



Unblocking the flow of biodiversity data for decision-making in Africa



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ABSTRACT

African countries need to conserve biodiversity and use natural resources rationally if they are to avoid continued environmental degradation that jeopardizes sustainable development and human wellbeing. However, many government agencies cannot access or use the biodiversity data they need to make informed decisions for environmental and economic management. More than forty stakeholders representing governments, civil society organizations (CSOs) and UN agencies, including delegates from 20 African states, identified decisions that require biodiversity information and explored blockages and potential solutions to data access and use. The participants concluded that the key enabling environment includes data availability, data quality and usability, willingness to collect and use data, and financial and technical capacity. We recommend that African government departments across sectors work with academic bodies and CSOs to: i) enhance internal resources for monitoring and develop partnerships with donors; ii) build capacity for data collection, using tools, guidelines and communities surrounding CBD planning and biodiversity monitoring; iii) improve national and international co-ordination and

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cross-sectoral collaboration for biodiversity data management; iv) produce and use more data-derived products that encourage data use, especially assessments that demonstrate the importance of biodiversity to economies and wellbeing and dashboards that facilitate interpretation and analysis. Governments, CSOs and academic bodies should test different science-policy interfaces in a handful of pilot countries or regions, building on existing models to demonstrate how data providers and users can work together to break down barriers to data access and sharing and mainstream biodiversity information into decision-making.

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1. Introduction

Almost all of the world's governments have rallied around the Convention on Biological Diversity (CBD) Global Strategic Plan for Biodiversity 2011–2020 and its twenty Aichi Biodiversity Targets (CBD, 2010). However, recent assessments suggest the Aichi Targets are not on track to meet the 2020 deadline; the state of biodiversity is declining and species and habitats are being lost whilst human pressures on the environment are increasing (Secretariat of the Convention on Biological Diversity, 2014; Tittensor et al., 2014; WWF, 2014). Ecosystems are degrading and losing their capacity to provide the services that people depend on, with negative implications for human wellbeing and environmental sustainability (Cardinale et al., 2012; Bernstein, 2014). In order to address biodiversity conservation and ensure sustainable livelihoods, decisions at multiple levels across multiple sectors need to be guided by information on the state of the environment. However, numerous challenges block access to, and use of, biodiversity data, including gaps or other inadequacies in indicators, data sets and capacity (e.g. Secades et al., 2014; Stephenson et al., 2015). Some of the larger challenges identified in Africa include data collection, access and management, infrastructure and capacity (Han et al., 2014). There is also a widespread absence of credible science-policy interfaces where scientists and decision makers (from the government bodies and civil society organizations managing resources) can come together in a dynamic and constructive manner to address common issues (Young et al., 2014; Sarkki et al., 2015).

We present an analysis of the barriers that hinder the flow of information from generation to use in decision-making in Africa and how these might be unblocked. The analysis originated during an international workshop on 12 October 2014 held in the margins of the Twelfth meeting of the Conference of the Parties to the CBD (COP12) in Pyeongchang, the Republic of Korea. The workshop was hosted by the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) and the World Wide Fund for Nature (WWF) International. The main workshop objective was to bring together African environmental managers to identify the barriers to accessing and using biodiversity information within decision-making processes in their countries and to identify potential solutions. The situation in Africa is a particular cause for concern as a high proportion of the population depends on natural resources directly for their food and livelihoods, yet pressures from unsustainable use are causing continuing declines in resources and biodiversity which in turn is impacting human wellbeing (e.g. Craigie et al., 2010; Cardinale et al., 2012; WWF, 2014).

2. Methods

The workshop at the CBD COP was attended by 42 participants, including representatives from 20 African states (Angola, Botswana, Burkina Faso, Cameroon, Djibouti, The Gambia, Ghana, Guinea Bissau, Kenya, Malawi, Mali, Mauritania, Morocco, Niger, Senegal, South Africa, Tanzania, Chad, Uganda and Zimbabwe), as well as partner agencies *inter alia* the CBD Secretariat, the Global Biodiversity Information Facility (GBIF), the South African National Biodiversity Institute (SANBI), UNEP-WCMC and WWF. During a structured programme and a series of plenary and working group sessions, the participants identified

decisions in African countries that require biodiversity information, then provided the top five most important answers to two key questions: Why are some decisions currently not using biodiversity information? What are the potential solutions to ensure information is available when and where needed?

The results generated by the workshop participants (decisions requiring data, blockages to data use and potential solutions) were then compared with the findings of a literature review conducted by PJS, NBN and ER to produce overall conclusions on the major factors enabling the flow of biodiversity information into evidence-based decision-making.

3. Results and discussion

3.1. Decisions requiring information and data needed

The main decisions requiring biodiversity information, as identified by workshop participants, are:

- The development of environmental resource legislation;
- National planning and budgeting for resource management across sectors (e.g. protected areas, forestry, fisheries, agriculture, infrastructure, mining, water management), including delivery of multilateral environmental agreements (MEAs) such as CBD, the Ramsar Convention, the Convention on Migratory Species (CMS) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);
- Transboundary and global planning and collaboration, when managing shared resources and developing (and contributing to) global goals such as the CBD Aichi Biodiversity Targets and the UN Sustainable Development Goals (SDGs);
- Access and benefit sharing and the control and licensing of resource use (e.g. mining, hunting, and quotas);
- The measurement and mitigation of human impacts on the environment (such as legal and illegal exploitation of resources, threats from invasive species, and health-related issues such as those around Ebola);
- Mitigation of resource-related conflicts and human-wildlife conflict.

Biodiversity underpins natural capital – the natural resources and ecosystem services essential for development and human wellbeing – and therefore has an economic value. Values such as those held, for example, by forests (for timber, climate stability and hydropower to name just three) and coral reefs (for fisheries and tourism) can only be used in national accounting and managed effectively if they are quantified – which needs data. When ecosystem services are not measured their economic values are not taken into account in decision-making and ultimately biodiversity is lost, as has been shown in Malawi (Ring et al., 2010; Ministry of Natural Resources, Energy and Mining, 2015).

The decisions requiring biodiversity information in Africa are not limited to those ministries with a mandate for environmental protection. Workshop participants noted that it is critical to engage with decision makers across sectors in order to fully mainstream biodiversity into national efforts for sustainable development such as National Development Plans and Poverty Reduction Strategy Papers.

The types of biodiversity data currently needed in Africa to make the collections listed above include: species populations, distributions, offtake, trade and threat status; habitat cover or distribution; protected area coverage and management effectiveness. In some cases, databases focused on African biodiversity data exist, such as the ARCOS (Albertine Rift Conservation Society) Biodiversity Management Information System (<http://arbmis.arcosnetwork.org/>) and FishBase for Africa (<http://www.fishbaseforafrica.org/>), and national biodiversity centres compile data locally (e.g. South African National Biodiversity Institute, Uganda's National Biodiversity Data Bank, Egypt's National Biodiversity Unit). In addition, several large global datasets have African data that are relevant, such as Protected Planet (<http://www.protectedplanet.net/>), the Global Biodiversity Information Facility (<http://www.gbif.org/>), Ocean Data Viewer (<http://data.unep-wcmc.org/>) the WWF/ZSL Living Planet Index (<http://www.livingplanetindex.org/>) and the IUCN Red List of Threatened Species (<http://www.iucnredlist.org/>). However, in spite of these resources, a set of barriers frequently prevents the data being available to, or usable by, the decision makers that need it.

3.2. Enabling factors required

Four main barriers to using biodiversity information in decision-making were identified for Africa. These were reframed in the workshop as key enabling conditions: (i) availability of data, (ii) willingness to use data, (iii) accessibility, usability and quality of data, and (iv) capacity for data collection, management and use.

3.2.1. Availability of data

Decision makers cannot use data if the data inadequate or not physically accessible to them. Many global data sets for biodiversity are incomplete with taxonomic, temporal and geographic gaps in coverage (Butchart et al., 2010; Stephenson et al., 2015). Lack of access to the relevant data has led to biodiversity in Africa not being fully considered within environmental decision-making processes and national CBD reporting. Data sharing is complicated further by a lack of consensus about what to monitor and different organizations and projects adopting diverse measurements (Pereira et al., 2013). Most existing monitoring programmes have been designed primarily at localized scales, and often produce information that is disaggregated, heterogeneous, and non-standardized when considered at national or regional scales (Han et al., 2014).

In an African context, there are significant challenges associated with data being scattered among institutions, government departments and academia, with little sharing of data between them. For example, the Government of Mozambique is aware of the importance of biodiversity, and has put in place relevant bodies and legislations to control biodiversity loss. However integration of biodiversity data into government decision-making processes is a challenge because of poor institutional connections arising from underlying political tensions and insufficient dissemination of information on biodiversity (Ministry of Coordination of Environmental Affairs, 2014). Similarly in Cameroon the second National Biodiversity Strategy and Action Plan highlights that the inaccessibility of data to decision makers and the poor links between science and biodiversity policies have indirect negative consequences on biodiversity (Republic of Cameroon, 2012). In Egypt, effective implementation of the CBD is hampered by limited sharing of information between ministries and other stakeholders (Ministry of State for Environmental Affairs, 2014). A widespread paucity or non-existence of data is a recurring theme in African national reports to the CBD (*inter alia* Egypt, Ghana, Somalia, Sudan, and Uganda).

3.2.2. Usability and quality of data

Even the limited data that are available are often not of a quality, reliability or timeliness to be of use to decision makers and may be presented in a way that is not conducive to decision-making, due to overly technical jargon or a lack of adequate interpretation (Roe and

Mapendembe, 2013; Segan et al., 2011). For example, in Malawi information on biodiversity is mainly gathered by academic institutions. Since these institutions have relatively little interaction with the data users – the government agencies responsible for land use planning – their findings on the impacts of land use on biodiversity are not informing decision-making (Ministry of Natural Resources, Energy and Mining, 2015). Transforming scientific evidence into usable information is not a straightforward process (McNie, 2007; Knight et al., 2010). For example, several African countries conduct regular wildlife surveys, yet the resultant data are rarely analysed and presented in a form that could be used by decision makers (Bubb et al., 2011).

3.2.3. Willingness to collect and use data

Actors within different government sectors have different priorities and information needs. The lack of inter-ministerial collaboration and the disconnections within and between government ministries are major barriers to the willingness to use and mainstream biodiversity information. In countries like South Africa, environmental strategies are often lower political priorities than social ones (housing, education, healthcare, crime prevention etc.) and are sometimes seen as conflicting (Crouch and Smith, 2011; Wilhelm-Rechmann and Cowling, 2011). One of the key obstacles to the implementation of Uganda's first National Biodiversity Strategy and Action Plan (NBSAP) was the lack of a central node to facilitate information sharing among institutions involved in biodiversity conservation, and the country's second NBSAP notes that political interests drive public managers to disregard biodiversity information (National Environment Management Authority, 2015). In Angola, the structure of local government severely hampers biodiversity-related decision-making and environmental issues are often seen as an obstacle and not relevant to development (Ministério do Ambiente, 2014).

3.2.4. Capacity

When data are available, accessible and in a useable format, and when decision makers are willing to integrate this information into decision-making processes, the final pre-requisite for the flow of data is the appropriate level of technical and financial capacity. Inadequate technical capacity of decision makers was highlighted as the key obstacle to implementing NBSAPs in many African national reports to the CBD including Angola, Ghana, Somalia, and Uganda. Financial capacity is another factor highlighted by workshop participants.

There is a general lack of funding and capacity for conservation monitoring (Martin et al., 2012). Tools for data collection can be expensive, technically demanding and ignore the local context (Thapa et al., 2014). Remote sensing is one area where data sharing has increased in recent years. However there remain numerous limitations and challenges to its use, including lack of technical capacity among biodiversity experts, lack of financial capacity to acquire the data, the need for data processing and derived products, lack of sufficient data validation and lack of harmonization of methods and data collection at national and international levels (Secades et al., 2014; Turner et al., 2015). In Africa these issues are compounded by limited internet capacity for many data users (Roy et al., 2010).

3.3. Solutions identified

There are signs of hope. Data and technology are becoming cheaper and more easily available, with growing examples of their application for biodiversity monitoring in Africa (e.g. Beresford et al., 2013; Knights et al., 2014; Swanson et al., 2015). Capacity building workshops for CBD monitoring in eastern and southern Africa demonstrated that in most countries at least a few indicators of national relevance can be produced from existing data (Bubb et al., 2011). Initiatives under the Global Biodiversity Information Facility (GBIF) are helping African countries build capacity to acquire data by creating networks of data holders and users and digitizing and mobilizing existing data from natural

history collections and surveys (GBIF, 2015). This work has underlined the importance of increased technical capacity and information resources to assist data mobilization. Some data sharing platforms and communities have been developed that provide access to African data, examples including the AfriBES social network of scientific and technical information for Africa (<http://afriseb.net>), the ARCOS Biodiversity Information Management System for the Albertine Rift region (<http://arbmis.arcosnetwork.org/>) and the information resources at SANBI (<http://www.sanbi.org/information>). Efforts are needed to scale up activities like these to tackle the blockages that remain.

3.3.1. Availability

Improved co-ordination and collaboration within and between institutions and initiatives collecting and holding biodiversity data are essential to bridge gaps between and within governments, academic bodies and civil society and link decision makers to data collectors (Secades et al., 2014; Turner et al., 2015). Local and international civil society organizations (CSOs) as well as academia have a significant role to play in supporting government agencies. National efforts to address data collection can be enhanced by harmonizing measures across scales and programmes and expanding existing efforts to standardize and share data (Pereira et al., 2010; Stephenson et al., 2015). Policy makers can aid in breaking down barriers to the availability of biodiversity information by enabling the creation of accessible data platforms that will allow the required trust and transparency to be fostered, reducing the time and effort expended on sharing information (Guerry et al., 2015). Appropriate monitoring and data collection methods also require local inputs. Equitable participation of data providers and users, including local communities, is considered central to the adaptive management process and can lead to better results and sustainability (Jacobson et al., 2009; Danielsen et al., 2014). Citizen science initiatives, where volunteers participate in monitoring, offer an opportunity to enhance data collection and efforts in South Africa (e.g. iSpot South Africa www.ispot.org.za) should be built on.

3.3.2. Usability

Biodiversity data need to be produced of the right quality at the right time and in the right format to be useful. Working together, scientists and decision makers need to plan, produce and use more data-derived products in relevant forms and languages. Priority products include materials that showcase in a user-friendly way the results of studies that demonstrate the importance and multiple values of biodiversity to national livelihoods, economies and human wellbeing (e.g. Costanza et al., 1997; Turner et al., 2012) and easy-to-use dashboards that facilitate data interpretation and analysis and encourage its use for adaptive management (Han et al., 2014; Stephenson et al., 2015). The wide range of users of such products will have differing priorities and mandates so the focus should be on ensuring simplicity and on open access to underlying data and methodologies to encourage transparency and easy replication.

The production and use of appropriate data-derived products can only work if the absence of effective science-policy interfaces is addressed. Young et al. (2014) suggest scientists and policy makers from across fields and sectors will need to work together, frame research and policy jointly, promote inter- and trans-disciplinary research and put in place structures and incentives for interactive dialogue. Data collectors need to understand decision makers' needs and priorities and co-develop tools and information products that directly address those needs (Cowling et al., 2008); enhancing the credibility, relevance and legitimacy of information will strengthen the case further (Sarkki et al., 2015).

There will likely be no common solution across Africa, given the differences in national capacity and socio-economic situation and the varying importance of environmental planning in political agendas. In some countries, certain government ministries may take the lead in convening and building structures for dialogue around data; in other cases,

MEA secretariats or CSOs could facilitate national-level dialogues to bring together appropriate science and policy actors from different sectors. Structures and networks will vary but need to embrace the principles of collaboration and data sharing, and be willing to work towards common goals.

3.3.3. Willingness

Ensuring data providers and users collaborate on producing data and data-derived products in formats that meet decision makers' needs (in being, for example, brief, understandable, timely and iterative) is an important first step in increasing willingness to use data (Segan et al., 2011; Sanchirico et al., 2014). There will also be more data uptake if measures are used that respond predictably to policy changes (Jones et al., 2011). For example, in cases where biodiversity goals and measures in Africa have been aligned to national development priorities, such as in Namibia and South Africa, they have received considerably greater attention and uptake, with positive outcomes for biodiversity and development (Martens, 2012; Brown et al., 2014).

The SDGs recently agreed by the United Nations should encourage more governments to use data for monitoring across sectors and thereby encourage inter- and trans-disciplinary research within national academic and research bodies. The science community – especially in countries where social science research is well developed – could help by investigating further the conditions that enable the use of environmental data in decision-making and seeking input into their research objectives from decision makers (e.g. McKenzie et al., 2014). Furthermore, African countries willing to receive technical or financial support to enhance their biodiversity data collection and use should communicate their priorities to the global academic and NGO communities.

3.3.4. Capacity

The development of capacity for biodiversity monitoring in relevant national institutions has already been acknowledged as essential (Walpole et al., 2009; Tittensor et al., 2014; Stephenson et al., 2015).

African governments need to enhance the allocation of internal resources for environmental monitoring, develop partnerships with donors and map and build capacity for data collection and management at national and regional levels. Whilst capacity issues are largely linked to resources, more governments need to take advantage of opportunities being offered to build capacity for environmental data collection and monitoring, such as the tools and guidelines surrounding CBD planning and biodiversity monitoring (e.g. 2010 Biodiversity Indicators Partnership, 2010; Hansen et al., 2013), and relevant communities of practice, such as the NBSAP Forum (<http://nbsapforum.net/>), Biodiversity Observation Networks (Wetzel et al., 2015) and data holders networks (GBIF, 2015). The SANBI information system helped track biodiversity measures and stimulate biodiversity mainstreaming in the country (Huntley, 2014); similar institutional structures may be useful elsewhere on the continent.

Data collection may not be overly expensive – especially if governments can rely more on shared and publicly available data sets. For example, one estimate suggests that initiating integrated monitoring programmes for selected plant and animal species in sub-Saharan Africa could require as little as USD 50,000 per country per year (Pereira et al., 2010) – and taxa for which monitoring capacity already exists could be prioritized. It should be noted that setting up monitoring systems in Africa requires more investment in the early stages to support training and awareness creation, as well as the capital costs for equipment and materials not always covered by under-resourced management authorities (Bennun et al., 2005). Citizen science contributions may often be cheaper but also require resources, and investments are encouraged to support relevant associations, online toolkits and network portals (Chandler et al., 2017–this volume). Even at a global scale, costs estimates for key environmental databases range from USD 856,000 per annum to USD 4.7 million per annum, which are much smaller sums than the billions required for climate change monitoring (Juffe-Bignoli

et al., 2016). The global environment community needs to find ways of sharing the costs of data acquisition to support African nations more directly and making data available more easily to governments who need them. A range of actors, from the Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services (IPBES) to international CSOs and MEA secretariats could play a role in co-ordinating these efforts and mobilizing resources, exploiting opportunities when data providers and users come together, such as around MEA conferences and technical meetings.

4. Conclusions

This paper represents one of the first stakeholder assessments of African biodiversity data needs. If African governments can work with key partners, from academia, civil society and MEAs to improve the mainstreaming of biodiversity into decision-making, chances of achieving sustainable development and halting biodiversity loss will be increased. An appropriate enabling environment will necessitate an improvement in national and international cross-sectoral, inter-agency and inter-departmental collaboration to improve information availability and usability, encourage more willingness to use this information, and enhance the capacity for data collection and management.

Scientists and decision makers need to interact more so as to improve mutual understanding about what is needed to enhance biodiversity data flow and use in Africa. Research has demonstrated that these so-called science-policy interfaces will need to be dynamic, active, long-term, cross-sectoral and adapted regularly to meet the needs of the participants and their audiences (Young et al., 2014; Sarkki et al., 2015). We recommend that governments, CSOs and academic bodies test different sorts of science-policy interfaces in a handful of pilot countries or regions to see what works best in the African context. Dicks et al. (2014) propose a method involving decision support systems for organizing relevant science to improve environmental decisions; the further development of this framework in Africa should be explored. Boundary organizations – bodies that specifically breach the divide between policy and science by assisting interactions and brokering knowledge (e.g. Cutts et al., 2011; Briley et al., 2015) – may also be part of the solution and relevant ones for Africa will need to be identified or created. The AfriBES network of scientific and technical information for Africa could play a role as its aims revolve around information sharing and south-south collaboration. There is also need to build on successes in countries like Namibia and South Africa to ensure closer harmony between biodiversity goals and development goals, and the SDGs may provide a platform to stimulate that.

The actions taken by governments between now and 2020 will be critical in determining whether we continue along economic development paths without jeopardizing biodiversity and ecosystem services. We can only achieve this goal if we work together to break down barriers to data access and sharing and mainstream biodiversity information into decision-making.

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