CAPACITY BUILDING

Namhla Mbona – wetland mapping maestro and citizen science champion

This article forms part of a series of profiles on high achieving water researchers supported by the Water Research Commission as part of the Commission's 50-year celebrations.

Most freshwater scientists are zoologists or botanists who got their feet wet doing postgraduate research projects on aquatic ecosystems. Namhla Mbona took a slightly different route and brought a set of skills to the table that are in high demand. Sue Matthews spoke to her about her career journey at the South African National Biodiversity Institute (SANBI).

"After finishing school in Keiskammahoek in the Eastern Cape, I signed up at the University of Fort Hare for a zoology degree with the aim of it being a pre-med, but within that first year I was introduced to GIS," she explains. "I had a love of maps and computers, so I took computer science too and married the use of GIS and zoology for my third-year project. The linkages of using GIS as a tool in understanding biodiversity was what brought me to SANBI."

It was while she was doing a GIS internship at the Department of Public Works, based in Bisho and tasked primarily with capturing spatial data for Expanded Public Works Programme projects, that she heard about internships at SANBI, and duly applied.

"They called me to say I was successful and gave me a choice of protected areas expansion or wetlands. Growing up, I knew a bit about wetlands, but I didn't know about ecosystem services – I mainly thought of a dirty smelly place, where livestock had been stuck a few times. But I chose wetlands for my six-month internship, and that's when I became part of the Working for Wetlands team based at SANBI."

Her first week, in October 2006, was effectively a crash course in wetlands because she attended the National Wetlands Indaba in Stutterheim, even before she had moved to Pretoria. During the Indaba, the first version of the National Wetland Map was launched, but it was very much a broad-brush, desktop effort

Mbona was given the WRC Knowledge Tree Award in the category 'Informing policy and decision making' in 2017. Here she accepts the award from WRC Deputy Chair, Prof Sibusiso Vil-Nkomo, while WRC CEO, Dhesigen Naidoo, looks on. Mbona's contributions in the wetland sector had also been recognised in 2014, when she was given the inaugural Young Wetland Scientist Award at the National Wetland Indaba.

produced by applying terrain-based hydrological modelling to the wetland data derived from Landsat imagery in the National Land Cover 2000 project.

Mbona soon got to work, assisting the project manager of the National Wetland Inventory (NWI) to improve the dataset for the map, develop a GIS-linked database, and integrate the data into other projects, including Working for Wetlands ones. The NWI had been set up to be the repository for wetland information – such as locality, size, type and condition – as it became available, in accordance with South Africa's obligations in terms of the Ramsar Convention and the Convention on Biological Diversity.

In 2008, Mbona began a BSc Honours degree in Geo-informatics at the University of Pretoria, and towards the end of that year she was promoted to NWI project manager, a position she held until December 2013. Apart from all the responsibilities associated with the job, including administration and stakeholder management, coordination of NWI activities countrywide, mapping and metadata compilation, as well as training and mentoring interns and staff, she was heavily involved in the multi-partner National Freshwater Ecosystem Priority Areas (NFEPA) project, completed in 2011.

"The NFEPA project was a big team, and being part of it was really great," she says. "We invested about two years in data gathering and crunching, getting data from municipalities and provinces, and then going through to regional areas for review. We'd get people into a hall with print-outs of our draft maps, ask if we'd represented everything and they'd point out what we'd missed, then we'd go back to the computer and redigitise that area."

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The GIS layers developed in the NFEPA project were adopted by SANBI as National Wetland Map 4, and were used for the freshwater component of the 2011 National Biodiversity Assessment (NBA). In the previous NBA, conducted in 2004, wetlands had been given short shrift. The lack of spatial data had meant that a full assessment was not feasible, so the freshwater component dealt only with rivers and the terrestrial component included just a limited analysis of wetlands. In NBA 2011, however, wetlands were comprehensively assessed, and found to be South Africa's most threatened ecosystem type.

Nevertheless, the shortcomings of National Wetland Map 4 soon became apparent. Mbona says the best-available data was used for it at the time, but the NFEPA team always emphasised that a national-scale dataset would have limitations in terms of accuracy and detail, and that ground-truthing was needed for fine-scale mapping at local level. The opportunity to do this came in the form of a Water Research Commission (WRC) project, which Mbona – in her new position as SANBI's freshwater biodiversity planner – headed up as project leader.

Given that regulatory authorities were using the NFEPA data in their decision-making pertaining to mining, and that SANBI was in the process of developing both a decision support tool

applicable to coal mining in the Mpumalanga Highveld and a guideline on wetland offsets, the WRC-funded project honed in on this area. The final report, *Supporting better decision-making around coal mining in the Mpumalanga Highveld through the development of mapping tools and refinement of spatial data on wetlands* (**WRC Report No TT 614/14**), was published in February 2015.

The methodology involved thoroughly reviewing the existing data and delineating wetlands using aerial imagery and topographic data, then selecting a subset of wetlands for ground-truthing and validation, after which the collated data was reviewed by wetland and GIS specialists. Apart from generating new polygons of wetland boundaries, information on wetland type and condition was collected at each step.

The project gave Mbona plenty of time in the field, something she enjoys most about her job.

"I'm not a seasoned wetland ecologist, so I'm always learning, and always linking what we see on the computer and what is happening on the ground," she says, but jokes there are downsides too. "In that project, we spent a lot of time driving up and down, with long days working in the forestry lands. The frustrations of fieldwork sometimes take hold and you end up not speaking to each other by 8 pm when you're trying to find the accommodation!"

The research confirmed that National Wetland Map 4 had significantly under-represented wetlands in the Mpumalanga Highveld. The total area of wetlands leapt from 213 579 ha to 590 391 ha, which amounted to almost 20% of the study area's surface. The improved data also allowed the ecosystem threat status depicted in NBA 2011 to be updated, and 23 of the 49 wetland types in the Mpumalanga Highveld moved to a less threatened class, with none upgraded to a higher class.

Mbona drew upon the research for her thesis, 'Using GIS as a tool to map and type fine-scale wetland data', for her MSc GIS degree awarded by the University of Salzburg in early 2016. The degree is offered through the UNIGIS Salzburg Global Campus programme, which had formed links with universities in South Africa. This meant that Mbona completed her coursework at the University of Pretoria and Nelson Mandela University, but she did get to do a month-long winter school in Salzburg.

Shortly thereafter, work began in earnest to improve upon National Wetland Map 4 in preparation for NBA 2018. Mbona was project leader of the WRC-funded project 'Enabling more responsive policy and decision-making in relation to wetlands through improving the quality of spatial wetland data in South Africa'. She spent months trying to source wetland data and coordinating a team of interns, who she trained in desktop wetland mapping.

"I did a survey where I requested people who had data, no matter how small, to share it with us," she explains. "Then we cut up the country into pieces and allocated them to about a dozen interns, who were sitting in CSIR Stellenbosch, CSIR Pretoria, SANBI Kirstenbosch and SANBI Pretoria. Each person was responsible for either a whole province or certain district municipalities, and I was working with them week to week. If data was received from a municipal official or a consultant, you compared it with what you got from the topographic maps and then created the most true polygon that you believed represented the wetland. In some areas, we didn't receive any additional data so just had to clean the data from the topographic maps, which are actually provincial geodatabases updated by the Department of Rural Development and Land Reform's National Geo-Information Directorate."

Wetland experts with specialist knowledge of each area were contracted to provide input, undertake ground-truthing and review the data. Essentially, the project conducted the mapping and ground-truthing using the same approach outlined in the Mpumalanga Highveld project's methodology, which had been

During a career talk organised by the United States Embassy in May 2018, Mbona spoke about environmental research and conservation, and the importance of wetlands.

further developed into a wetland digitising guideline by Heidi van Deventer and wetland mapping guidelines produced by Nancy Job and co-authors.

The process and outcomes are comprehensively covered in the report for which Mbona was lead author, *Improving the spatial inland wetland data for National Wetland Map 5 in South Africa to Inform policy and decision-making* (**WRC Report No. TT 778/18**), published in February 2019. The nuts and bolts are also succinctly summed up in the paper 'National Wetland Map 5: an improved spatial extent and representation of inland aquatic and estuarine ecosystems in South Africa' by Van Deventer and co-authors, including Mbona, in the January 2020 issue of *Water SA*. The new map depicts over 2.6 million hectares of inland wetland area, representing a 23% increase compared to the previous version and making up 2.2% of South Africa. Its limitations are also outlined in the paper – only 7% of the country's surface area was mapped by experts and less than 17% by the interns, with the rest relying purely on the provincial geodatabases and therefore ranked low confidence.

Even the interns' contribution is ranked low-medium confidence, but this doesn't bother Mbona.

"I always believe half a look is better than nothing. The first version of the map was literally just a computer model, and each version since has had more human input, which I consider an improvement," she says. "Learning how to interpret imagery is a process of training your eye and understanding wetland

Ground-truthing in the field was an important part of the wetland mapping projects.

ecology. In some cases, the wetland boundary might not be the key issue – we've at least been alerted to the presence-absence of a wetland, and that's a good start. Besides, the national dataset always comes with a disclaimer that you cannot use it as your only decision support tool. It's meant to be part of a pre-screening process, so before using it people should at least check on Google Earth that it's a reasonable reflection of their area of interest and then do their own verification."

Mbona says she's pleased to see more young people coming into wetland mapping, but after 15 years she feels ready for a change. She's moving divisions within SANBI and will now be focusing on citizen science – a passion of hers. She's a big fan of the iNaturalist app, and has been the City Nature Challenge coordinator for Tshwane for the past two events.

"I go everywhere and just bioblitz," she laughs. "Cape Town always beats us in the Challenge, but I engaged 130 people this year compared to 25 last time, so it's a win – people know about it and are interested. I tried to cover the whole of Pretoria and was out the entire weekend, focusing on aquatic plants. If we can collect photos of them and get them in the database so they can be identified, they could potentially be useful for wetland mapping assessments and riparian audits."

"We always say that we're not progressing in most of our projects because of limited resources, or that we don't have enough information about our wetlands, so it's difficult to plan for them. But what if we can use citizens' knowledge about the history of wetlands they've been seeing in different climates and flooding regimes. There also seems to be a lot of interest from citizen scientists in terrestrial life, but in the aquatic environment it's not really happening, and I'm wondering whether it could be because we're using complicated tools. I'd like to see whether we can take GIS and simplify it into an app, with a one-page questionnaire that a person can use to identify water quality or the ecological condition of that ecosystem, and how the barrier of language and scientific terminology can be overcome."

In the immediate future, she will be applying some citizen science to the Living Catchments project, a SANBI-WRC-DSI partnership, and will also remain involved in the Data Acquisition Management Strategy, a project SANBI is driving for the Department of Water and Sanitation. The idea is to create a 'one-stop shop' for data, focusing on wetlands initially, and groups have been set up to obtain data from different sources, including citizen science contributions and *ad hoc* projects such as EIAs and WRC projects.

"I've been fortunate to have been involved in so many areas of work that I was exposed to because of the need for wetland data or mapping, such as the wetland classification scheme, the NBA, or resource quality objectives. The project management side and working with SANBI's publications unit to turn some of the reports into glossy booklets was also good experience. Being given two awards was very gratifying, of course, and another highlight was attending the Ramsar COP13 in Dubai in 2018 as part of the Ramsar technical review portfolio. But I'm now looking to grow, and hope I can make the same level of contribution in the citizen science sphere going forward."