



How can global conventions for biodiversity and ecosystem services guide local conservation actions?

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With global science-policy conventions for biodiversity and ecosystem services in place, much effort goes into monitoring and reporting on the progress toward policy targets. As conservation actions happen locally, can such global monitoring and reporting efforts effectively guide conservation actions at subnational level? In this paper we explore three different perspectives: policy reporting for policy implementation; scientific knowledge for empowerment and actions; and from past trends to influencing the future. Using these three perspectives, we identify ways forward for both decision makers and scientists on how to engage, inform and empower a larger diversity of actors who make decisions on the future of biodiversity and ecosystem services at multiple scales.

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Without doubt, scientific understanding of why and where biodiversity and ecological resilience are degrading is advancing [1[•],2]. In addition, there is enormous investment and engagement by both decision makers and scientists to maintain and raise the environmental stakes on international policy agendas in the face of worldwide economic, social and political challenges. Global biodiversity targets as set by the signatories to the Convention on Biological Diversity in 2010 (the Aichi targets), the 2013 European Union strategy on adaptation to climate change, and the Sustainable Development Goals, require short to medium term action in translating such targets to local conservation actions [e.g. 3], for instance at the level of protected areas, watersheds or a village [4].

With the first thematic, regional and global assessment reports of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) being published [5,6] or steadily advancing, it is timely to reflect on how the substantial scientific and political investments in monitoring and reporting on progress toward global biodiversity and ecosystem service targets can be used effectively for conservation actions. Taking the perspective of societal actors faced with subnational or site-

based conservation challenges, we explore the possible guidance that these global initiatives may provide. As the ultimate objective is to decrease biodiversity degradation [7], frequent backcasting of the extent of biodiversity and ecosystem services loss for reporting does not necessarily provide guidance on what to do differently to curb downward trends in the future [8^{••}]. A different approach is therefore required to obtain and use information from global conventions to enhance the effectiveness of societal actors in addressing local biodiversity degradation. A lack of information is only one of many factors mentioned when listing impediments to the impact of local conservation actions. Empowerment of local actors, multi-actor mobilization and addressing the impaired effectiveness of governance are measures that have been suggested as steps toward curbing current biodiversity trends [9,10^{••},11–13], steps which cannot be taken by decision makers, scientists or NGOs in isolation or bilaterally.

In this paper we reflect on: policy reporting for policy implementation; scientific knowledge for empowerment and actions; and from past trends to influencing the future. From these three perspectives, we identify ways forward for both decision makers and scientists on how to engage with, inform and empower a larger diversity of actors that take decisions on the future of biodiversity and ecosystem services at local scales.

Policy reporting for policy implementation

From the experience of the Intergovernmental Panel on Climate Change (IPCC) it is evident that the road from developing a shared perception of the problem to assessing challenges and identifying solutions for the future is long and paved with strategic and political pitfalls [14]. With biodiversity and its relation to ecosystem services being even more complex to understand than climate change, developing a shared perception and understanding of the problems around biodiversity and its associated services between scientists, decision makers and societal actors will be at least equally challenging [15[•]].

Biodiversity trend assessments with comparable methods to increase the credibility of the observed trends have emerged over time [e.g. [Convention on Biological Diversity](#), 16] and many indicators and trends have been identified [e.g. 17–22]. The recent surge of interest in ecosystem services has similarly led to monitoring and reporting efforts at all spatial and institutional scales [e.g. 23–25; the ongoing [Regional and Global IPBES assessments](#)]. Biodiversity and ecosystem assessments still lack systematically recorded data and indicator use is inconsistent, making it difficult to conduct trend analyses over time and across regions. In the absence of this, the integration and harmonization of different kinds of data is one of the priorities in developing subnational management plans, for example for the state of New South

Wales, Australia, in mitigating the impacts of climate change on biodiversity [3].

Although it is difficult to assess the realized implementation of international conventions across all the different actors who take biodiversity and ecosystem service related decisions, the credibility and value of comprehensive science-policy-platforms, such as IPBES, partly depend on whether their findings are successfully implemented [1^{••}]. In recent decades, internationally shared objectives have been transformed into global initiatives, such as sustainable development [26] or the protection of specific species and ecosystems (e.g. Ramsar [27]; Biodiversity Action Plans or Convention on Illegal Trade in Endangered species: www.worldwildlife.org/pages/cites). Without national and regional implementation commitments, it is difficult at a local level to anticipate which objectives and actions will be endorsed by national governments in the longer-term. Simultaneously, progress made at a local scale may not be recognized at national or global scales [28[•]].

Common assumptions are that low efficacy of biodiversity conservation management can be improved by filling existing knowledge gaps [29^{••}] or increasing the protection status. Although local actors may indeed perceive a lack of information (for instance the exact way climate change is going to affect biodiversity at their protected areas [e.g. 3]), this is rarely the only or most important barrier to local conservation action [e.g. 12]. Take for instance, the impact of stakeholder involvement in policy implementation [10^{••},13,30]. In addition, it is becoming increasingly clear that protection of areas is not sufficient to change biodiversity degradation trends [7,8^{••}]. Despite governments making long-term commitments to the conservation of biodiversity, ecosystem services and related natural resources, such commitments can be threatened by changes in power, and a protection status previously approved by a government may be changed or simply terminated [e.g. 31]. This is complemented by a growing trend of attributing limited value or credibility to scientific evidence in political debates, which affects policy development and implementation [32].

Furthermore, taking into consideration some multinational companies today generate more profit than the Gross Domestic Products (GDP) of entire countries, it would not be fair nor realistic to expect or request governments to single-handedly protect biodiversity. Assessments and recommendations, such as those delivered through IPBES, should therefore not solely focus on decision makers in governments, but also on the multiple actors involved in real world decisions on biodiversity and implementation. Where reports have their limitations, adding clickable maps or additional data repositories can offer a downscaling of report results that facilitates use by mayors, urban planners, NGOs, community

leaders, business executives, investors and citizens. Following up on the objective of IPBES to provide capacity building [Item 6 (a) of 33], concrete actions could include the supply of expertise to translate global recommendations into concrete approaches for management plans. The involvement of different actors is essential because their roles in safeguarding ecosystem services (e.g. food production, water purification) and biodiversity (e.g. for nature related tourism) are different from the role government bodies play (e.g. to define and protect national parks). For instance, the role that the private sector could play in the financing and implementation of the Sustainable Development agenda has been clearly articulated in the Addis Ababa Action Agenda [34].

Scientific knowledge for empowerment and actions

Many scientific publications identify and call for harmonized biodiversity and ecosystem services monitoring schemes for policy reporting [e.g. 35,36]. However, recommendations for concrete actions, which would help non-governmental actors' implementation of findings from these reports at a local level, are hard to find. For instance the knowledge that management decisions result in trade-offs among ecosystem services [37,38] has yet to be transformed into concrete guidelines which go beyond simple optimization and effectively help navigate trade-offs at local scales. The implementation of a reserve protection status can be detrimental to local peoples' access and recognition of their cultural and natural heritage [13].

Information which leads to new or adaptation of existing conservation actions is not identical to the information required for monitoring and reporting. Notably, indicators need to be sensitive enough to detect change [20] at a rate at which decisions can be triggered [39**]. This is not an easy endeavor when monitoring data of pressures on biodiversity and ecosystem services is often missing [40**]. There are, however, examples where scientific initiatives are successfully and systematically monitoring changes over time. Notably the Global Forest Watch initiative (www.globalforestwatch.org/) has increased the effectiveness of local law enforcement on illegal logging, by providing open access to frequently updated earth observation images of forest cover.

Whereas citizens are increasingly considered as a credible source of observations and data for scientific studies and policy reports [41,42], the potential impact citizens have on daily decisions about natural resources and biodiversity is much less acknowledged or understood. International reviews and place-based research [10**,43*,44*] have demonstrated that the involvement of local actors in biodiversity knowledge development stimulates a much quicker uptake of recommendations than only following top-down governance implementation. More

knowledge about how local citizen engagement and empowerment can be increased (e.g. through votes, changing consumption patterns or supporting NGOs) could diversify conservation strategies and result in positive impacts for biodiversity and ecosystem services. For practitioners, an improved quantification of biodiversity decline is less likely to lead to adaptation of management decisions than information on how to prepare for and mitigate the impacts of land use and climate change [e.g. 44*]. A greater understanding of which kind of information empowers citizens and results in positive impacts for biodiversity and ecosystem services could be obtained through long-term involvement of stakeholders in place-based research [28*].

Some of today's largest nature conservation organizations began as a result of an integrated approach of interests of citizens and private funding to safeguard nature, sometimes together with, or in opposition to national governments (see for example the importance of collaboration between decision makers, scientists and hunters in the birth of WWF, or the creation of Doñana National Park [45]). Currently ways to influence general adherence to environmental objectives have partly changed (e.g. social media is increasingly important for creating international visibility for progress as well as breaches of international agreements), creating a wider range of options for a diversity of actors to connect and act. The successful Turkish Flamingo Campaign (2012–2013), for instance, predominantly oriented its outreach directly at the general public, journalists and local actors (Birdlife Turkey, unpublished data).

The industry and banking sectors are often portrayed as exerting multiple pressures upon the environment, but events in 2017, when CEOs of multinationals urged the President of the USA to uphold its commitment to the 2015 Paris Climate Accord, indicate they can be potential allies. This does not naively assume that concern for the future of the planet is a top priority for industry. It does however, indicate that economic and innovation interests can, and some say should, mobilize important support ([46], <https://www.nature.org/about-us/working-with-companies/index.html>). Similarly, the financial sector, especially the World Bank, is maturing its environmental impact assessments. Such assessments are obligatory for large infrastructure projects and are gradually being introduced in many responsible investment domains, for example through the International Finance Corporation's (IFC) performance standards (<http://www.ifc.org/sustainability>). Having relevant knowledge can improve impact assessments (e.g. <http://ec.europa.eu/environment/cia/pdf/EIA%20Guidance.pdf>) and lead to credible monitoring of impacts and evidence-based mitigation. Scientists can contribute relevant knowledge by increasing data and knowledge availability and developing credible assessment tools

for more transparent and evidence-based impact assessments [1^{••}]. Although there are ever-present concerns about conflicts of interest [47], environmental researchers should not (be asked to) close the door on collaboration with industries that genuinely strive to minimize their impact.

From past trends to influencing the future

Biodiversity and ecosystem service reports for decision makers yield valuable information on past trends [30,48] and contribute support for international decision making and agreements. However, data on past trends at national and international spatial scales does not inform local actors on how to act now to curb downward trends [39^{••},1^{••}]. In addition, the implementation of policy measures is often not accompanied by a monitoring of their impact, leaving little information to evaluate effectiveness for future reference [e.g. see the EU Common Agricultural Policy 49].

Important information on the impact and timing of possible actions could come from future projections or back-casting from a desired outlook. Science-policy platforms can stimulate scenario building, but biodiversity scenario studies have focused increasingly on single pressures (notably climate change [27]) whereas comprehensive studies incorporating multiple factors including changes in land cover and land use intensity, are rare [50]. For multiple driver scenarios, many barriers have to be overcome, such as data deficiencies (e.g. on land use intensity [51]), mismatches in time horizons between climate change and socio-economic scenarios [50] and an absence of common scenarios for habitat fragmentation and land cover change [44[•]]. Moreover, generally large-scale model outputs are used, which often do not provide information on local priorities. It would be important to assess which actions undertaken by which actors in the social-ecological landscape have the most impact. The IPBES Modelling and Scenario expert group and the scientific community are taking first steps to address this challenge [5] by, for instance similarly to the IPCC climate scenarios, developing biodiversity scenario narratives that could be applied to different spatial scales. Although co-development of biodiversity scenarios does take place [e.g. 52,53], it is relatively rare and the development of coherent scenarios across spatial scales remains a challenge which has not yet been solved.

Conclusion

To prevent a further decline of biodiversity and to ensure the long-term sustainable use of the ecosystem services biodiversity provides, decision makers and scientists need to diversify their strategies. Communication of results has to be timely, include concrete recommendations at relevant spatial scales and be oriented to a wider range of actors who make decisions on biodiversity actions. Information and communication can be complemented with

concrete actions to facilitate the uptake of results at subnational level while simultaneously addressing barriers for biodiversity conservation efficacy. This requires a clear vision of what can be changed to improve the future, which may build on, but cannot come solely from an improved quantification of past trends.

Conflicts of interest

None.

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