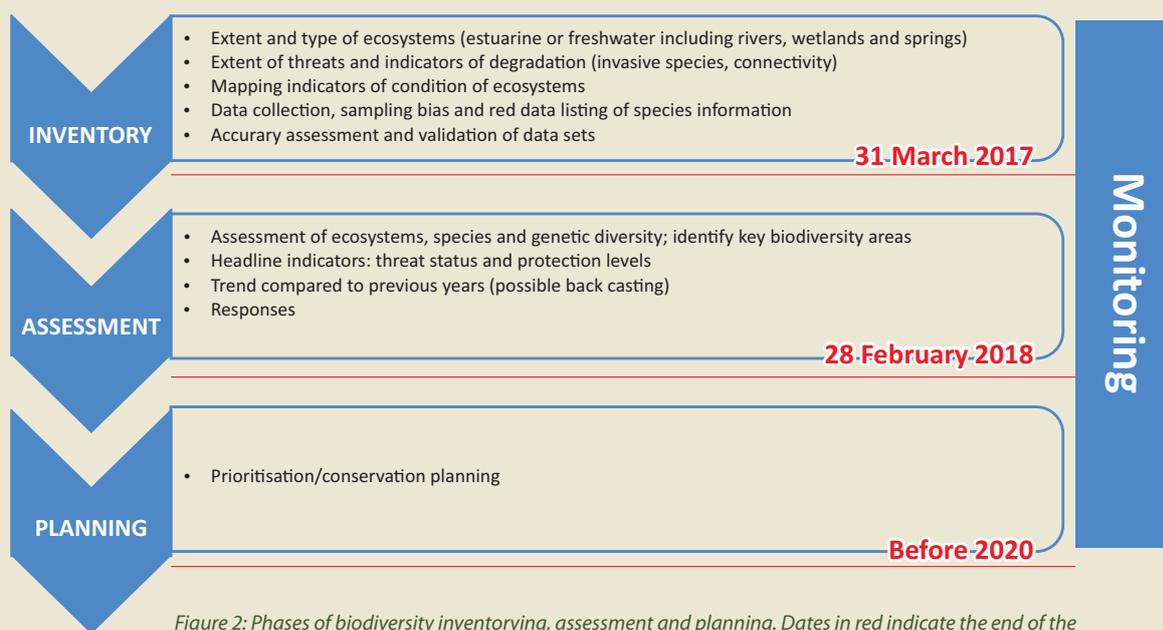**Before 2020**

Monitoring

Figure 2: Phases of biodiversity inventorying, assessment and planning. Dates in red indicate the end of the phase for the NBA2018, though the update and validation of data may continue for the next NBA2025.

The sampling bias and red data listing for a number of freshwater species will be done by the SANBI under leadership of Domitilla Raimondo. The freshwater component will consider fish, wetland dependent birds and frogs, damsel and dragonflies (Odonata) and possibly wetland vegetation.

Freshwater invertebrate data available from the Department of Water and Sanitation (DWS, https://www.dwa.gov.za/iwqs/rhp/naehmp.aspx) will be considered, which includes the representation of amphipods related to groundwater. Key species experts from other organisations have been identified to partake in the assessments, including the SAIAB, the Albany Museum and experts from universities.

The feasibility of trend analyses will also be investigated as well as priority indicators and keystone species for the next NBA (approximately 2025). From an estuarine perspective, mangroves and saltmarsh will be a key group of species that will be assessed in the NBA2018 by NMMU and SANBI.

Similarly, exploited estuarine-dependent linefish species will be evaluated in by SANBI and DAFF.

Anguillid eels are a group of more intriguing fish species, and add information on the connectivity between marine, estuarine and freshwater ecosystems. Eels are catadromous, migrating from the marine ecosystems where it breeds at abyssal depths of ocean gyres, through estuaries to riverine ecosystems. The occurrence of the species indicates ecosystem health or intactness in certain regions. Damming of rivers, poor water quality, invasive alien fish and pathogens in rivers and estuaries negatively impact the habitat of this species.

Similar to the previous two assessments, SANBI and the CSIR will partner in the NBA2018, with the CSIR particularly focusing on the freshwater and estuarine environments. Scientific and technical assurance will be provided by the Estuarine, Wetland and River Ecosystem Classification Committees and communication is planned at various conferences and meetings. A temporary web map viewer (http://gsdi.geoportal. csir.co.za/projects/national-biodiversity-assessment-of-2018) has also been created to allow people to view the freshwater ecosystem types and provide corrections and feedback to the team. More permanent viewers for the freshwater and estuarine components will be communicated in due course.

Team members that are working on the freshwater and estuary sections of the National Biodiversity Assessment 2018 are Jeanne Nel, Lindie Smith-Adao, Heidi van Deventer, Lara van Niekerk, Chantel Petersen and Namhla Mbona.

Jeanne Nel

Lindie Smith-Adao

Heidi van Deventer

Lara van Niekerk

Chantel Petersen

Namhla Mbona