SANBI
Biodiversity for Life
South African National Biodiversity Institute

Strategy for Developing a Centre for Biodiversity Information Management / Biodiversity Informatics

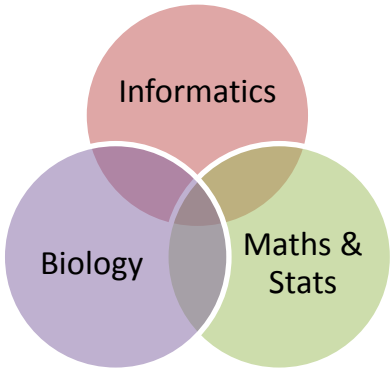
Fatima Parker-Allie BIMF 11 May 2016

Background

- South Africa's prospects for improved competitiveness and economic growth rely, to a great degree, on science and technology.
- Its ten-year innovation plan, which is built on the foundation of the National System of Innovation (NSI), recognizes that the country needs to take further steps to becoming a knowledge-based economy in order to meet its developmental objectives.
- Knowledge is the basic form of capital for innovation (knowledge generation, accumulation, and exploitation). Economic growth is driven by innovation, and the key driver for innovation is "high-end" human capital.
- A significant strengthening of the production of human capital and the institutional environment for knowledge generation is necessary, in collaboration with international partners.
- This especially in light of the fact that today, a growing percentage of the wealth in the world's largest economies is created by knowledge-based industries that rely heavily on human capital and technological innovation.

Biodiversity Informatics

- In South Africa, as in other parts of the world, Biodiversity Informatics is a young field, lies at the nexus of a number of disciplines



- Being such a new and dynamic field, there are **enormous challenges** in **recruitment, training and retention of BIM personnel**, **to support the mobilisation, management, coordination and utilisation of biodiversity** information for key conservation and biodiversity outcomes, and initiatives such as IPBES and the Aichi targets that require relevant data to meet the science-policy and decision making needs

- This demands broad **efforts to build human capital in the field**.

- The purpose of this document is to **propose a 5 year strategy towards a Centre in Biodiversity Information Management (BIM)** and outline a way forward for the development and management of this relatively new field of science.

Partnerships to Establish a Research Hub with a Vision towards a Centre for Biodiversity Information Management

- In order to support a holistic approach to BIM, engagements with **Institutions of Higher Learning** have been identified as the most strategic intervention towards a **longer term solution for more sustainable capacity development.**

- In 2012 an MoU was signed between the UWC-SANBI, to further develop a post-graduate research hub in Biodiversity Information Management, to drive towards the establishment of a Southern Africa Centre of in Biodiversity Informatics.

- Overall to take this initiative further, the approach has been to **develop and refine a curriculum** for (BIM) for broader-spectrum diffusion of new knowledge. The curriculum would be implemented initially at the Hub and into the University system, and be rolled out to other Universities.

- The hub would act as a focal point for **undergraduate and post-graduate training and research** which would serve South African students and researchers but would also support regional and international students that wish to focus their studies in BIM.
- In addition, the hub would also serve as a basis for developing an appropriate knowledge-based research strategy and together with the curricula, would form a foundation for the creation of the Centre.

Holistic Approach to Capacity Development

	SO1. Grow relevant skills	SO2. Build a robust team	SO3. Improve quality and use of information	SO4. Grow an inspired coordinated network
				
Target markets	University departments Students	SANBI BIM staff (SABIF)	Data providers Data users	Current and potential users and providers
Activities	UWC – SANBI MoU Postgrad research hub Bursaries Intern programme GreenMatter	Internal learning sessions Training Recruitment Skills matrix and development plan	**Training** **Providers**: Data mobilisation and fitness for use **Users:** Website use Modeling	BIMF User needs analysis Communication and marketing

Vision & Mission

Vision

- A proposed vision for the Centre is:
- “To build a world-class research and teaching facility in biodiversity information management in South Africa”

Mission

- A proposed mission statement for the Centre:
- To effectively train and build capacity in young biodiversity conservation and environmental scientists in biodiversity information management

What will the BIM Centre offer?

1. A structure and framework to develop a hub for Biodiversity Information Management training in South Africa

2. Developing and implementing **Biodiversity Informatics curricula** at both undergraduate and post-graduate levels

3. **Research Agenda** - Identify appropriate research themes/topics for MSc, PhD and Post-doctoral projects within these themes/topics **(Academic Training)**

- This is further detailed in the strategy

4. Provide **professional work-based training** and capacity development of individuals/young scientists interested in pursuing a career in BIM or related field

5. **Supervision** of post-graduate students

6. A dynamic and vibrant environment enabling the **exchange** of student and **academic** expertise at the national, regional and international level

To enable an environment of innovative and vibrant learning the hub will (ideally) need to accommodate:

- A mixture of **local, regional and international** students to allow for global exchange and interaction
- Facilities to assist students and academics to engage formally and informally (lecture rooms, library, outdoor facilities)
- Opportunities to engage in discussion groups regarding BIM related work or outputs
- Opportunities to engage in seminars and other forums.
- Opportunities to attend weekend or week- long field research trips. This allows students to gain valuable field experience and often creates a more informal environment to discuss issues with supervisors or other academics/researchers.

Current Situation: Postgraduate Hub - UWC

UNIVERSITY of the WESTERN CAPE

- The Department of Biodiversity and Conservation Biology (BCB) at the University of the Western Cape has been earmarked for the development of the hub.

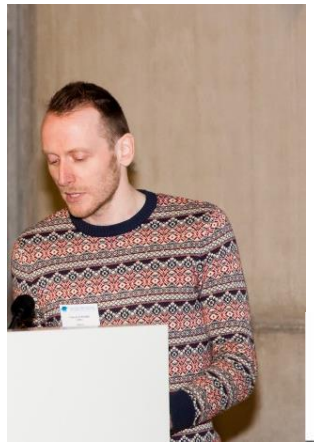
- In 2013, the BCB developed and introduced an **eight-week BCB Honours module** in Biodiversity Information Management (BIM); under a Funding Agreement between SANBI and UWC for the initial establishment for the Postgraduate Hub.

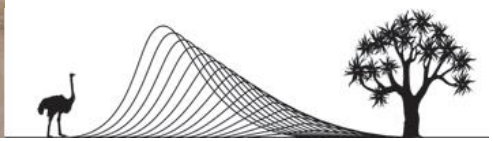
- **Twenty-four** students registered for the BIM elective module from 2013–2015.

Current Situation: Postgraduate Hub - Postdocs

- 1st Post doc, Dr. Douglas Harebottle – Started (October 2014) appointed to support the development of a Biodiversity Informatics Research Strategy and to grow the Postgraduate Hub.
- Has moved to Sol Plaatjies University as Senior lecturer and has initiated discussion with HOD to look at the implementation of BIM into the School of Natural and Applied Sciences at the University

- 2nd Post doc, Dr. Francis Strobbe – started Aug 2015 – Focus on Content and tools;
- **Advisor:** Prof. Res Altwegg, Centre for Statistics in Ecology, Environment and Conservation (SEEC-UCT)





Current Situation: Curricula

Data Generation	Biodiversity Information Management & Visualisation	Data Use and Application/Knowledge Generation

Knowledge / Data Generation	Biodiversity Information Management	Biodiversity Information Management	Data Use and Application
Theory: The basics of Taxonomy	**(Post Data Capture)**	Representation and management of ecological and biogeographic information **Theory: Biogeographic Studies**	**Theory: Biogeographic Studies, Distributional Ecology, Conservation Planning, Global Change (including climate change and invasive alien species)**

Introduction to Biodiversity Data
• Biodiversity data
• Sourcing biodiversity data
• Inventories and monitoring of biodiversity
• Spatial versus attribute data
• Metadata
• Assessing data quality
• Introduction to using maps
• Introduction to DIVA
	Databases and their design
	• Database relationships
	• Database normalisation
	• Herbarium and Museum data
	• Should all data be digitized (discussion on data prioritization)
	• Databases – basic concepts SQL
	• Databases – basic conceps QBE
		Geographic Information Systems
		• Introduction to geographic information systems
		• Digital representation of geographic information
		• Projections and scales
		• Vector and raster models
		• Metadata (FGDC, ISO) and Standards (DC, DG, DiGIR)
		• Google Earth
		• Data interpolation and geostatics IDW, TIN, Krieging,
			Ecological Niche Modelling
			• Conceptual overview/theoretical
			Data Requirements for Models
			• **Biological data / Primary Data**
			  • Natural History Collections
			  • Private Collections
			  • Monitoring Data
			  • Observation Records
			• **Data Format-** Gridbased/Presence/absence/pseudo

SARUA Curriculum Innovation Network SCIN

sarua southern african regional universities association

GBIF-Africa has identified the need for increased capacity development and a **research agenda for Africa**. This would align common research goals throughout the continent and set priorities for biodiversity conservation initiatives that would **direct outcomes** which are aligned with **global and national objectives**.

Models for Hub - Approach A

The hub hosted by a **single academic institution**

- The hub and CoE be hosted by a **single academic institution** with partnership links via other academic institutions and/or research organisations and institutions. External links would allow for additional funding opportunities for post-graduate, collaboration on biodiversity research projects and opportunities for curricula development and teaching.

- This strategy is currently used by most CoEs in South Africa but does require firm institutional and financial support from the host institution.

- The Department of Biodiversity and Conservation Biology at the University of the Western Cape was identified as a potential host institution, with high-level buy-in.

- **The department is however faced with ongoing capacity challenges** and staff are overstretched, which indicates a lack of stability with the current situation. There is a **clear need for further investment** if this model is to continue. For this model to succeed additional **funds to support a dedicated position will be required in moving the postgraduate hub towards a Centre.**

- Other potential options are to consider universities that have existing engagements with SANBI.
  - Sol Plaatjies
  - UKZN – Prof. M. Rouget - SARCHI Chair on Land Use Planning and Management, School of Agricultural, Earth and Environmental Sciences,)
  - NMMU - Prof. Richard Cowling (Research Professor, Dept of Botany) .

Approach B - Co-hosting

- The hub and Centre to be **co-hosted by appropriately identified academic institutions** with partnership links via other academic institutions and/or research organisations and institutions.

- **Co-hosting** has distinct advantages of sharing funding, expertise and other resources to meet the desired objectives of the Centre, and showcases the important collaboration and linkages between tertiary institutions working together in an inter-disciplinary environment.

- Additional external partnerships with other tertiary institutions or research/conservation institutions would allow for additional funding opportunities for post-graduates, collaboration on biodiversity research projects and opportunities for curricula development and teaching.

- This strategy is currently used by some CoEs in South Africa (e.g. CoE for **Food Security**, http://www.uwc.ac.za/Faculties/EMS/COEFS/ which is hosted by the University of the Western Cape and the University of Pretoria.

- Like 'Approach A' this will require firm institutional and financial support from both host institutions.

- A possible outlook for this strategy is to consider a co-hosting partnership between the Universities. The Centre for Statistics in Ecology, Environment, Conservation **(SEEC)** in the Department of Statistical Sciences at UCT is engaged with robust, and long-term biodiversity informatics-based projects, analysis and teaching programmes and is well placed to partner with other identified Universities, also UKZN or NNMU.

Approach C - Centre at SANBI and then move it to a University after 2-3 years

- The hub and Centre be hosted by a **research entity** (e.g. **South African National Biodiversity Institute**) with partnership links to academic institutions and/or research organisations and institutions.

- For this strategy it would **be important for the external links to have strong academic ties** in order to implement and offer accredited BIM curricula (courses) at post-graduate level.

- Would also require firm institutional and financial support from the host institution. This would represent a novel approach in establishing a Centre in this biodiversity and conservation sector in South Africa. It does however come with its own set of challenges, as it does not provide the immediate infrastructure of a tertiary institution and will be more resource intensive to SANBI, in terms of staff time and management.

- The Biodiversity Information Management Directorate could act as a focal point for developing content and resources for uptake into a University, which may be willing to implement the activities of the Centre.

- The advantages of hosting the Centre at a research entity/facility include, but not limited to:
  - Teaching staff will not be limited to academic staff of the relevant tertiary institution ('Approach A or B'). Lecturers/trainers with relevant expertise could be drawn from a pool of prospective academics and other researchers from various institutions;
  - Students could be registered at different partner universities linked to bursaries offered under their specific field of interest (e.g. Centre for Invasion Biology at Stellenbosch University, and Land Use Planning at University of KwaZulu-Natal).

A phased approach towards developing Biodiversity Informatics in SA

Stage 1

Research Hub established with 2 staff members in place

6 week BI Honours module / elective in place and taught

BCB Students actively participate (12 students)

Stage 2

2 Post-doc appointments

Post Doc Research to be conducted

4 Masters students to be appointed and supervised by Postdocs

Further development and implementation of **BI curricula** at honours level

Stage 3

Collaborative engagements

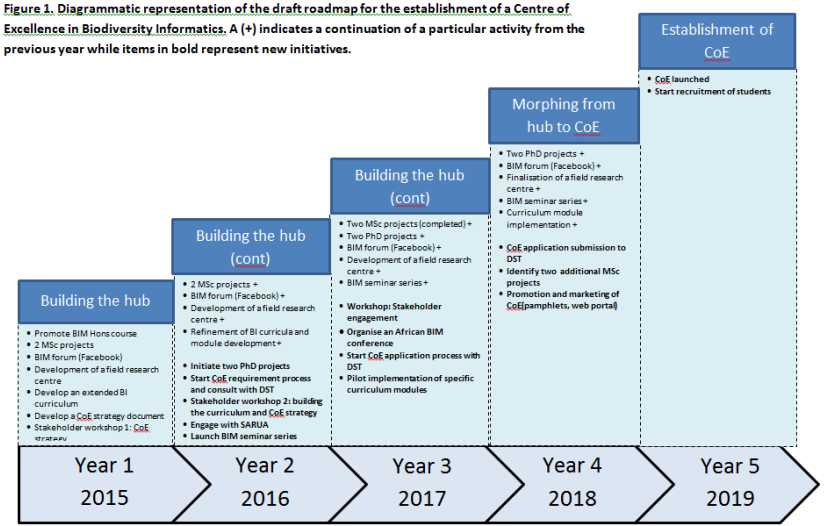
Rollout of curricula to other universities in South Africa

Increased involvement by other university academics nationally, willing to co-supervise Masters and PhD student projects

Exchange programmes or co-supervision with **academics** from other countries in **Africa** – Benin, Ghana – GBIF networks

Exchange programmes or co-supervision with leading **international academics** from other labs internationally

Figure 1. Diagrammatic representation of the draft roadmap for the establishment of a Centre of Excellence in Biodiversity Informatics. A (+) indicates a continuation of a particular activity from the previous year while items in bold represent new initiatives.



Key Performance Areas

- **Education and training -**Training and building capacity in BIM at post-graduate level will be a primary focus for the hub development and Centre operations.

- **Research -** A Centre will support both long-term and short-term research and/or projects. Research Themes/Agenda has been identified.

- **Partnerships and networking -** The cornerstone of the Centre is to build strong partnerships in order to use cross-disciplinary research expertise and knowledge to provide mutual and reciprocal benefits to all partners involved. The BIM CoE will seek to partner and network with all relevant institutions and organisations nationally, within Africa and globally.

- **Outputs -** Research outputs will most likely constitute - academic papers in peer reviewed journals, popular articles and reports.
  - Outputs potentially need to be **measurable**. For the BIM Centre the **two main indicators**, based on the KPAs, would be the number of students graduating and the number of publications emanating from both direct research and that produced from post-graduate projects each year.

  - Publications would be broken down into peer reviewed papers, popular communications, presentations at conferences, and reports.

Activities towards establishing Biodiversity Informatics Capacity and a Centre for Biodiversity Information Management (2007 – current) - Investments

Year	Activity	Outcome	Approximate Costing
2007	The start of national engagements through the BIMF, with the aim to harmonise biodiversity information sharing	Capacity Enhancement in Biodiversity Informatics and the development of a community of practice in biodiversity information management.	R 100 000
2008-2011	Through annual BIMF meetings the idea of building BIM capacity was further supported and strengthened	In 2010, through BIMF discussions SANBI was elected to drive the development CoE for Biodiversity Informatics, in an endeavour to build capacity in the field (BIMF Report 2010).	R 400 000
2009	A skills profile for Biodiversity Information Management was developed by SANBI		
2010	DST (Ms Marjorie Pyoos) recommended the development of a Center for BIM at the SABIF data handover event.		
2010	SANBI's **Human Capital Development Strategy** Report for the Biodiversity Sector was developed	Biodiversity Informatics was listed as a scarce skill in South Africa	
2011	**Training coordinator** for BIM Directorate funded by SABIF (3 years)	• A Learning Network Strategy developed for BIM • Training events were coordinated	R1 100 000
2012	A more recent Priority Skills Report, [GreenMatter, 2012] was developed	Biodiversity Information Management was listed as an **absolute scarce skill,** within the top 21 priority skills for South Africa's Biodiversity sector	
2012	SANBI signed an MoU with UWC on the 31st March 2012, towards the establishment of a Postgraduate research hub.	• High level support from the Deputy Minister of Science and Technology, the Vice Chancellor of UWC and CEO of SANBI • Two academics were in place to support the initiative. One as champion and other costed through MoA	R 1 000 000 SANBI R1 000 000 UWC (co-funding)

Year	Activity	Outcome	Approximate Costing
2012	SANBI secured funding for **two post-doctoral students** to work on Biodiversity Informatics curricula and development of a research strategy, and developing BI content and tools.		R 1 400 000
2014	Appointment of first Post-doc	Focus Area: South African Biodiversity Informatics Research Strategy	R100 000 (Running Costs)
2015	Engagement with SEEC as a partner (Prof. Res Altwegg) for academic supervision of second Post-doc	Fund disbursement Agreement signed	
2015	Appointment of second Post-doc	Focus Area: Biodiversity informatics content and tools	R100 000 (Running Costs)
2015	Lead two sessions at the GBIF Nodes meeting entitled: "**Towards a Curriculum for Biodiversity Informatics"**	• SANBI identified to drive the process for a GBIF endorsed Global Curricula for Biodiversity Informatics • Lead the component on the GBIF workplan 2016/17 • Look at a unified TDWG /GBIF Interest Group	
2008-ongoing	**Professional Work Based Training Workshops**	BIM Directorate and SABIF Programmes	R 965 000
			R 6 225 000 (Total Cost)

Conclusion

- The development of a BIM Centre will be pivotal for biodiversity conservation outcomes in the years to come.
- Training young scientists and conservationists to acquire a holistic set of biodiversity informatics skills will enhance the way in which data is managed and desired outputs are produced.
- A fully operational Centre, providing exciting curricula and post-graduate programmes, has the potential to make South Africa a leader in this developing discipline and drive knowledge-based outcomes for a sustainable future.
- **High level buy-in from universities, strong champions, partnerships, funding and dedicated leadership is crucial for this endeavour to succeed**.

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Thank You