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Highlights

- Capacity development models linking science to policy offer new perspectives
- Capacity needs include ground truthing, economic valuation and modern technology
- Capacity development must include technology transfer for biodiversity indicators
- Biodiversity monitoring ownership should be increased through community involvement
- Lack of data, indicators and policy integration hampers biodiversity monitoring

Joining science and policy in capacity development for monitoring progress towards the Aichi Biodiversity Targets in the global South

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Abstract

In view of better linking conservation and sustainable development, it is imperative to optimize the transfer of biodiversity-related knowledge and technology from resource-rich countries to developing countries. All countries signatory to the Convention on Biological Diversity are expected to report on their progress towards achieving the Aichi Biodiversity Targets. However, weak data coverage and the technicality or even unavailability of indicators present major barriers to the monitoring of biodiversity as well as the development of adequate biodiversity policies and management plans in many countries of the global South, hence increasing the North-South knowledge and capacity gap. Capacity development in these countries may hence substantially enrich global biodiversity monitoring and policy. In this effort, ensuring that monitoring programs are realistic and sufficiently embedded in policy remains a challenge. To contribute to the mainstreaming of biodiversity into development cooperation, we developed a capacity development concept that links scientific data to policy development. To guarantee shared ownership, academic institutes and organisations or authorities with responsibilities in biodiversity policy were invited to jointly submit competitive "Monitoring, Reporting and Verification" (MRV) project applications. It appeared that especially ground truthing, economic valuation of biodiversity, and the application of modern technologies in biodiversity monitoring were missing capacities in the global South. Efforts are also required to increase the understanding and use of indicators to avoid them remaining a theoretical concept. As is observed with MRV in the carbon context, increased involvement of local communities is recommended in the global MRV framework, including techniques such as community-based Mapping, Measuring and Monitoring.

Keywords

Development cooperation; indicator; technology transfer; Measuring, Reporting and Verification (MRV)

1. Barriers to biodiversity monitoring in the global South

To optimize the link between conservation and sustainable development (Kok et al. 2008; Suich et al. 2015) unquestionably more and better technology transfer regarding biodiversity is necessary. Among signatories of the Convention on Biological Diversity (CBD)[1], scientific biodiversity knowledge and technology is expected to flow mostly from countries that are rich in resources to those rich in biodiversity. This encompasses all CBD aspects, including biodiversity conservation, sustainable use, and access and benefit sharing (Böhm & Collen 2015).

[1] BIP: Biodiversity Indicators Partnership; CBD: Convention on Biological Diversity; GBIF: Global Biodiversity Information Facility; GEO BON: Group on Earth Observations Biodiversity Observation Network; IPBES: Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services; MMM: Mapping, Measuring, Monitoring; MRV: Measuring, Reporting and Verification; NBSAP: National Biodiversity Strategy and Action Plan

The development and use of indicators for monitoring and follow-up is a challenge in particular regarding the CBD Aichi Biodiversity Targets. These 20 targets mirror the goals of the CBD Strategic Plan for Biodiversity 2011-2020. They contribute to a framework of national and regional biodiversity targets

> *… in accordance with national priorities and capacities and taking into account both the global targets and the status and trends of biological diversity in the country, and the resources provided through the strategy for resource mobilization, with a view to contributing to collective global efforts to reach the global targets…* (CBD 2010).

Projections however look grim as neither an improved state of biodiversity, nor reduced pressure have been observed. Societal responses favouring biodiversity have however improved (CBD 2014; Tittensor et al. 2014). This discrepancy is possibly explained by a lag-phase in these responses taking effect. The authors of these projections mention caveats with analyses, including limited geographical resolution and taxonomic coverage and the assumption of constant policy. However these barriers, amongst other factors, are linked to the type of indicators used, often showing variable spatial, temporal and taxonomic coverage. For some targets, suitable indicators are hardly available (UNEP-WCMC 2012). Hence, as efforts to reach the Aichi Targets must be increased, improved data collection, data sharing, capacity development and investment in local institutions in developing countries offer important entry points in enhancing the efficiency of monitoring states and trends (Collen et al. 2008; Tittensor et al. 2014). We define "capacity development" or "capacity building" as the development of capacity i.e. *the ability of a human system to perform, sustain itself and self-renew* (Ubels et al. 2010).

However, data-related uncertainties are not the sole, let alone the biggest problem of biodiversity monitoring in developing countries. Given the limited resources available in the global South, additional thought should be given to practical feasibility. Many programs are unsustainably large, complex and expensive, and lack integration (mainstreaming) into policy (Danielsen et al. 2003).

Indeed, bridging the gap between science and policy has often been called for, but there is no consensus on how to achieve this goal (McNie 2007) across the North-South knowledge and capacity gap.

2. MRV-inspired capacity development bridges the science-policy gap

As several development agencies intend to mainstream biodiversity into their mission (Garnett et al. 2007; DGD 2014), we worked out a capacity development concept for biodiversity monitoring. It promotes the connection between scientific data and policy development. Parallel to the need for the involvement of, and mutual trust between, local stakeholders and government agents (Danielsen et al. 2003) it stimulates affinities, information flow and shared objective setting between researchers and biodiversity policy-makers. We were inspired by global carbon management, where Measuring, Reporting and Verification (MRV) of sequestration and emission levels is crucial to documenting and assessing the outcome of policy alternatives at both national and international levels. MRV has mostly been applied to forestry, but its use has also been advocated for other fields related to climate change, e.g. agriculture (de Brogniez et al. 2011) and in other sectors like biodiversity (McCall et al. 2016). In the carbon context, MRV capacity needs are highest in Africa. Mayaux (2011) recommends capacity development at different levels:

> *… technicians involved in the day-to-day management of natural resources and in the implementation of the MRV systems, managers of natural resources involved in the planning and implementation of policies, high profile scientists for adapting scientific tools and methods to the African context.*

Along these lines we devised an “MRV call”, consisting of a competitive call (to ensure South demand and quality) for small projects, jointly submitted by an academic partner (university or public research institution) and an organisation with responsibilities in biodiversity policy, management or conservation (e.g. conservation agency, environmental ministry, NGO) in partner countries of the Belgian Development Cooperation, focusing on Africa. We devote separate calls to countries sharing an official language, allowing mutual feedback and collaboration between projects. We proposed focal topics for each call to maximize synergies between projects and to tailor the workshop contents. A first call received projects from Benin, Burundi, the D.R.Congo and Morocco. Topics covered a range of scales, including case studies about data feeding into national indicators (bottom-up) or on indicator prioritisation, development or use at national level (top-down) (Table 1). Given the size of the D.R.Congo, a different call focuses solely on that country, linking data and policy and connecting Congolese institutions at the regional level. Eligibility criteria included, apart from formal project requirements: (1) synergies between partners; (2) collaborations at the science-policy interface; (3) potential for continued use of proposed indicators; (4) relevance for the respective National Biodiversity Strategy and Action Plan (NBSAP) and other (inter)national reporting and (5) availability of biodiversity-related data. We invited representatives of both partner institutions within selected projects to an opening workshop that consisted of lectures, discussions and exercises on project-cycle management, GIS, indigenous knowledge, indicator development, valorisation of natural history collections, valuation of ecosystem services and database creation and management. Collaboration with experts from the North is offered during the one-year life cycle of the project. In a closing workshop in the South, in the country of origin of one of the selected projects, further collaboration opportunities are explored (Fig. 1). The two workshops gathering representatives of all selected projects, respectively at the projects' inception and conclusion, allow *ex-ante* and *ex-post* exchange of ideas, best practices, problems and lessons learned. A follow-up call is planned within *ca.* three years to monitor changes over time.

During the opening workshop and informal contacts with participants from Benin, Burundi, the D.R.Congo and Morocco, gaps and capacity needs appeared. These align with the gaps identified by Mayaux (2011) and McCall et al. (2016) such as the need for direct observation (ground truthing), economic valuation and practice in the use of modern technologies, e.g. GPS, GIS, biodiversity informatics and remote sensing. The prominent use of indicators in the applications received and how well-defined indicators were at the onset of the funded projects differed widely, demonstrating that a generalised understanding and use of indicators and related concepts presented a challenge in itself. This therefore highlighted the need to include as part of the call capacity development on the use of and development of indicators, for projects where such needs were identified, when necessary also during the application process. It was already clear that using globally consistent indicators is a challenge and that most countries lack evidence-based reporting (Pereira et al. 2013; Han et al. 2014). Our experience is further proof that not only indicator choice and empirical monitoring, but also the process of data analysis and reporting will seriously hamper (inter)national reporting. This also illustrates a gap between the terminology and goals applied in global policy and by international bodies, the work of field scientists and the responsibilities of local and national authorities. It is exactly this gap that the two-partner approach of the present call intends to bridge. Biodiversity indicators will remain a theoretical concept in many countries unless efforts for technology transfer and capacity development are increased.

3. Perspectives and the need for improved community involvement

Many developing countries are biodiversity hotspots, but lack sufficient research capacities. This hampers progress towards Aichi Target 19, aiming at the improvement, sharing and transfer of biodiversity-related knowledge, science and technology, and towards a range of other Aichi Targets and CBD objectives (Wilson et al. 2016). Capacity development and external funding for policy-relevant biodiversity assessment should meet needs expressed in the framework of international bodies such as the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (Perrings et al. 2011). Also, the Group on Earth Observations Biodiversity Observation Network (GEO BON) aims to fill gaps in monitoring in those regions richest in biodiversity and where this biodiversity also experiences most pressure (Pereira et al. 2012). Initiatives like the Biodiversity Indicators Partnership (BIP) and the Global Biodiversity Information Facility (GBIF) are crucial to these efforts.

The present ongoing pilot capacity development program (Fig. 1) intends to introduce practice that may improve monitoring of biodiversity and implementation of biodiversity policy in developing countries in two ways. (1) Fostering formal South-South collaboration between researchers and policy-makers. This increases "social capital" between stakeholders, mutual understanding of each other's highly different knowledge systems and the legitimacy of scientific information (McNie 2007 and references therein). It also bridges the gap between active extension by researchers and decision makers alike, at the interface between science, policy and development. (2) Supporting scientists in the South to produce and mobilise policy-relevant, scientifically sound biodiversity data.
Community involvement within MRV for carbon management is increasingly deemed necessary (Mayaux 2011; Palmer Fry 2011; McCall et al. 2016). Similarly, several projects selected in our MRV biodiversity call include aspects of community involvement (e.g. stakeholder involvement in indicator prioritisation; ethnobotany in work on economically important plants). We recommend that indigenous and local communities and other local, regional or national stakeholders be included in a more systematic way into biodiversity-related MRV initiatives. It is however questionable to what extent indigenous and local communities are interested and capable to contribute within MRV in an (inter)national context, given the technical challenges and the pre-defined highly standardized protocols used for consistency. Therefore, it is worthwhile to explore complementing or underpinning MRV of biodiversity with participative methods such as community-based Mapping, Measuring, Monitoring (MMM) (McCall et al. 2016). Hence, (1) local and/or traditional knowledge, priorities and experiences would be taken into account in scientifically sound and reproducible reporting towards biodiversity objectives and (2) local contribution, ownership and involvement towards the Aichi Targets would be better valorised and possibly increase for the benefit of

biodiversity and sustainable development, in line with the United Nations' 2030 Agenda for Sustainable Development.

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Tables

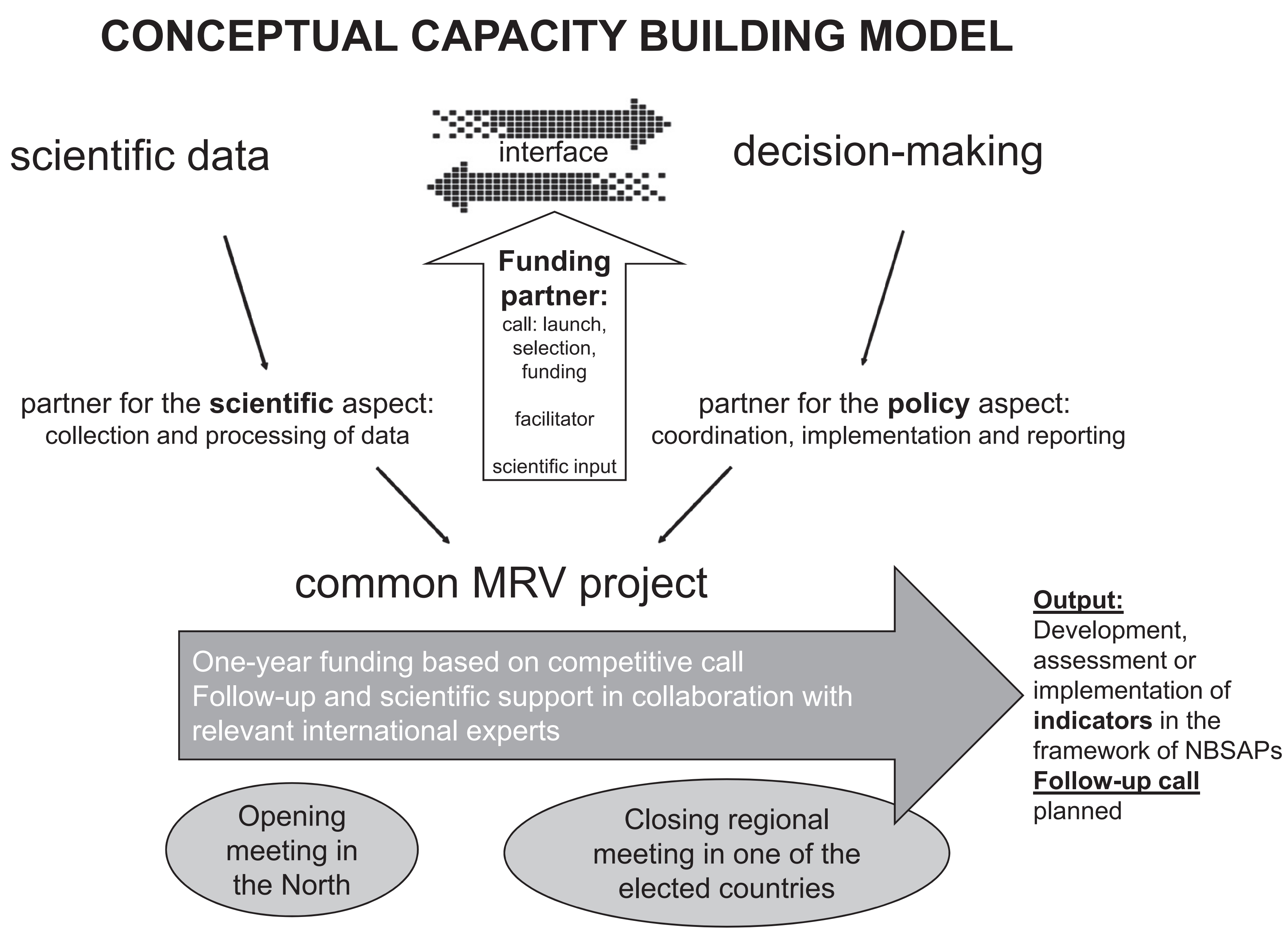
Table 1. Overview of projects funded through a competitive call for projects on the measuring, reporting and verification of biodiversity and biodiversity policy. Nine applications were submitted in total.

Topic	Type of project partners	Country
Installing a follow-up system for biodiversity in Benin	environmental agency & university laboratory	Benin
Value chain and traditional knowledge regarding selected medicinal plants in the major urban centres of Benin	environmental ministry & forestry research institute	Benin
Indicators for the follow-up of biodiversity trends in Burundi	environmental agency & university laboratory	Burundi
Floristic and ethnobotanical investigations on the plants utilised in an area near the capital	environmental ministry & university laboratory	D.R.Congo

Figure legends

Figure 1. Schematic overview of the proposed capacity development program for the measuring, reporting and verification of biodiversity and biodiversity policy.

Figure 1


CONCEPTUAL CAPACITY BUILDING MODEL
scientific data
interface
decision-making
Funding partner:
call: launch, selection, funding
facilitator
scientific input
partner for the scientific aspect:
collection and processing of data
partner for the policy aspect:
coordination, implementation and reporting
common MRV project
One-year funding based on competitive call
Follow-up and scientific support in collaboration with relevant international experts
Opening meeting in the North
Closing regional meeting in one of the elected countries
Output:
Development, assessment or implementation of indicators in the framework of NBSAPs
Follow-up call
planned