Building biodiversity knowledge for action in Southern Africa:
Spatial Biodiversity Assessment, Prioritization and Planning in South Africa, Namibia, Mozambique and Malawi
('SBAPP Regional Project')

Introductory workshop on improving spatial ecological condition data for southern Africa

(a component of the SBAPP Regional Project led by UCT and SANBI)
30 November 2023; 09:00-12:30

Meeting Report

1. Welcome – introductions to core team and others in the meeting chat

Dr Andrew Skowno from SANBI welcomed everyone to the meeting. He asked each participant to write their name, role and institution into the chat of the meeting. The Attendance Register is Appendix A to this report.

Andrew explained that this workshop is to introduce interested parties to the SBAPP Regional Project and specifically its component on ecological condition. He introduced the core team members from SANBI and the University of Cape Town – as these two institutions co-lead this component.

Note that the main webpage of the condition component is https://science.uct.ac.za/seec/sbapp-ecological-condition and participants will be able to find the meeting recording and presentation there, as well as links to the surveys and tools mentioned below.

2. Overview of the SBAPP Regional Project

Ms Carol Poole, a Project Manager at SANBI, gave an overview presentation about the SBAPP Regional Project – which is a 5-year project funded by French donors Agence Française de Développement and the Fonds Français pour l'Environnement Mondial. The project started in July 2022, and its full name is '*Building biodiversity knowledge for action in Southern Africa: Spatial Biodiversity Assessment, Prioritization and Planning in South Africa, Namibia, Mozambique and Malawi*'. The ecological condition work is Objective 4 of the project.

3. How we will use ecological condition data (once southern African has better data) and why it is so important: RLE, spatial biodiversity planning, GBF targets, UNCCD, restoration, etc.

Andrew gave a presentation to explain how important better ecological condition data is for southern Africa. It has a multitude of uses. He explained that ecological condition data feeds into biodiversity planning and prioritisation, as well as mainstreaming objectives that can ultimately lead to decisions, strategies, and

policies for biodiversity. To give more context, he also explained the definitions of an ecosystem, the South African National Ecosystem Classification System, ecosystem integrity and land degradation. There is also a need for ecological condition and land degradation data based on the data deficiency for criteria C and D (environmental degradation and biotic disruptions) of the Red List of Ecosystems (RLE). We have data for criteria A and B (distribution reduction and restricted distribution), however for a more comprehensive RLE assessment we still need data for criteria C and D as well.

4. Overview of SBAPP Ecological Condition Component

Dr Vernon Visser, from the University of Cape Town, gave a presentation on how the team plans to approach the work, and asked the participants to keep an eye on the webpage: https://science.uct.ac.za/seec/sbapp-ecological-condition.

He explained that the plan is to (1) identify indicators of or pressures on ecosystem integrity per biome across the region, (2) gather spatially explicit data representing these indicators or pressures, (3) identify data gaps and attempt to fill these, (4) consolidate these layers into data cubes, and (4) provide guidance on interpretation of these data in different biomes. He emphasised the importance of using low-hanging fruit of data already available. He ended by explaining that the ultimate goal is to develop a toolbox and guidance on how to use layers for assessing condition. The team knows this is a challenge, and therefore calls on all experts to provide inputs and guidance.

Comments (spoken and in the chat) included:

- The mapping of the condition needs to be at the scale that is suitable for the actual degradation happening in the biome. Site-specific mapping rather than an aggregated idea for the whole biome.
- Potential link with HORIZON project Biodiversity Building Blocks for policy (https://b-cubed.eu/) that aims to transform biodiversity monitoring by integrating diverse data sources, using data cubes based on the Essential Biodiversity Variables framework to access biodiversity change. Developing a biodiversity data pipeline that is locally relevant and globally integrative.
- Ecosystem condition assessments must speak to (clearly articulated) objectives linked to scale, both temporal and spatial.
- Avoid value judgements – overgrazing, degradation bush encroachment…. until we have measured relevant indicators that speak to the set objectives.
- And with a blue sky vision of not, as far as possible in a changing/dynamic environment, foreclosing land use options for future generations.
- It is great that you are looking at the LC categories. In the Northern Cape we are concerned about the Upper and Lower Gariep Alluvial vegetation (linear vegetation). As you mentioned it comes down to what is the most important driver for which I only have questions and not answers – e.g. there is a lot of mining such as diamond mining, extensive agriculture such as pivot irrigation and grapes, Prosopis invasion, and water abstraction for the developments, impacts of dams and planned Vioolsdrift dam, are adjacent land areas (another veg type) more important, or the upstream vegetation more important to prevent collapse etc.
- You can work at the biome level, however sometimes certain drivers are much more prevalent in certain biomes than others, for example, the fynbos biome and fire compared to other biomes where fire is not a big driver. In this case the driver can be investigated at the biome level where fire is one of the main drivers, whereas with other biomes that are not impacted largely by fire you would need to look within the biome at a smaller scale.
- We also need a systematic way to validate global ecological condition datasets with our own data to actually prove their level of usefulness, and not just 'eyeball' these.
- We should perhaps consider providing guidance on which existing Global Ecosystem Typology level is important. One can also consider breaking up ecological condition work according to Ecosystem Functional Group.
- It will be a challenge to incorporate the dynamic range of ecosystem structure/state across different biomes in an ecological integrity assessment. For example, Succulent Karoo that is generally more stable inter-annually than fire driven ecosystems

5. Current remote sensing and other data collection work in Southern Africa on ecological condition

The following were speed presentations about various projects looking at ecological condition.

5.1. Biodiversity Intactness Index for Africa (BII4Africa) - approach and progress

Dr Hayley Clements, from Stellenbosch University, gave a speed presentation about BII4Africa project, and encouraged everyone to look on the website: https://bii4africa.org/ The spatial data is not yet available for download as the team is still publishing papers.

Questions and answers that were posted in the chat were as follows:

- *Have you done any validation of the BII and how it actually correlates with field measurements of the species abundances/richness that is measures? I always wonder with these BII type models whether they have more predictive power than simply using the underlying human pressure/land-use datasets?* Good question. We have compared the BII to other indicators such as human footprint, biomass modification, biodiversity habitat etc, and they track well (of course we would expect variation). Importantly - the BII captures variation in how different species respond to land use pressures, so provide an added layer of detail. We would love to test it using empirical data and good idea to test its predictive power vs just using the land use map - though the reference state becomes a bit tricky (experts can think further back than empirical data).
- *Was the land use intensity assumed in a top-down manner for Protected Areas or did you require that they be protected AND the data indicates conservation is in fact the predominate land use (versus for example subsistence agriculture that occurs within the "protected" area?* Protected areas were allocated last, so pixels had to be a protected area and not be transformed. So croplands are excluded. It's much trickier though for strictly protected areas subject to high poaching pressure, for now we cannot account for that (hopefully once PA effectiveness data becomes more available we can do better)
- *What spatial resolution is your final map?* 1 x 1 km. We do not go finer because experts need to think at 'landscape scale' when making estimates of impacts of human activities on species (e.g. a patch of intact vegetation in a city is not an appropriate scale, need to consider context, so we describe a city with limited green space vs a suburban area with more green space, etc)
- *Are the data available yet?* The expert dataset of 'intactness scores' will be available very soon (it's in press at Scientific Data). The map isn't published yet (hopefully next year). But I'm happy to share it sooner - can pop me an email hayleyclements@sun.ac.za

5.2. Fynbos condition models and BioSCape programme

Dr Jasper Slingsby, from University of Cape Town, gave a speed presentation on the work a large team led by NASA is doing in the Fynbos Biome studying the value of various remote sensing data tools.

Questions and answers that were posted in the chat included:

- *Is the idea with the BIOSCAPE project to create a spectral library for various ecosystem types in the Western Cape; and would this be rolled out in other biomes?* That is one of the many things that can be done. I think the issue it can address there is the mosaic nature of many of our ecosystems (or even biomes). In terms of roll out to other biomes, that would have to wait for the satellite data. For now we just have airborne data, and the presentation was more about highlight what is coming down the road that we should be prepared for. Satellite missions are typically only planned for a 5-year lifespan, so we do not want to waste 1-3 years working out what the data are and how to use them.
- *What can this project provide to a national condition layer?* It is not national at this stage, but I was just highlighting the potential for of these approaches for ecosystem mapping (and monitoring) and developing various indicators of ecological condition. Note that there are many aquatic applications too (marine and freshwater). Kelp forest mapping and monitoring, harmful algal blooms, cyanobacteria and water quality, etc.
- *Are the quick easy wins like layer of pines for all fynbos areas?* This is the hope!

- *Did you use ENMAP hyperspectral satellite data yet?* We have played with ENMAP data, but have been focussed on using EMIT for regional applications because our collaborators at NASA have been kind enough to prioritize the Western Cape such that we now have multiple images covering the entire province and beyond.
- *Are there certain disruptions in the fynbos that emma struggles to pick up, and what scale of disruptions (large or small) is it confident at picking up?* I would say invasions are probably one of the hardest. It won't pick up an NDVI anomaly until the invasion is quite dense (i.e. a few years into the invasion). It also won't give you info on the invasive species. This is where direct classification of multispectral imagery (or ideally imaging spectroscopy) helps. I guess one of the messages I meant to get across in my talk is that there are pros and cons of each of the suite of tools and we really need to think about how best to take advantage of them all.

5.3. Grassland productivity mapping in the context of ecosystem services and degradation

Prof Onisimo Mutanga, from University of KwaZulu-Natal, gave a speed presentation on grassland productivity mapping.

Questions and answers that were posted in the chat included:

- *Given your success in mapping C3 and C4 grass species using remote sensing, do you think there is potential for mapping overgrazed grasslands, perhaps in terms of composition, i.e., could we detect high abundances of certain overgrazing indicator species (and conversely indicator species of healthy grasslands?* Yes it will be possible to map indicator species with hyperspectral data if the species/ is dominant. I will send you papers on the detection and mapping of increaser and Decreaser species based on hyperspectral data in the Drakensberg but we also mapped areas dominated by Ngongoni grass in communal areas of KZN. Another form of assessing degradation will be to measure the proportion of fractional cover - bare lands vs grass clump species using multispectral data.

5.4. Ecological condition from a catchment health perspective

Ms Nancy Job, lead of the Freshwater Biodiversity Programme at SANBI, gave a speed presentation on ecological condition at the catchment scale.

Questions and answers, and comments, included:

- It is great to see the detail on the ground, and the context we need to be cognisant of if we want to scale up.

5.5. Global efforts to map ecological condition

Dr Glenn Moncrieff, Spatial Data Scientist at The Nature Conservancy globally, gave a speed presentation on mapping global ecosystem condition. The TNC is working both globally and regionally to improve datasets.

Questions and answers, and other comments that also moved beyond just Glenn's presentation, included:

- *Most of the approaches to model ecological integrity seem to incorporate data on human pressures at their core, as human pressure is a key predictor variable in the models of composition, function or structure. Similarly, there are lots of datasets which just map human pressure directly (e.g. Human Modification Index, Human Footprint) etc. For global reporting these data are probably all useful in some way, but do we have any thoughts on which, if any, would be useful for RLE assessments under SBAPP? We really need to ensure that these datasets are linked to clear, measurable declines in ecosystem condition, and I wonder if this has been well-tested in Southern Africa? We did use a similar index for Mozambique's RLE assessment as it was all we could obtain in our timeframe, but more robust testing would be great.* I agree completely. Very few of the HM/HF papers have done this rigorously. The best we have is the PREDICTS data (used for the global

biodiversity intactness index), but even this is not good enough and only measures impacts on composition.

- *Yes, and the PREDICTS model incorporates human pressures as a key predictor, so in some ways is driven by the same kinds of data that go into the human footprint. I wonder if there is some scope to identify a set of independent response variables around ecosystem condition, and use them to test all these indexes (e.g. biomass, veg. structure, etc.).* This is something we are very keen to do, and I would be keen to discuss a collaborative effort with anyone interested. Kendall and Glenn agreed to connect after the meeting.
- We have not used the foot print approach in South Africa's RLE, as the existing data at the time were coarse and used inaccurate input land cover. But it is something to consider if we can fine tune it to different areas. There are major differences in how human foot print as a proxy of pressure (as a proxy of impact) manifests in communal vs non communal vs PAs for example.
- *What would be your ideal set of verification points to use as for verification of global and local products? Also, to what extent can we use conservation areas for this verification – I can see that they could work well in some situations, but not all given impact of AIP or paper parks with lack of management.* It is a tough question - but I suppose point data (does not need to be wall-to-wall) on the degree of various factors that might be interpreted as an indicator of reduced integrity (% invasive species, % biodiversity intact vs ref site, runoff reduction, grazing potential reduction, carbon loss, nitrogen deposition). These sound good – one thing to note is that it would be important that the verification data doesn't include modelled variables that use human pressure as a predictor (lots of layers do this, e.g. biomass models).

6. Rapid scan of relevant available datasets, research (current and planned); feedback on results of the survey sent out prior to the workshop. Brainstorming other people and projects to contact.

Andrew and Curtley explained several items that team asked the participants to contribute to, and advised contributors not to worry if it is a duplicate record as we will sort that out later. Please contribute to the following:

- The survey asking various questions from knowledge holders: https://forms.office.com/r/WDFc8w25tG
- The current spreadsheet of references for a literature review – published data, but let us know of unpublished data or ongoing initiatives of note, as well as grey literature: https://docs.google.com/spreadsheets/d/1LI_VIHrVxIUffhir_By2rjzVAqp9dL8RT-wxQqNrtw4/edit?usp=sharing
- A tool to post datasets that participants know of in a specific location: https://felt.com/map/SBAPP-ecological-condition-and-land-degradation-datasets-M0MEtJ9C7SeGaaTW3cUPbBD?loc=-21.84,30.03,4.9z&share=1 (please post details about the dataset – e.g. year – and give your name and institution)

Or send Curtley Tonkin C.Tonkin@sanbi.org.za an email if you are struggling.

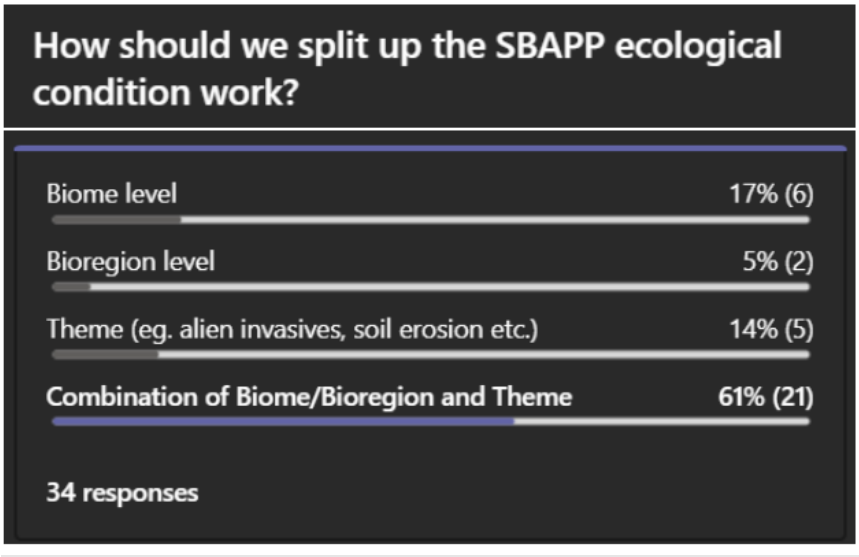
Questions:

- *Is this just a terrestrial assessment (you mentioned mangrove datasets earlier)?* This project is mostly limited to the terrestrial realm, but we are aware of the freshwater links to terrestrial. So mangroves won't necessarily be studied. But the data cubes etc. will be useful tools for those who want to take them further. Please do include non-terrestrial datasets in the reference list.

7. Discussions on how to organise the research and outputs (content), how to arrange the process (task teams etc.) and organise the network of collaborators

7.1 Organising content and research (biomes, sub biomes or Ecosystem Functional Groups) – assuming common drivers and ways in which condition is disrupted and degraded

A poll was launched into the meeting, which had the following results:



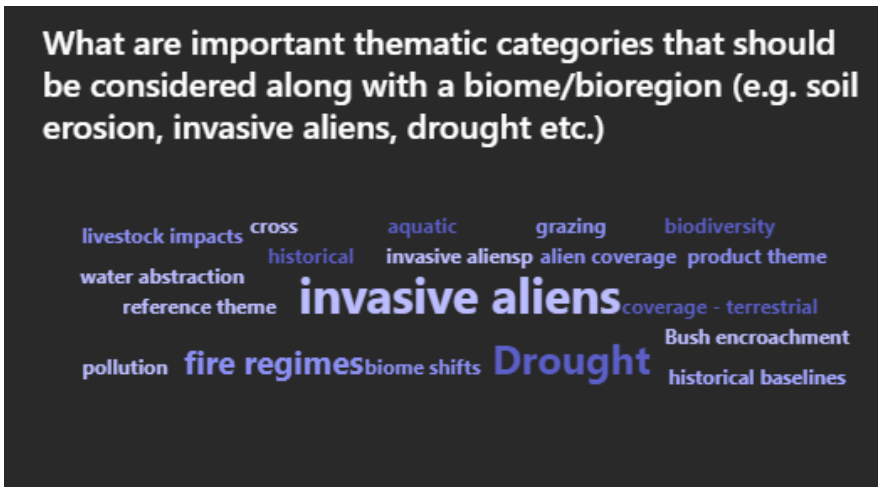
Questions and comments included:

- One reason to motivate for a biome level approach is because many remote sensing variables behave respective to a certain biome. For example, the Savanna biome has a specific spectral signature according to NDVI relating to its distinctive grass and trees distribution. It is thus fairly easy to monitor tree increases or decreases within the biome.
- Can we see the cross-walk to the EFGs? This is exactly why we wanted to talk about how to break up the landscape.
- We should not tend towards the themed approach too much, as we want a comparable approach across biomes. Thus there needs to be a careful thematic co-ordination and how they are investigated within the biomes to ensure they are comparable across biomes. For example, to create a national alien invasives map, you would like to compare how biomes are more impacted by certain alien invasives than others.
- When you do finer scale studies you would need fairly specific thresholds to map certain vegetations types and their height for example, especially when doing a land cover classification. Thus, when looking using a smaller scale method within a biome, it also important to decide early in the project what data is available that covers the area of interest.
- *Is there any emphasis on the construction of historical baselines? Satellite monitoring goes back 40+ years but that is a long time after human modification of the environment. The palaeoecologists and environmental historians would have a role to play here. It could be one of the themes envisaged for the overall project or it could also be a task set for each of the Expert [Biome] Groups to grapple with.* Historical baselines are definitely something for future discussions as you need a lot of time to deal with such as discussion. But it is nevertheless very important especially when dealing with the Red List of Ecosystems. The RLE depends to a large extent on what timescale you are considering since you have to decide how far back in time you would use a baseline for your assessments.

Important themes across all biomes that might be tackled as a theme not on a biome level:

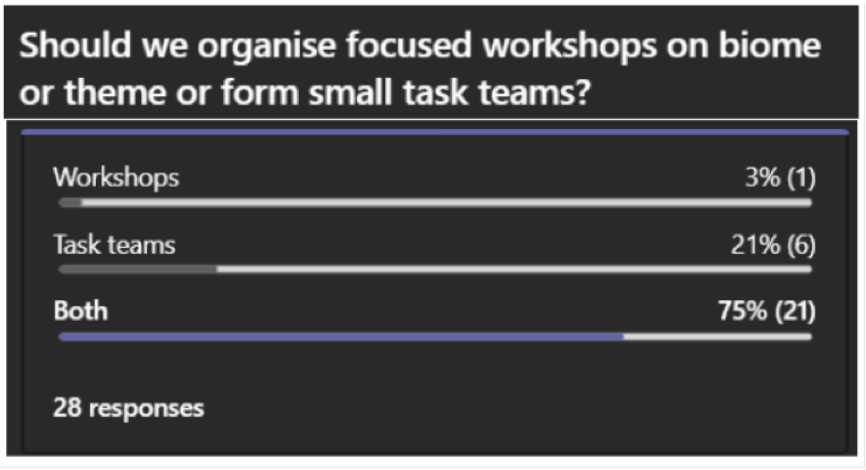
- overgrazing in arid regions
- invasive species

Another poll was launched that provided a Word Cloud result as follows:



7.2 Forming working groups or task teams to coordinate collaborative efforts - new structure or using existing ones like Arid Zone Ecology Forum etc.

A poll was launched into the meeting, which had the following results:



Comment in the chat:

- A community of practice type of approach with task teams that feedback into the larger COP via workshops or other group fora.

7.3 Finding key collaborators to help lead this work – ecologists with aligned interests, skills and or projects.

Participants were encouraged to complete our survey where they could give the names of other experts. They could also email experts that participants know of to Curtley at C.Tonkin@sanbi.org.za. The names given are then added to our expert list.

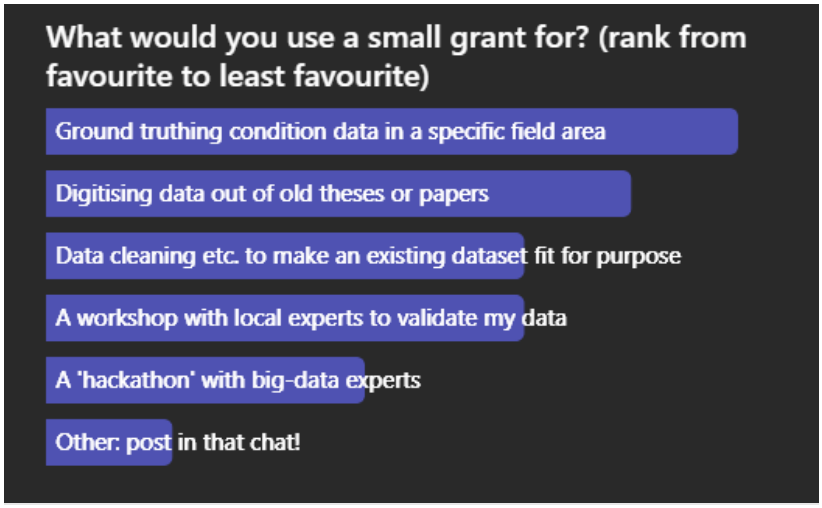
8. **Small grants programme with historically disadvantaged universities – opportunity to identify some short and small projects that will have good value for money (e.g. to update old datasets to be useful now)**

Carol explained that the idea of a potential small grants programme is to ensure that we enable participation from other institutions. It is clear that many of South Africa's bigger and older institutions have been working substantially in this space – e.g. University of Cape Town, Stellenbosch University, University of KwaZulu-Natal – as we heard from them today. However, there might be other institutions who want to participate and do not have the resources to do so.

The SANBI Board is very keen to work with the historically disadvantaged universities, which are: University of Limpopo, University of Fort Hare, University of Venda, Walter Sisulu University, University of the Western Cape, University of Zululand, and Sefako Makgatho Health Sciences University. However, some of the newer universities in South Africa – those established post-1994 – might also benefit from this programme.

Carol noted the amount of the small grants is still to be determined, but it will be a formal application process via SANBI's systems and the evaluation of the proposals will be on a predetermined set of criteria not on price (a task team will be established to evaluate proposals).

Carol launched the following poll to gauge interest in the small grants idea:



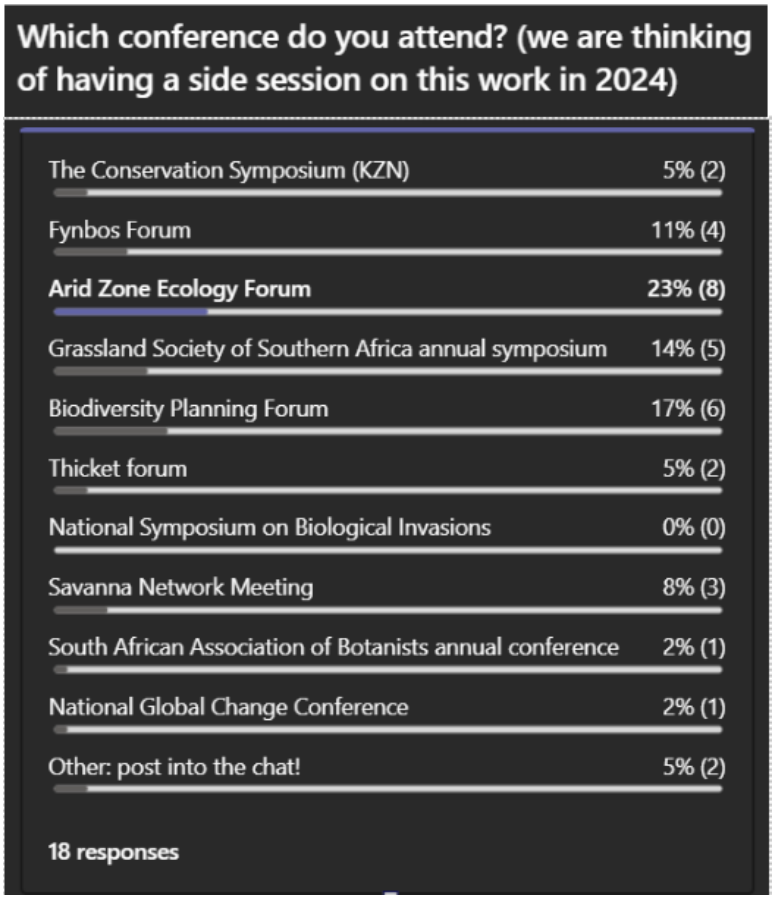
Carol also asked that anyone with access to additional funding should please contact her, as perhaps there is potential to expand on this small grants programme idea in a more systematic way (as the SBAPP Regional Project does not have an unlimited supply of funding). Please contact Carol Poole C.Poole@sanbi.org.za

Questions and comments:

- *Are grants only for projects in South Africa?* Yes these will be for within SA only, as the SBAPP SA budget is paying for these small grants. The other SBAPP countries could consider doing something similar with their budgets if they have budget available.
- We will have to liaise with Sol Plaatje University, Helga van der Merwe, which is a post-1994 university. They have a drone and the geography unit is busy with a project at Mokala with SANParks. So we could look at small area that needs baseline info. Main problem in the Northern Cape is traveling distances.

9. Closure of the session and explain future plans

A final poll was posted in the meeting, asking participants which conference they usually attend. The idea might be to run a side session at one or more of these conferences in the future:



Others mentioned were:

- The Southern African Wildlife Management Association (SAWMA)

Andrew thanked everyone profusely for attending this introductory workshop and wished them a safe and restful summer holiday season. The workshop ended at approximately 12:50.

Certified as a true record of proceedings:

_____ **Date: _____13/12/2023____**

Chair: Dr Andrew Skowno, SANBI

Appendix A: Attendance register

Name and surname	Institution
A Ndhlovu	Stellenbosch University
Adam Wilson	University at Buffalo
Adwoa Awuah	South African National Biodiversity Institute (SANBI)
Alastair Potts	Nelson Mandela University
Alice Lureau	Office Français de la Biodiversité (OFB)
Andrew Skowno	SANBI
Anisha Dayaram	SANBI
Ben Strohbach	NUST
Carol Poole	SANBI
Chenay Simms	SANParks
Christiane Schmullius	Jena University
Colleen Seymour	SANBI
Conrad Geldenhuys	Northen Cape DAERL
Cornelis van der Waal	Nambian University of Science & Technology
Craig Mahlasi	University of Cape Town (UCT)
Curtley Tonkin	SANBI
Debbie Jewitt	Ezemvelo KZN Wildlife
Dewidine Van Der Colff	SANBI
Dickson Mbeya	Malawi University of Science & Technology (MUST)
Domitilla Claudia Raimondo	SANBI
Emma Wright	SANParks
Ernest Mbeba	Malawi University of Science & Technology
Geethen Singh	Unknown
Genevieve Pence	Independent
Glenn Moncrieff	TNC
Graham Von Maltitz	SANBI
Greer Hawley	Big Thorn Environmental CC
Guillaume Gigot	Office Français de la Biodiversité OFB-MNHN
Hayley Clements	Stellenbosch University
Heath Beckett	Stellenbosch University
Heidi van Deventer	CSIR
Helen De Klerk	Stellenbosch University
Helga van der Merwe	SAEON
Hermenegildo Matimele	Wildlife Conservation Society, Mozambique
James Ayuk	University of Western Cape (UWC)
Jasper Slingsby	UCT
Jessica Da Silva	SANBI
Johan Baard	SANParks
Johan Bester	SANParks
Jussi Baade	Jena University
Justin du Toit	Grootfontein Agricultural College
Kagiso Mogajane	SANBI
Karen Esler	Stellenbosch University
Keletso Moilwe	UCT
Kendall Jones	WCS

Lize von Staden	SANBI
Louise Geldenhuys	NC DAERL
Luxolo Qokweni	Department of Rural Development and Agrarian Reform
Mandy Driver	Independent
Maoela, Malebajoa Anicia	UNISA
Maphale Monyeki	SANBI
Matthew Child	SANBI
Melanie Lück-Vogel	Council for Scientific and Industrial Research (CSIR)
Michael Cherry	Stellenbosch University
Mohale Mokoena	SANBI
Moses Cho	CSIR
Nacelle Collins	Free State DESTEA
Nancy Job	SANBI
Natalie Uys	Northen Cape DAERL
Naïk Faucon	OFB
Nicholaus Huchzermeyer	Rhodes Restoration Research Group
Nokubonga Mzimela	SANBI
Nokuthula Mahlangu	SANBI
Norbert Jürgens (Gast)	University of Hamburg
Ntombekhaya Faku	Eastern Cape Department of Rural Development & Agrarian Reform
Onisimo Mutanga	University of KwaZulu-Natal (UKZN)
Paul Gordijn	South African Environmental Observation Network (SAEON)
Pearl Mzobe	SANBI
Peter Carrick	UCT
Phil Desmet	Independent
Phumla Mayekiso	SANBI
Samukelisiwe Tshezi	Unknown
Sandra MacFadyen	Stellenbosch University
Sediqa Khatieb	SANBI
Sinetemba Xoxo	Rhodes University
Stephen Holness	Independent
Thulile Vundla	Working on fire
Timm Hoffman	UCT
TK Sepuru	University of Pretoria
Tony Rebelo	SANBI
Tony Swemmer	SAEON
Vernon Visser	UCT
Vida Viljoen	NUST
Vukosi Baloyi	Unknown
Wataru Tokura	UCT
YN Mbuyisa	Stellenbosch University

Appendix B: Action items summary (numbered according to agenda items):

ITEM	WHO	ACTION	WHEN
6	All participants	Please contribute to the following: - The survey asking various questions from knowledge holders: https://forms.office.com/r/WDFc8w25tG - The current spreadsheet of references for a literature review – published data, but let us know of unpublished data or ongoing initiatives of note, as well as grey literature: https://docs.google.com/spreadsheets/d/1LI_VIHrVxIUffhir_By2rjzVAqp9dL8RT-wxQqNrtw4/edit?usp=sharing - A tool to post datasets that participants know of in a specific location: https://felt.com/map/SBAPP-ecological-condition-and-land-degradation-datasets-M0MEtJ9C7SeGaaTW3cUPbBD?loc=-21.84,30.03,4.9z&share=1 (please post details about the dataset – e.g. year – and give your name and institution)	As soon as possible
8	Anyone with access to additional funding	Carol asked that anyone with access to additional funding should please contact her, as perhaps there is potential to expand on the Small Grants Programme idea in a more systematic way (as the SBAPP Regional Project does not have an unlimited supply of funding). Please contact Carol Poole C.Poole@sanbi.org.za.	As soon as possible
9	SANBI-UCT Team	As part of forming biome specific working groups, we will organise ecological condition workshops/side events at biome specific workshops such as the Fynbos Forum, Thicket Forum, and Arid Zone Ecology Forum, etc. next year. Alastair Potts is willing to help organise a workshop at the Thicket Forum.	Next year depending on the dates of each forum next year.