

People and biodiversity in the 21st century

This article belongs to Ambio's 50th Anniversary Collection. Theme: Biodiversity conservation

Jeffrey Sayer , Christopher Margules, Jeffrey A. McNeely

Received: 22 July 2020 / Revised: 10 December 2020 / Accepted: 11 December 2020 / Published online: 10 February 2021

Abstract Fifty years have elapsed since the first publication of *Ambio*. Throughout this period, fundamental changes have occurred in societal attitudes to biodiversity conservation. *Ambio* has published numerous papers that have aligned with these new approaches. High citations numbers suggest that *Ambio* papers have had a significant impact on conservation strategies. We review these publications and find that they align well with changed societal perspectives on biodiversity. *Ambio* papers have called for greater contributions of local and indigenous peoples and for conservation in multi-functional landscapes. The 1992 Convention on Biological Diversity built on these principles. Negotiations are now underway for a post-2020 framework for biodiversity. *Ambio* papers have argued for a stronger scientific basis for conservation and for the need to adapt to changing conditions and to the rich diversity of societal preferences for conservation. International processes favor simple, generalizable approaches to conservation but we call for recognition of the diversity of ecological and human conditions in which conservation occurs. There is a need to build capacity to support a diversity of conservation approaches that are adapted to changing local conditions and to the priorities of diverse human societies.

Keywords Convention on biodiversity · Indigenous people and conservation · Landscape approaches · Post-2020 biodiversity framework

INTRODUCTION

The publication of *Ambio* in 1972 occurred in a year that marked a turning point in concepts and approaches to the

conservation of nature. 1972 was also the year when the Stockholm Conference on the Human–Environment agreed “Common principles to inspire and guide the peoples of the world in the preservation and enhancement of the human–environment.” The Conference led to the establishment of the United Nations Environment Programme, moving nature conservation from a concern of specialized government agencies and non-governmental interest groups to a significant issue on the international agenda.

Studies subsequently published in *Ambio* reflected the changes that were occurring in thinking and practice for natural resources management. For example, Gadgil et al. (1993) presented evidence that “much of nature was already being sustainably managed by traditional and indigenous communities,” implying that the understanding accumulated by local indigenous people over long periods should become part of the body of knowledge used to manage biodiversity and ecosystem services. This led to greater recognition of the rights of traditional resource users and recognized that national parks had often denied traditional people access to areas they had traditionally used. Papers in *Ambio* also showed that indigenous communities managed their natural resources at the landscape or seascape scale. Examples of river valleys managed as integrated systems in Asia and Oceania, fire used to promote landscape heterogeneity in Australia, Africa, and North America, and the rotation of harvest pressure in many hunter-gatherer societies, for example, through use of periodic no-take zones.

Gadgil's paper built upon other studies published in *Ambio* that illustrated integrated ecosystem approaches to resource management (Folke 1989). Landmark papers documented the challenges faced by marine conservation in Australia (Kelleher and Kenchington 1982) and the Caribbean (Dixon et al. 1993). These contributions

provided evidence of synergies between conservation initiatives and improvements in natural resource productivity to support peoples' livelihoods.

These foundational trends marked the change from nature conservation as the objective of special interest groups to the more inclusive concept of environmental management as a major objective of global governance. The reality of trade-offs between conservation and development began to be addressed (Poore and Sayer 1991). *Ambio* drew attention to these environmental trade-offs and suggested ways of addressing them (Wells 1992; Wells and Brandon 1993; Sheil et al. 2006) and demonstrated the complexity of links between conservation and development, while highlighting the need for evidence rather than ideology to guide attempts to untangle these interactions. Box 1 summarizes the major events that marked change in perceptions and programs for nature conservation during the latter years of the 20th Century.

LANDSCAPE APPROACHES TO CONSERVATION

As conservation entered center stage in international diplomacy, it had to address the reality of the poverty faced by the burgeoning human population on the planet. Landmark papers in *Ambio* by Bengtsson et al. (2003) and Hanski (2011) helped nurture the process of shifting conservation thinking beyond the maintenance of the status quo towards a more adaptive agenda to confront changing contexts. Both authors reinforced the message that biodiversity conservation should focus on landscapes. Bengtsson et al. (2003) proposed conservation management strategies that included managing areas outside strict reserves, calling for 'dynamic' reserves such as fallows and successional areas mimicking natural disturbance regimes in order to build resilient landscapes. Hanski (2011) tackled the issue of the ecological viability of meta-populations at the landscape scale threatened by habitat fragmentation. He drew on previous studies, both his own and others, of the genetic factors that threatened population viability,

Box 1 Evolving concepts: From nature conservation to environmental husbandry

Starting in the early 1970s, the world moved from protecting nature to a broader approach to environmental management. International environmental initiatives emerged to support this transformation. The 1972 World Heritage Convention aimed to conserve cultural and natural sites "of outstanding universal value," becoming the first global agreement to link culture and nature. In 1976, UNESCO launched its system of Biosphere Reserves to promote research, knowledge sharing, and capacity building in representative examples of natural biomes located in harmonious landscapes. Biosphere reserves recognized the value of nature in traditional patterns of land use and focused attention on modified ecosystems capable of restoration to more natural conditions (Batisse 1982). The UNESCO Man and Biosphere Program now lists 701 biosphere reserves in 124 countries

In 1978, IUCN expanded its definition of protected areas beyond the traditional national parks to include a range of categories from strict nature reserves (Category I) to protected areas with sustainable use of natural resources (Category VI). Debate about protected area categories is continuing (Locke and Dearden 2005; Boitani et al. 2008) and identifying a globally applicable set of categories remains challenging. The basic principles set out in the *Ambio* papers of Bengtsson et al. (2003) and Hanski (2011) provided thoughtful analyses that continue to have relevance to this debate

IUCN, WWF, and the United Nations Environment Programme collaborated to publish the World Conservation Strategy (IUCN and WWF 1980), an authoritative statement on the need to reconcile the conservation of nature with the improvement of the livelihoods of people and the maintenance of a functioning environment to support human development.

The 1980s saw concepts of protecting examples of wild nature evolve towards maintaining sustainable ecosystems as a basis for human development. The 1982 World Parks Congress, held in Bali, Indonesia, recognized the economic, cultural, and political contexts of protected areas and called for increasing local support through measures such as education, revenue sharing and participation in decision-making (McNeely and Miller 1984). In 1983, the World Commission on Environment and Development began its deliberations, leading to its seminal 1987 report, *Our Common Future* (Brundtland 1987) that introduced "sustainable development" to the global vocabulary and the notion that the goals of conservation needed to be an integral part of measures to improve the human condition. In 1986, a National Forum at the National Science Foundation in Washington DC introduced the term "biodiversity" to the world and initiated a wave of interest in this new framing of the concept of nature conservation (Wilson 1988)

In the latter years of the 1980s, seeking broader support for emerging environmental concerns, conservation organizations worked with governments to debate early drafts of a convention on biological diversity along with conventions on climate change and desertification. The World Summit on Conservation and Development held in Rio de Janeiro in 1992 adopted these conventions. The Convention on Biological Diversity (CBD) was concerned with both in situ protection of biodiversity and ex situ conservation. The CBD drew attention to the challenges of sharing access to, and benefits from, biodiversity and promoted national plans for its conservation and sustainable use. The CBD accepted multiple understandings and approaches to biodiversity conservation and recognized that conservation was subject to societal choice.

Further advances in understanding of the economic dimensions of biodiversity came in the 1990s (Perrings et al. 1992; McNeely 1994) leading to the wide acceptance of the concept of ecosystem services. Ecosystem services were defined as the benefits that genes, species, and ecosystems provide to people through provisioning, such as the production of food and water; regulating, such as the control of climate and disease; supporting, such as nutrient cycles and oxygen production; and cultural, such as spiritual and recreational benefits (Daily 1997)

extinction thresholds in habitat fragments, and the evolutionary dynamics of fragmented populations. He used the conclusions of these studies to argue for what he called conservation landscapes, within which one third should be multi-use landscapes with conservation as an outcome, and a third of that third, about 10%, dedicated to strict protection. These arguments explicitly recognized that the world was too crowded and demands on resources too intense to allow for the continued expansion of inviolate conservation areas. Bengtsson and Hanski both provided scientific arguments that support investments in ecosystem—and landscape-scale conservation (Sayer et al. 2005).

THE CONVENTION ON BIOLOGICAL DIVERSITY AND ITS STRATEGIC PLAN

The 10th Conference of Parties of the Convention on Biological Diversity, held in Nagoya, Japan, in 2010, negotiated a first global Strategic Plan for Biodiversity and launched a “decade of biodiversity.” The Plan presented a set of ambitious targets, known as the Aichi Targets after the Japanese prefecture where Nagoya is situated. Agreed by the 192 government parties to the CBD, the world now had a set of targets to guide biodiversity conservation action. The targets were ambitious; for example, target 11 called for effective area-based conservation measures for 17% of the world’s land and inland water area and 10% of coastal and marine areas.

The Aichi target has inspired many countries to expand their systems of national parks and other categories of protected area, and over 90 of them have attained the 17% target. Much of the increase in protected areas has been in IUCN categories V and VI—protected landscapes and resource management areas (Dudley et al. 2016). Some governments anxious to achieve the 17% target have established protected areas in degraded and marginal areas that have limited conservation value. There is still not enough evidence of the effectiveness of protected landscapes in delivering on biodiversity outcomes (Dudley et al. 2016), and in some cases, it is clear that these are areas that simply were not needed for anything else. There was a failure to respect some of the arguments put forward by Hanski (2011), notably with marginal and degraded lands with little alternative use should not count towards conservation targets.

The potential value of landscape approaches to conservation does align with Bengtsson et al. (2003) and Hanski (2011), as well as Sayer et al. (2003, 2008) who all advocated conserving biodiversity through management of the broader landscape within which conventional strictly protected areas would be located.

THE POST-2020 FRAMEWORK FOR BIODIVERSITY CONSERVATION

Encouraged by the perceived success of the Aichi targets, governments are now considering targets that are more ambitious. The Conference of Parties of the CBD will devote its upcoming meeting in China to negotiating a post-2020 Framework for Biodiversity. The first draft of the negotiating text includes targets of protecting up to 30% of terrestrial areas, and proposals by Wilson (2016) to allocate 50% of the planet for biodiversity and ecosystem services have some support. Several countries have already approached or achieved this target (Bhutan, 48%; New Caledonia 54.4%; Slovenia 53.6%; and Venezuela 54.1%).

Enthusiasm for such ambitious protected area targets should be tempered by the realization that the effectiveness of management of even old-style totally protected areas in IUCN categories I–III is often poor (Hockings et al. 2006). The Bengtsson and Hanski papers in *Ambio* provided valuable analysis of land allocation options for achieving biodiversity conservation by presenting evidence that careful targeting of conservation investments is often better than simply maximizing protected area coverage. Governments have often been unwilling to allocate the resources that would be required to manage protected areas effectively. Even if funds were available, it is clear that in many countries, civil society would not tolerate the withdrawal of extensive areas of productive land from potential use. The true extent of areas benefitting from effective biodiversity conservation remains poorly known. The few published studies suggest that conservation is only effective in a limited proportion of legally established protected areas (Locke and Dearden 2005). IUCN has launched an ambitious plan to monitor management effectiveness of protected areas worldwide (Hockings et al. 2006), but the program is based on self-reporting by national protected area management agencies and has not yet provided credible or easily accessible data. The evidence reinforces the view that the CBD should target specific biodiversity outcomes and not just increased area.

Bengtsson et al. (2003) suggested a hierarchy of conservation areas within which high priority features would receive permanent protection but with more flexible and adaptable approaches used to meet other conservation objectives. Sayer et al. (2000) suggested identifying elite tropical forest sites for protection under the World Heritage Convention with explicit biodiversity goals set and monitored. Some of those contributing to the post-2020 biodiversity agenda are advocating landscape approaches based on the models of Bengtsson and Hanski. In other parts of the world, the achievements of landscape conservation remain poorly documented, and it is often difficult to identify the specific conservation goals that are being

targeted (Dudley et al. 2016; Sayer et al. 2016). Measuring landscape performance in achieving conservation goals has proven challenging (Sari et al. 2018, 2019).

The debate on the post-2020 agenda highlights challenges raised by the papers in *Ambio* by both Bengtsson et al. (2003) and Hanski (2011). Marine, terrestrial, and freshwater ecosystems are changing. Competing claims on land are intensifying (Conway and Wilson 2012; Laurance et al. 2013); climate change is affecting biodiversity; and invasive alien species and new plant and animal diseases are having devastating effects on natural ecosystems. Disruption of natural fire patterns, and of management regimes implemented by indigenous people, are leading to less frequent but more catastrophic fires. Such challenges raise questions about the extent of political commitment and the degree of management competence available to manage natural areas. The location of existing protected areas may not be ideal, and there is a need to achieve the flexibility and adaptability of protected area location and management advocated by Bengtsson et al. (2003).

The upcoming CBD COP is likely to adopt relatively simple, aspirational, and politically attractive targets for biodiversity conservation. Surveys indicate that civil society will express preferences for enhanced conservation measures, but people are often reluctant to accept measures that restrict their material well-being. Investments in conservation need to be scientifically sound and aligned with the cultures and economies of local societies.

CONCLUSION: FUTURE CHALLENGES FOR BIODIVERSITY CONSERVATION

Negotiators at the CBD COP should heed the insights of Gadgil et al. (1993), Bengtsson et al. (2003), and Hanski (2011), who called for a far more nuanced agenda for biodiversity. Conservation programs impact on Indigenous groups, and these people should be fully engaged, and preferably in leadership positions, in the establishment and management of protected areas (Gadgil et al. 1993). Already in 2010, Aichi target 18 committed the convention to engage with indigenous people and harness their knowledge to conservation (Box 1). Strategies for conserving biodiversity and ecosystem services may be best achieved through a modest highly targeted set of strictly protected areas destined for permanent protection situated in a supporting landscape (Bengtsson et al. 2003; Hanski 2011). Research, training, and capacity building are needed to develop the highly competent individuals and institutions needed to manage programs of biodiversity conservation. Conservationists will need to deal with the fundamental social and economic changes that will continue to challenge the world in coming centuries.

Many countries are empowering indigenous communities to manage and protect biodiversity. This is clearly a welcome development but as Gadgil et al. (1993) noted, the opportunity to make indigenous peoples responsible for biodiversity is not a panacea. Agrawal and Gibson (1999) pointed out that as human populations are growing and people are becoming more connected to market economies, indigenous peoples also aspire to the economic benefits of development. Brosius (1997) provides a balanced view of the potential and challenges associated with indigenous conservation. Gadgil et al. (1993), Bengtsson et al. (2003), and Hanski (2011) all emphasized the need for evidence of conservation outcomes to support strategies for biodiversity conservation. Other contributions to *Ambio* over the years have supported greater involvement of local people and broader adoption of landscape approaches, along with calls for clearer targets and more flexible and adaptive management of biodiversity conservation programs (Brandon and Wells 1992; Sayer et al. 2000; Sheil et al. 2006).

Over the 50 years of its existence, *Ambio* has included contributions that have heralded significant innovations and stressed the need for hard empirical evidence to document conservation achievements. As the debate about conservation continues in the political arena, it will be important to ensure that the science continues to drive the agenda.

The message from *Ambio* to negotiators of the post-2020 Biodiversity Framework should emphasize that the broad diversity of values rooted in different cultures and stages of economic development means that one size cannot fit all. International processes produce simplistic, standardized solutions, whereas conservation has to be adapted to the rich diversity of ecological and human conditions. Papers published in *Ambio* have consistently argued for local adaptation and mobilization of local knowledge. Indigenous and other local communities most directly affected by conservation measures must have an increased role in decision making. Outcomes for species and ecosystems and the people who depend upon them should provide the basis for assessing the success of conservation programs. The number and extent of areas nominally allocated for protection is an inadequate indicator of progress. In coming years, *Ambio* should seek contributions that provide the essential clarity on agreed goals and on metrics that assess the performance of conservation measures. Biodiversity conservation will have to confront an increasingly complex and inter-connected world, and the simple solutions that often appeal to politicians may not work in real life (Boedhihartono et al. 2018; Bull et al. 2018). The future lies in sensitive science-based management of all ecosystems in ways that exploit local knowledge and are

responsive to local cultures and economies (Sayer and Campbell 2004).

Acknowledgements We are grateful for the comments and contributions of numerous colleagues who have shaped our views on biodiversity conservation. Two anonymous reviewers provided valuable feedback on earlier drafts of this paper.

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AUTHOR BIOGRAPHIES

Jeffrey Sayer (✉) has spent his life working on conservation programs in Africa and Asia. He initiated and managed the Tropical Forest Conservation Program of IUCN and subsequently directed the Center for International Forestry Research during its first decade. He is now Professor of Tropical Forest Conservation at the University of British Columbia in Canada and continues to support landscape-scale conservation initiatives in the Congo Basin and Indonesia.

Address: Department of Forest and Conservation Science, Faculty of Forestry, Forest Science Center, University of British Columbia, 2424 Main Mall, Vancouver, BC V6T 1Z4, Canada.
e-mail: Jeffrey.sayer@ubc.ca

Christopher Margules is an Adjunct Professor at the University of Indonesia and at James Cook University, Australia. Previously, he was a research scientist at CSIRO Australia for 32 years and then Senior Vice-President and leader of the Asia Pacific Division at

Conservation International. He has worked in Namibia, South Africa, and PNG, as well as Australia and Indonesia. He received Order of Australia honors in the General Division (AM) in 2005.

Address: James Cook University, PO Box 785, Tolga, QLD 4882, Australia.
e-mail: chrismargules@gmail.com

Jeffrey A. McNeely retired in 2016 after a 50-year career in conservation, including 13 years in Thailand, 3 years in Indonesia, 2 years in Nepal, and 32 years with the International Union for Conservation of Nature in Switzerland. He remains active as an advisor to Thailand's Department of National Parks, serves as Policy Liaison for the Society for Conservation Biology Asia Section, and is an Associate Editor of *Ambio*.

Address: 1445/29 Petchkasem Rd, Saitai ChaAm, Petchburi 76120, Thailand.
e-mail: jeffmcneely2@gmail.com