



**United
Nations**

Department of
Economic and
Social Affairs

CEPA strategy guidance note on

Ecosystem management

December 2021

The [United Nations Committee of Experts on Public Administration \(CEPA\)](#) has developed a set of principles of effective governance for sustainable development. The essential purpose of these voluntary principles is to provide interested countries with practical, expert guidance on a broad range of governance challenges associated with the implementation of the 2030 Agenda. CEPA has identified 62 commonly used strategies to assist with the operationalization of these principles. This guidance note addresses ecosystem management, which is associated with the principle of intergenerational equity and can contribute to strengthening the inclusiveness of institutions. It is part of a series of such notes prepared by renowned experts under the overall direction of the CEPA Secretariat in the Division for Public Institutions and Digital Government of the United Nations Department of Economic and Social Affairs.

In reading this guidance note, individuals in government ministries and agencies who are less familiar with the topic will be able to understand the fundamentals. Those who have perhaps taken initial steps in this area with limited follow-through or impact will be able to identify how to adjust elements of their practice to achieve better results and to better embed and institutionalize the strategy in their organizations. Those who are more advanced in ecosystem management will be able to recognize the practices which contribute to its success.

Understanding the strategy

Ecosystem management involves using ecological knowledge about a particular ecosystem's structure and function to achieve a desired set of objectives. By setting and working toward appropriate objectives that are grounded in sustainability, ecosystem management can be an effective tool for public administrators and others to promote intergenerational equity within the framework of sustainable development.

Ecosystem management is a broad concept that can be applied to an array of contexts at and across different spatial and temporal scales – as a result this note is relevant to a plurality of flexible approaches. Given the unsustainable patterns of development that have resulted in the crossing of several planetary boundaries of safe operating space for humanity,¹ ecosystem management requires not only the conservation and protection of well-functioning ecosystems, but also the restoration of degraded ecosystems and eco-cultural systems. This point is particularly resonant in the current United Nations Decade on Ecosystem Restoration, which runs from 2021 to 2030.²

Well-recognized threats of catastrophic climate change and biodiversity loss,³ among other global-scale phenomena, make clear that using ecosystem management to promote intergenerational equity is a local-to-global, cross-scale challenge. Strong national and local institutions as well as concerted international commitments and actions are necessary to fully meet this challenge. Agriculture, exploitation of coastal and marine fisheries, extractive industries, urbanization and unsustainable patterns of production and consumption, driven in part by globalized trade and land and resource grabbing, are causing the degradation of ecosystems and the loss of biodiversity worldwide, all of which are exacerbated by climate change. As the United Nations and its agencies, as well as other international, regional and national assessments, have shown, local-to-global threats to ecosystem health and biodiversity are at a critical level.

At the national level, the effective use of ecosystem management requires lawmakers and public sector officials to first understand and appreciate the value of ecosystems and biodiversity, and of ecosystem management as a tool for sustainability and intergenerational equity. With this foundation, the responsible authorities must ensure that ecosystem management is integrated consistently, with appropriate capacity, funding and human resources, into all relevant areas of the public domain.

¹ Steffen, et al., 2015, Planetary boundaries: Guiding human development on a changing planet, *Science* 347(6223):1259885-1–1259885-10; Bai, et al., 2018, Plausible and desirable futures in the Anthropocene: A new research agenda, *Global Environmental Change* 39: 351-362.

² <https://www.decadeonrestoration.org>

³ See reports of the International Panel on Climate Change (IPCC) at <https://www.ipcc.ch>, and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, <https://ipbes.net>.

Ecosystem management grounded in sustainability and intergenerational equity promotes the important objectives and commitments of the 2030 Agenda for Sustainable Development. In the 2030 Agenda, the world's nations stated their determination “to conserve and sustainably use oceans and seas, freshwater resources, as well as forests, mountains and drylands and to protect biodiversity, ecosystems and wildlife.”⁴ Accordingly, Goal 15 of the Sustainable Development Goals (SDGs), supported by nine targets, is to “[p]rotect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.” SDG 14 calls broadly for the conservation and sustainable use of the oceans, seas and marine resources, and Target 14.2 aims to “sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts.” In further support of SDGs 14 and 15, Target 2.4 of Goal 2 (zero hunger) aims to ensure that food production systems and agricultural practices maintain ecosystems. Target 6.6 of SDG 6 (clean water and sanitation) aims to “protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.” With regard to governance for achieving the SDGs and their related targets, Target 15.9 aims to “integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts.” Ecosystem management can help achieve these and other goals and targets of the SDGs.

What is an ecosystem?

The 1992 Convention on Biological Diversity defines an ecosystem as “a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.”⁵ This definition includes all scales at which ecosystems can be considered, from individual organisms, to populations and communities of organisms, to local ecosystems that include both biotic and abiotic components, to biomes⁶ made up of broad assemblies of local ecosystems, and on up to the biosphere or ecosphere at the planetary scale.⁷ Thus, ecosystems can be delineated not only by the boundaries of wild, undeveloped areas, such as many protected areas, but also partially or significantly developed lands and waters that humans have altered, impacted or otherwise transformed, such as urban areas; forests with active timber harvesting and other economic uses; arable land; and developed coastal areas, water courses, mountains and seas.⁸ Although much of ecosystem management is focused on

⁴ Para. 33 of the 2030 Agenda.

⁵ Convention on Biological Diversity, Article 2.

⁶ The Earth's major terrestrial biomes and ecozones are described in Chapter 8 of Freeman, B., 2018, *Environmental Science: A Canadian Perspective*, Dalhousie University, Dalhousie Libraries Digital Edition, <https://digitaleditions.library.dal.ca/environmentalscience/chapter/chapter-8-biomes-and-ecozones/>

⁷ An ecosystem could be “be a grain of soil, a pond, a forest, a biome or the entire biosphere.”

Convention on Biological Diversity, COP 5 Decision V/6, Paragraph A.3 (2000).

<https://www.cbd.int/decision/cop/?id=7148>.

⁸ Notably, at least 75 percent of the Earth's ice-free terrestrial regions have been characterized as anthropogenic biomes, as opposed to wildlands, in view of human use of and impacts on those regions over time. Ellis, E.C.

relatively undeveloped areas, such as protected areas, it is useful to keep the broader scope of ecosystems as human-inclusive eco-cultural systems and landscapes in mind when considering the significant challenges policymakers and public administrators face in managing ecosystems, especially at the landscape or national level.

What is “ecosystem management”?

The term “ecosystem management” was first coined in 1992, referring to the objective of ensuring that the ecosystems of national forests in the United States remain “diverse, healthy, productive and sustainable.”⁹ Many methods of ecosystem management have developed in the context of public lands and protected areas designated for legislated uses and purposes and managed by institutional bureaucracies. This remains an important context for ecosystem management. Because they serve multiple uses and purposes, including recreation, wilderness, timber harvesting, livestock grazing, and mining, national forests in the United States were a particularly apt setting for introducing ecosystem-based approaches. The objective is to ensure that all of these uses can occur without degrading the overall structure and function of the ecosystems within the national forest over time. If successful, this approach promotes intergenerational equity by ensuring that the forest provides for both people and other living beings that rely on the forest from one generation to the next. Since 1992, “ecosystem management” has spread to many other regions of the world. As well, much of what could now broadly be considered ecosystem management existed well before the term was coined in 1992, and those approaches are considered here, too.¹⁰

For public administrators or officials responsible for ecosystem management, the appropriate management scale is linked to the scope of the management regime, including management goals¹¹ – sometimes an artificially bounded natural protected area, as with many forests and other public lands, and sometimes a more naturally determined system, such as a watershed, ecoregion, landscape, biome or, ultimately, the entire biosphere or ecosphere. For example, some geoengineering projects to address global climate change, which might materialize despite the controversial nature of many such proposals, would involve ecological management at the global or ecospheric scale. As well, ecosystem management can range from a focus on maintaining ecosystem services that benefit humans, to more transformative

and N. Ramankutty, 2008, Putting people in the map: anthropogenic biomes of the world. *Front Ecol Environ* 6(8): 439-447.

⁹ Defries, R. and H. Nagendra, 2017, Ecosystem management as a wicked problem. *Science* 356: 265-270.

¹⁰ For example, in Belize, in the absence of government resources, local NGOs such as the Belize Audubon Society (BAS) began as early as 1969 to work toward the establishment of protected areas for jaguars and other ecological features of concern, leading over time to a substantial network of protected areas. The establishment of the Cockscomb Basin Wildlife Sanctuary is recounted in Emmons, K.M., J. Kamstra and R.H. Horwich, 2018, *Cockscomb Basin Wildlife Sanctuary: Its History, Flora, and Fauna for Visitors, Teachers, and Scientists, 2nd Edition*, Caye Caulker, Belize: Producciones de la Hamaca.

¹¹ “[T]here are things, systems, we commonly call ecosystems, but their scale is determined by the management problem at hand.” Lackey, Robert T., 1999, Radically Contested Assertions in Ecosystems Management, *Journal of Sustainable Forestry* 9(1-2): 21-34, at 25.

approaches that adopt a more ecocentric, holistic conception of ecosystems, with consideration for the needs of both human and non-human components.¹² Regenerative agriculture systems, which aim to provide food and fiber for human use while maintaining the land's additional ecological benefits for humans and non-human nature, typically take this more ecocentric approach.

Where available and applicable, Indigenous and traditional knowledge and practices that are grounded in a time-tested understanding of interdependencies among components of Earth's life systems, including people, and that have proven to sustain ecosystem integrity and resilience across generations, are a crucial source for learning to use ecosystem management to promote intergenerational equity. In Indigenous or traditional knowledge systems, in which people have kinship relationships with non-human nature, ecosystem management typically consists of communal interactions and lifestyles, embedded in and interdependent with supporting ecosystems, that have evolved over many generations.¹³

Regardless of the scale or focus of ecosystem management, several core elements generally apply:

1. Ecosystem management is intentional and goal-driven, typically with a focus on the ecological sustainability and integrity of interconnected social and ecological systems.
2. Ecosystem management is grounded in systems-based approaches and requires an understanding of feedbacks, stocks and flows, systems dynamics, resilience, complex systems behavior and other fundamental systems concepts.
3. Ecosystem management involves adaptive approaches, whereby in order to attain management goals, adjustments are made based on monitoring during implementation.
4. Ecosystem management incorporates collaborative decision-making that accounts for the values, capabilities and interests of affected individuals and communities in establishing and working toward management goals.
5. Ecosystem management involves an understanding of how to sustain ecological functions, structures and processes.

Public sector situation and trends

Established and emerging trends in ecosystem management include (1) approaches specifically framed as ecosystem management, such as within public lands and protected areas (for example, national forests in the United States); (2) ecological restoration and eco-cultural

¹² Lackey, 1999.

¹³ See Borrows, J., 2010, *Canada's Indigenous Constitution*. Toronto: University of Toronto Press, at p. 242: "Many Anishinabek people characterize the Earth as a living entity who has thoughts and feelings, can exercise agency by making choices, and is related to humans at the deepest generative level of existence."

restoration projects; and (3) approaches that include ecosystem management as an element of broader programmes or approaches framed around sustainability, the rights of nature or environmental protection and conservation.

Ecosystem management or ecosystem-based approaches are emerging as an important element of broad public sector responses to local-to-global ecological and sustainability challenges, as exemplified by the ongoing global climate crisis and the dramatic and continuing losses in recent decades of biodiversity and the abundance of wildlife. At the global level, the United Nations' 2005 Millennium Ecosystem Assessment highlighted the need for new and more serious efforts to combat the ongoing degradation of Earth's ecosystems. The Millennium Ecosystem Assessment revealed the extensive and often irreversible adverse effects on ecosystems and biodiversity of human provisioning and economic development, particularly since the mid-twentieth century. The assessment also emphasized that the resulting loss of ecosystem services to human society puts future generations at risk and undermines efforts to achieve sustainability. According to the assessment, significant changes in policies, institutions and practices regarding humanity's use of ecosystems and their services are required to sustain future generations. Expanded use of ecosystem management intentionally designed to promote intergenerational equity is a key tool for implementing these institutional changes.¹⁴

Other high-profile reports of the Intergovernmental Panel on Climate Change (IPCC),¹⁵ the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES),¹⁶ the World Wide Fund for Nature,¹⁷ planetary boundaries researchers¹⁸ and others have further made clear the urgent nature of these challenges, and the failure to date of the international community to sufficiently prevent ecosystem degradation. The work of the IPBES, established in 2012, is especially relevant to implementing public sector ecosystem management and ecosystem approaches at the national level. Public officials and administrators should consider the IPBES platform a primary source of knowledge about the status of challenges facing biodiversity and ecosystems at the global and sub-global scales, and of opportunities for capacity building and best practices for integrating ecosystem approaches into national policy.

The IPBES work programme to 2030 was designed to complement the 2030 Agenda for Sustainable Development and the SDGs and ultimately to support achievement of the 2050 Vision for Biodiversity (see discussion below). The 2030 work programme aims to highlight the importance of biodiversity in achieving the 2030 Agenda; societal options for transformative change for the conservation, restoration and wise use of biodiversity in the

¹⁴ Millennium Ecosystem Assessment, What are the Main Findings of the MA?
<http://www.millenniumassessment.org/en/About.html>

¹⁵ See <https://www.ipcc.ch>

¹⁶ See <https://ipbes.net/document-library-categories>

¹⁷ See <https://livingplanet.panda.org>

¹⁸ See <https://www.stockholmresilience.org/research/planetary-boundaries.html>

context of sustainable development; and tools for assessing, measuring and monitoring both the impacts and dependence of business on biodiversity. The IPBES undertakes this work by:¹⁹

- assessing knowledge on biodiversity and nature's contributions to people;
- building institutional and other capacities for a strengthened science-policy interface for biodiversity and ecosystem services;
- promoting the generation of knowledge and the management of data on biodiversity and ecosystem services;
- identifying and promoting the development and use of policy tools and methodologies related to biodiversity and ecosystem services (including ecosystem management);
- increasing the visibility of IPBES's work, including in governments through national IPBES focal points; and
- conducting regular internal and external reviews of IPBES work.

In response to global assessments by the IPBES, the IPCC and others, governments, with the support of international governmental organizations and non-governmental organizations (NGOs), are coordinating many ecosystem management efforts around the resilience and adaptation of ecosystems in the face of climate change and other environmental changes, and enhancing the capacity of ecosystems to buffer the impacts of environmental change on human communities.

The United Nations Convention on Biological Diversity, in conjunction with the IPBES, the United Nations Environment Programme (UNEP) and other biodiversity-related conventions, is driving the international response to these challenges. Much of the recent response has been focused on the Aichi Biodiversity Targets for 2020,²⁰ adopted by the Convention on Biological Diversity (CBD) Conference of the Parties (COP) in 2010. The twenty Aichi Targets were linked to five strategic goals:²¹ (1) addressing the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society; (2) reducing the direct pressures on biodiversity and promoting sustainable use; (3) improving the status of biodiversity by safeguarding ecosystems, species and genetic diversity; (4) enhancing the benefits to all from biodiversity and ecosystem services; and (5) enhancing implementation through participatory planning, knowledge management and capacity building. The targets for 2020 included eliminating all incentives and subsidies that are harmful to biodiversity, at least halving the loss of natural habitats, having at least 17 percent of terrestrial and inland water

¹⁹ <https://ipbes.net/work-programme>

²⁰ <https://www.cbd.int/sp/targets/>

²¹ <https://www.cbd.int/sp/targets/#GoalA>

and 10 percent of coastal and marine areas as protected areas, and restoring at least 15 percent of degraded ecosystems.²²

The Aichi Targets were largely not met by 2020, placing pressure on national governments and the international community to develop even more ambitious and transformative goals and strategies for the future. At the COP 15 for the CBD, which began in October 2021 and will continue in April–May 2022 in Kunming, China, the post-2020 strategic framework is being developed.²³ Adopted on 13 October 2021, the Kunming Declaration, *Ecological Civilization: Building a Shared Future for All Life on Earth*,²⁴ confirmed the continuing relevance of the 2030 Agenda and expressed concern that ongoing biodiversity loss and failure to achieve the Aichi Targets jeopardizes the achievement of the SDGs. The Kunming Declaration also highlighted the aim of many countries to conserve 30 percent of land and sea areas through connected protected areas and other measures by 2030. The parties' commitments relevant to ecosystem management included:

- Adopting a post-2020 global biodiversity framework that will put global biodiversity on a path to recovery by no later than 2030;
- Continuing to promote the mainstreaming of the conservation and sustainable use of biodiversity in government decision-making;
- Supporting the development of national biodiversity strategies that will ensure the effective implementation of the post-2020 strategy at the national level;
- Enhancing effective systems of protected areas and other area-based conservation measures;
- Enhancing global and national legal frameworks for protecting biodiversity;
- Increasing the use of ecosystem-based approaches to address biodiversity loss, restore degraded ecosystems, boost resilience, mitigate and adapt to climate change, support sustainable food production, promote health, and meet other challenges; and
- Working with finance and economic ministries to reduce incentives and subsidies that harm biodiversity and promote financing that benefits it.

The draft post-2020 strategic framework envisions expanding the links of the CBD's biodiversity strategies and targets to “other biodiversity-related conventions, the Rio conventions, other multilateral environmental agreements, other international processes and instruments, and the broader international community”²⁵ – most prominently, the SDGs and 2030 Agenda for Sustainable Development. The draft framework is built on the understanding “that urgent policy action globally, regionally and nationally is required to transform economic,

²² The CBD issued a status report on the development of national strategy and action plans as of February 2020: <https://www.cbd.int/nbsap/>

²³ Note that this guidance note will be updated following the conclusion of COP15 in May 2022.

²⁴ <https://www.cbd.int/doc/c/c2db/972a/fb32e0a277bf1ccff742be5/cop-15-05-add1-en.pdf>

²⁵ Convention on Biological Diversity, Open-ended Working Group on the Post-2020 Global Biodiversity Framework, *First Draft of the Post-2020 Global Biodiversity Framework*, CBD/WG2020/3/3 (5 July 2021).

social and financial models so that the trends that have exacerbated biodiversity loss will stabilize in the next 10 years (by 2030) and allow for the recovery of natural ecosystems in the following 20 years, with net improvements by 2050 to achieve the Convention’s vision of ‘living in harmony with nature by 2050’.”²⁶ The goals for the post-2020 strategic framework²⁷ are being negotiated, with a view to adoption in May 2022, around a draft that envisions: an increase of at least 15 percent in the area, connectivity and integrity of natural ecosystems and a tenfold or more reduction of the rate of species extinctions; valuing, maintaining or enhancing nature’s contributions to people; fair and equitable sharing of benefits from the use of genetic resources; and improved financing and other implementation measures for achieving the 2050 vision.

Regional and national ecosystem assessments and follow-up planning and implementation are important complements to global and international ecosystem management assessments and strategies. The 2005 Millennium Ecosystem Assessment included over 35 sub-global assessments, which established an important baseline for potential local, national or regional public sector responses using ecosystem management.

Another relevant trend is the increasing recognition or assertion of the rights of nature, for example in Bolivia, Canada, Colombia, Ecuador, India, New Zealand and the United States.²⁸ Rights of nature have the potential to lead to a broad application of ecosystem management approaches throughout law, policy and governance regimes where they apply. The Te Urewera case study below illustrates this potential.

Methods of implementation

From the perspective of national policy and planning, the role of healthy ecosystems in providing essential benefits to current and future generations and in overcoming the challenges of climate change, biodiversity loss and other ecological threats is such that an expansive approach to ecosystem management that goes beyond the management of discrete protected areas or ecosystems is necessary. Implementing an effective national regime of ecosystem management requires a comprehensive and integrated understanding of the terrestrial and aquatic ecosystems under national jurisdiction, including those that transcend national borders and extend into other jurisdictions. This understanding includes knowledge about how those ecosystems relate to each other, the role they play in sustaining human and

²⁶ Ibid., at Paragraph 5.

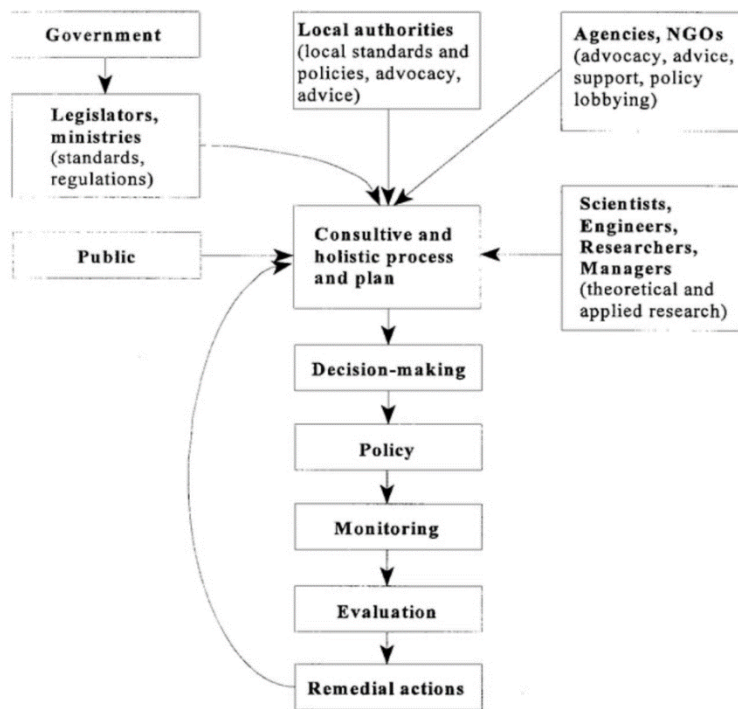
²⁷ Annex 1 of the Report of the Open-ended Working Group on the Post-2020 Global Biodiversity Framework on its Third Meeting (3 September 2021), <https://www.cbd.int/doc/c/3d2f/5d92/8ae5bac1459050a804ea5246/wg2020-03-04-en.pdf>

²⁸ See Boyd, D.R., 2017, *The Rights of Nature: A Legal Revolution That Could Save the World*. Toronto: ECW Press.; Chapron, G., Y. Epstein and J. López-Bao, 2019, “A Rights Revolution for Nature.” *Science* 363(6434): 1392–1383.

natural communities, how they fit into larger regional biomes and the biosphere as a whole, and the internal and external pressures and harm that human society imposes on them.

This knowledge base sets the stage for harnessing resources and knowledge for public sector officials within the national government, in collaboration with sub-national and local governments, to establish a national approach to ecosystem management. Figure 1 illustrates the general framework for incorporating ecosystem management and ecosystem approaches into public administrations; in this case, the consultative and holistic process and plan would be oriented around ecosystem management.

Figure 1. Integrated ecosystem management policy framework



Source: Based on Pavlikakis, G.E. and Tsihrintzis, V.A., 2000, Ecosystem Management: A Review of a New Concept and Methodology, *Water Resources Management* 14: 257-283, Figure 3.

Global Reporting Initiative

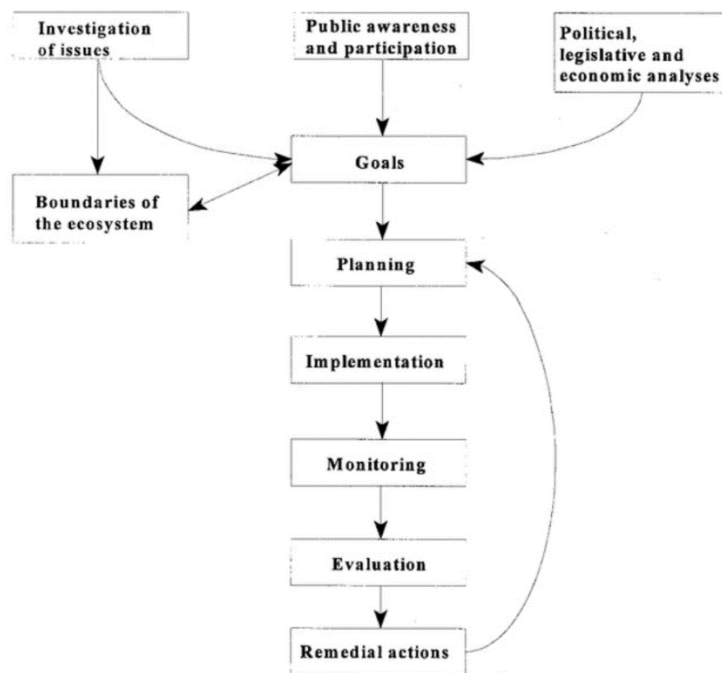
The Global Reporting Initiative (GRI)²⁹ was established in 1997 to improve the standard of international sustainability reporting by organizations. That has now evolved into a highly structured framework for companies and other organizations reporting their impacts on the

²⁹ <https://www.globalreporting.org/>

economy, environment and people, in a way that is credible, and allows comparison between organizations. In April 2021 GRI published detailed guidance on the links between their standards and each of the SDGs. The GRI standards recognize the importance of impact assessment for identifying potential positive and negative impacts, not only by organizations themselves but also other organizations in supply chains.

Figure 2 illustrates the basic approach for incorporating knowledge development, public awareness and participation and government policy and analysis in an ecosystem management process. The basic elements of the process are stakeholder and knowledge holder involvement in the development of ecosystem boundaries and management goals, and an adaptive approach for adjusting planning and implementation based on monitoring and ongoing assessment.

Figure 2. Case-specific application of ecosystem management

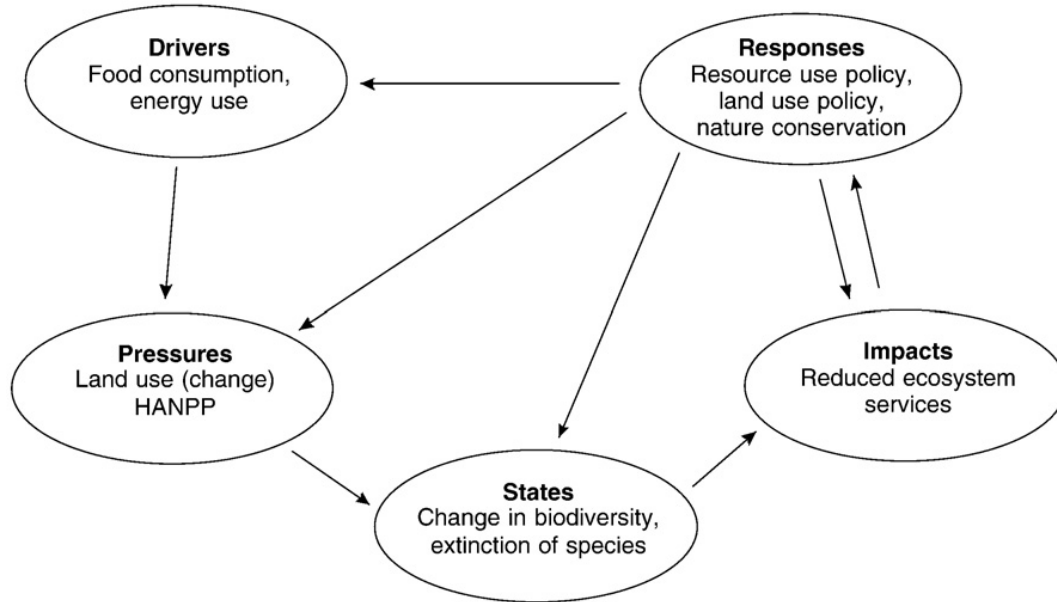


Source: Based on Pavlikakis, G.E. and Tsihrintzis, V.A., 2000, Ecosystem Management: A Review of a New Concept and Methodology, *Water Resources Management* 14: 257-283, Figure 2.

Within this institutional framework, the Driver-Pressure-State-Impact-Response (DPSIR) model is a widely applicable tool for incorporating appropriate responses to undesirable ecosystem impacts into the ecosystem management process. In Figure 3, ecosystem management and ecosystem-based approaches can be included in policy responses to address ecological impacts, such as reduced ecosystem services, resulting from societal drivers and

pressures, such as food consumption and energy uses that induce land use change and higher levels of human appropriation of biomass. This model is useful not only for incorporating responses based on existing law and institutional frameworks, but also for identifying institutional and legislative or regulatory gaps; pressures; and impacts that are beyond national control.

Figure 3. Ecosystem management in national policy and planning



Source: Based on Haberl, H. et al., 2009, Towards an integrated model of socioeconomic biodiversity drivers, pressures and impacts. A feasibility study based on three European long-term socio-ecological research platforms, *Ecological Economics* 68: 1797–1812.

Success at the national level will be enhanced if ecosystem approaches are applied not only in environment and natural resource ministries, but also in cross-cutting programmes and initiatives that integrate ecosystem-based approaches in all government domains, including finance, defense, health, international affairs, trade and other ministries. This broad understanding will also allow for effective engagement with other nations in the region, and the international community as a whole, regarding challenges such as climate change and loss of biodiversity that may result largely from drivers that are external to national jurisdiction and control.

The IPBES is a key resource for support to overcome institutional challenges related not only to ecological challenges but also to governance challenges related to CEPA’s 11 principles of

effective governance for sustainable development³⁰, all of which reinforce the effective use of ecosystem management. IPBES national focal points facilitate interactions between governments and the IPBES, and government designation and support for an IPBES focal point is recommended as a way to make use of the enormous range of knowledge, networking and capacity-building activities related to ecosystem management that the IPBES facilitates.³¹ The Global Environmental Facility (GEF), noted below in connection with international cooperation, focuses on financing, including for projects implementing ecosystem-based approaches. GEF is a particularly important resource for developing countries that may not have fully functioning legislative and institutional frameworks for ecosystem management.

In 2000, the parties to the United Nations Convention on Biodiversity identified 12 principles of ecosystem approaches, a term that encompasses ecosystem management.³² These principles (Table 1) provide comprehensive guidance for integrating ecosystem management into national and sub-national governance systems.

Table 1. Convention on Biological Diversity – Principles of the ecosystem approach

Principle	Summary	Rationale
1	The objectives of management of land, water and living resources are a matter of societal choice.	Different sectors of society view ecosystems in terms of their own economic, cultural and societal needs. Indigenous peoples and other local communities living on the land are important stakeholders and their rights and interests should be recognized. Both cultural and biological diversity are central components of the ecosystem approach, and management should take this into account. Societal choices should be expressed as clearly as possible. Ecosystems should be managed for their intrinsic values and for the tangible or intangible benefits for humans, in a fair and equitable way.
2	Management should be decentralized to the lowest appropriate level.	Decentralized systems may lead to greater efficiency, effectiveness and equity. Management should involve all stakeholders and balance local interests with the wider public interest. The closer management is to the ecosystem, the greater the responsibility, ownership, accountability, participation and use of local knowledge.

³⁰ <https://publicadministration.un.org/en/Intergovernmental-Support/CEPA/Principles-of-Effective-Governance>.

³¹ The Manual for IPBES national focal points provides detailed information on their roles and responsibilities. https://ipbes.net/sites/default/files/inline-files/ipbes_manual%20for%20focal%20points.pdf.
https://ipbes.net/sites/default/files/inline-files/ipbes_manual%20for%20focal%20points.pdf

³² These principles and the rationales for them are taken directly from the United Nations Convention on Biological Diversity, COP 5 Decision V/6 (2000).

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3	Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.	Management interventions in ecosystems often have unknown or unpredictable effects on other ecosystems; therefore, possible impacts need careful consideration and analysis. This may require new arrangements or ways of organization for institutions involved in decision-making to make, if necessary, appropriate compromises.
4	Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should: (a) reduce those market distortions that adversely affect biological diversity; (b) align incentives to promote biodiversity conservation and sustainable use; and (c) internalize costs and benefits in the given ecosystem to the extent feasible.	The greatest threat to biological diversity lies in its replacement by alternative systems of land use. This often arises through market distortions, which undervalue natural systems and populations and provide perverse incentives and subsidies to favour the conversion of land to less diverse systems. Often those who benefit from conservation do not pay the costs associated with conservation and, similarly, those who generate environmental costs (such as pollution) escape responsibility. Aligning incentives allows those who control the resource to benefit and ensures that those who generate environmental costs will pay.
5	Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.	Ecosystem functioning and resilience depends on a dynamic relationship within species, among species and between species and their abiotic environment, as well as the physical and chemical interactions within the environment. The conservation and, where appropriate, restoration of these interactions and processes is of greater significance for the long-term maintenance of biological diversity than the simple protection of species.
6	Ecosystems must be managed within the limits of their functioning.	In considering the likelihood or ease of attaining the management objectives, attention should be given to the environmental conditions that limit natural productivity and ecosystem structure, functioning and diversity. The limits to ecosystem functioning may be affected to different degrees by temporary, unpredictable or artificially maintained conditions and, accordingly, management should be appropriately cautious.
7	The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.	The approach should be bounded by spatial and temporal scales that are appropriate to the objectives. Boundaries for management will be defined operationally by users, managers, scientists and Indigenous and local peoples. Connectivity between areas should be promoted where necessary. The ecosystem approach is based upon the hierarchical nature of biological diversity characterized by the

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		interaction and integration of genes, species and ecosystems.
8	Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.	Ecosystem processes are characterized by varying temporal scales and lag effects. This inherently conflicts with the tendency of humans to favour short-term gains and immediate benefits over future ones.
9	Management must recognize that change is inevitable.	Ecosystems change, including species composition and population abundance. Hence, management should adapt to those changes. Apart from their inherent dynamics of change, ecosystems are beset by a complex of uncertainties and potential "surprises" in the human, biological and environmental realms. Traditional disturbance regimes may be important for ecosystem structure and functioning and may need to be maintained or restored. The ecosystem approach must utilize adaptive management in order to anticipate and cater to such changes and events and should be cautious in making any decision that may foreclose options, but, at the same time, consider mitigating actions to cope with long-term changes such as climate change.
10	The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.	Biological diversity is critical both for its intrinsic value and because of the key role it plays in providing the ecosystem and other services upon which we all ultimately depend. There has been a tendency in the past to manage components of biological diversity either as protected or non-protected. There is a need for a shift to more flexible situations, where conservation and use are seen in context and the full range of measures is applied in a continuum from strictly protected to human-made ecosystems.
11	The ecosystem approach should consider all forms of relevant information, including scientific and Indigenous and local knowledge, innovations and practices.	Information from all sources is critical to arriving at effective ecosystem management strategies. A much better knowledge of ecosystem functions and the impact of human use is desirable. All relevant information from any concerned area should be shared with all stakeholders and actors, taking into account, inter alia, any decision to be taken under Article 8(j) of the Convention on Biological Diversity. Assumptions behind proposed management decisions should be made explicit and checked against the available knowledge and views of stakeholders.

12	The ecosystem approach should involve all relevant sectors of society and scientific disciplines.	Most problems of biological-diversity management are complex, with many interactions, side effects and implications, and therefore should involve the necessary expertise and stakeholders at the local, national, regional and international level, as appropriate.
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All of these principles can help ensure that ecosystem management promotes intergenerational equity, and Principles 5, 8 and 9 are especially relevant. Ecosystem restoration, which is highlighted in Principles 5 and 9, implicitly promotes the conservation of ecosystem benefits for future generations. Likewise, Principle 8 highlights the need to set long-term objectives for ecosystem management in order to promote intergenerational equity and avoid the tendency to favour short-term or immediate benefits over future ones.

Ecosystem management in protected natural areas

Although ecosystem management is not limited to the management of public lands and protected areas, this kind of management, which is the context from which the concept of ecosystem management emerged, is still widely relevant. The essential elements of this type of ecosystem management are goal-setting that includes a core commitment to sustainability and intergenerational equity; assessment of the ecological, social and economic situation of the management unit (such as, protected areas); development of a management plan in consultation with relevant stakeholders, using ecosystem approaches; and monitoring and adaptation during implementation to maintain progress toward management goals (see the United States Forest Service case study).

Adaptive management

Adaptive ecosystem management involves learning-by-doing approaches grounded in the notion that ecosystems are complex adaptive systems that evolve in ways that are unpredictable and can never be entirely known with certainty. Thus, even with careful assessment and study of an ecosystem at the outset of a management process, the ecosystem may respond in unpredictable or surprising ways. Adaptive ecosystem management requires ongoing monitoring and knowledge acquisition, so that the management regime can be adjusted to stay on track to reach desired objectives or future conditions for the ecosystem. Even the management objectives may need to be adjusted in light of new information obtained through monitoring or advances in relevant scientific or traditional knowledge. Because adaptive management is essential for sound ecosystem management, it is crucial to have the institutional capacity, including well-trained personnel and adequate long-range funding, to monitor and make any necessary adjustments in implementation.

Co-management with Indigenous or local knowledge holders and habitants

Many managed ecosystems, especially at higher spatial scales such as landscapes, combine undeveloped or minimally developed wildlands with areas of human habitation or varying degrees of human alteration or impact. For example, managed ecosystems or protected areas

may include areas of use and occupancy by local or Indigenous communities that have a history of sustainable use of the ecosystems and an important role in informing, co-leading or leading regenerative management of the area. Successful institutional arrangements for this type of ecosystem management, where mutual agreement on the appropriate regime is reached between a national or sub-national government and the local community, are case specific. Where Indigenous communities are involved, the existence or lack of treaties may be relevant to achieving a mutually agreed management regime. Some co-management systems involve the appointment of a guardianship, with both Indigenous and state government representation, to represent the interests of the ecosystem itself. Examples of Indigenous co-management include the Whanganui River³³ and Te Urewera³⁴ in New Zealand and Thaidene Nënë National Park Preserve³⁵ in Canada (see the case studies section, below).

In cases of successful long-term sustainable management of common-pool resources (for example, a community forest or irrigation system), higher order levels of national or sub-national government defer to the local management regime, withholding legal authority as a matter of discretion. Studies³⁶ have shown that successful governance of common-pool resources, which is a form of ecosystem management, is possible when the following criteria are met.

- Those who have rights to use the common pool resources, as well as the spatial boundaries of the common pool resources, are clearly defined.
- Rules on the use of the common pool resources are related to, and emerge from, local conditions and communities.
- Those covered by rules regarding the use of the common pool resource can participate in creating and modifying the rules.
- Those monitoring common pool resource conditions and user behavior are accountable to the user community.
- Locally tailored, effective sanctions are applied in cases where rules regarding use of the common pool resource are violated.
- A reliable system is in place to resolve conflicts among users of the common pool resources, and between users and administrators or enforcers of the system.
- The rights of the local community to devise their own institutions are not challenged by external government authorities.

³³ <https://www.ngatangatatiaki.co.nz/our-story/tupua-te-kawa/>

³⁴ <https://www.ngaituhoe.iwi.nz/te-urewera>

³⁵ <https://www.pc.gc.ca/en/pn-np/nt/thaidene-nene>

³⁶ Ostrom, E., 1990, *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press. Available at https://www.actu-environnement.com/media/pdf/ostrom_1990.pdf See also Agrawal, A., 2001, Common property institutions and sustainable governance of resources. *World Development* 29(10): 1649–1672.

- All aspects of using and governing the common pool resources are organized in layers of administration that are appropriate for the local conditions and community.

Ecosystem assessments and impact assessments

Ecosystem management typically integrates environmental and sustainability impact assessment, and therefore a well-functioning and effective impact assessment regime is an important component or complement for ecosystem management. National or sub-national governments use impact assessment to determine the impacts of specific projects, strategic plans, programmes or policies, from local to regional or national scales, on the environment, sustainability, and related socio-economic or cultural spheres. Although the project, policy, plan or programme being assessed does not necessarily involve ecosystem management, assessments can identify impact areas for which ecosystem management is appropriate as a mitigation measure or other response to impacts. As well, assessment of the state of an ecosystem is an important step in successful ecosystem management. The IPBES is a valuable resource for developing national assessments of biodiversity and ecosystems and using them in ecosystem management and other responses that conserve and restore ecosystems for present and future generations.³⁷

Ecological and eco-cultural restoration

Ecological and eco-cultural restoration involve a “process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed,”³⁸ taking into account criteria such as ecological integrity, the history of the ecosystem and community values and engagement. Restoration is typically intended to make a damaged ecosystem viable again in an undamaged condition, with reference to its historical states, for present and future generations. Although ecological and eco-cultural restoration both account for interactions between humans and non-human nature, eco-cultural restoration places more emphasis on the recovery of mutually supportive cultural practices and ecosystem structure and functioning. Both involve intentional goal-setting and societal choice, including priority setting by public officials as to which restoration projects deserve limited public resources. In general, the goals of ecological or eco-cultural restoration are to re-establish and maintain (1) a basis for the mutual flourishing of the human and non-human components of an ecosystem; (2) ties to historical conditions in which a mutually enhancing relationship existed between humans and the ecosystem; (3) ecosystem resilience and persistence consistent with historical patterns; and (4) persistent communal connections of people and place.³⁹ Ecological and eco-cultural restoration undertaken by public authorities requires expertise on restoration processes, including

³⁷ <https://ipbes.net/guide-production-assessments>

³⁸ Society for Ecological Restoration International Science & Policy Working Group, 2004, *The SER International Primer on Ecological Restoration*. Tucson: Society for Ecological Restoration International, <https://www.ser.org>

³⁹ Garver, G., 2021, *Ecological Law and the Planetary Crisis: A Legal Guide for Harmony on Earth*, New York: Routledge, pp 157–159.

scientific or traditional knowledge about the damaged ecosystem and skills in stakeholder engagement, which is particularly important at the scale of landscapes or higher, where many different stakeholder groups may have direct interests.

Relevance of the precautionary principle

Application of the precautionary principle can help to ensure that ecosystem management promotes intergenerational equity, because the precautionary principle is fundamentally grounded in “concern about the effects of our actions today on the environment of future generations.”⁴⁰ Principle 15 of the 1992 Rio Declaration states that “where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.” By way of example, the precautionary principle could be applied in ecosystem management to preclude or prevent development activity with the potential to undermine long-term conservation and sustainable use of an ecosystem.

Relevance of discount rates and other economic assumptions and models

Economic modeling or the economic valuation of ecosystems and their services to humans is sometimes used in public sector ecosystem management, for example when cost-benefit analysis or monetary valuation of ecosystem services is used to assist in management decisions. The Economics of Ecosystems and Biodiversity (TEEB)⁴¹ is an international clearinghouse of information regarding these approaches, and TEEB’s Guidance Manual for Country Studies may be of particular interest to public sector officials in ecosystem management.⁴² Public sector officials should either avoid or exercise care in using discount rates for estimating future costs and benefits in cost-benefit analysis, in that discount rates that are too high can lead to an inappropriately low valuation of ecosystem benefits in the future, which impedes intergenerational equity. In addition, care is needed to avoid unreliable or inappropriate contingent valuation techniques used in the monetary valuation of ecosystem services. Multi-criteria decision-making using stakeholder engagement and other methods that avoid a problematic reliance on the monetary valuation of ecosystems can be used as alternatives to cost-benefit analysis and the monetary valuation of ecosystem services.⁴³

⁴⁰ Weiss, E.B., 1992, Intergenerational equity: a legal framework for global environmental change. Chapter 12 in Weiss, E.B. (ed.), *Environmental change and international law: New challenges and dimensions*. Tokyo: United Nations University Press.

⁴¹ <http://teebweb.org>

⁴² <http://teebweb.org/our-work/country-studies/what-is-tcs/guidance-manual/>

⁴³ Ackerman, F., 2008, “Critique of Cost-Benefit Analysis, and Alternative Approaches to Decision-making, http://frankackerman.com/publications/costbenefit/Critique_Cost_Benefit_Analysis.pdf.

Case studies

The cases below are just a few examples of different approaches to or aspects of ecosystem management. Numerous additional case studies can be found through the peer-to-peer learning and research resources and the institutions and organizations that support international cooperation on ecosystem management in the following sections.

Public lands and protected natural areas: The United States Forest Service prototype

The United States Forest Service remains a good example of ecosystem management applied to protected natural areas, with management goals centred on ecological, economic and social sustainability for present and future generations. A similar ecosystem management approach is used for forests in Canada.⁴⁴ Ecosystem management in the United States Forest Service is integrated in the national forest planning process, which is dictated by the National Forest Management Act of 1976⁴⁵ and the most recent National Forest Planning Rule, adopted in 2012.⁴⁶ Each of the Forest Service's 154 national forests, 20 national grasslands, and 1 national prairie, together comprising 193 million acres, must develop a forest plan at least every 15 years.⁴⁷ As the Forest Service explains,

Resources provided by national forests include timber used for wood products, forage for livestock and wildlife, mineral resources used in manufacturing and energy production, and many specialty products such as mushrooms, berries, and traditional medicines. Healthy forest ecosystems purify the air we breathe; provide clean water for our cities, homes, and irrigation; reduce the effects of drought and floods; store carbon; generate fertile soils; provide wildlife habitat; maintain biodiversity; and provide aesthetic, spiritual, and cultural values.⁴⁸

Forest plans must use an adaptive management approach (see below) and must contain:

- Desired conditions, goals, objectives, standards, guidelines and identification of the suitability of lands in the plan area for multiple uses and resources (such as vegetation management, timber, wilderness, fish and wildlife habitat, grazing, recreation, mineral exploration and development, water and soils, cultural and historic resources, research of natural areas, and diversity of plant and animal communities).

⁴⁴ Natural Resources Canada, 2008, *Implementing Ecosystem-based Management Approaches in Canada's Forests*, https://publications.gc.ca/collections/collection_2008/nrcan/Fo4-21-2008E.pdf.

⁴⁵ 16 U.S.C. §§ 1600 et seq.

⁴⁶ National Forest System Land Management Planning, 77 Fed. Reg. 21162 (9 April 2012) (to be codified at 36 C.F.R. pt. 219).

⁴⁷ United States Forest Service, *A Citizen's Guide to National Forest Planning* (2016), at p. 9-10, https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd520671.pdf

⁴⁸ *Ibid.*, at p. 9.

- Management areas and geographic areas designated as places where particular activities or goals can be considered (for example, areas suitable for timber harvest, motorized recreation, grazing, and/or wilderness).⁴⁹

The forest planning process consists of three phases that follow an adaptive management approach: assessment, planning and monitoring.

- **Assessment.** During assessment, the Forest Service and partners identify and evaluate existing economic, social and ecological conditions in and around the national forest undergoing forest plan revision.
- **Plan development.** This phase uses the information from the assessment, with input from the public, to revise a forest plan. Once the forest plan is approved, it will guide project-level decisions, like how and where to plan restoration or rehabilitation activities.
- **Monitoring.** Studying conditions on the ground helps determine whether the forest plan is actually achieving its intended desired conditions and objectives. Monitoring information helps managers determine whether they need to propose amending or revising the forest plan.⁵⁰

Landscape-scale restoration success stories: Ethiopia in “Hope in a Changing Climate”

In the 2009 documentary *Hope in a Changing Climate*,⁵¹ John Liu, a filmmaker and founder of the Environmental Education Media Project, presents success stories of the rehabilitation of large-scale damaged working (agricultural) landscapes in two farming regions of Ethiopia. In all cases, the revegetation of eroded hillsides in regions with ample rainfall led to better retention and flow of water and, consequently, vastly improved ecological and agricultural conditions. The film presents similar success stories in China and Rwanda.

Rights of nature and Indigenous co-management as an emerging framework for ecosystem management: Te Urewera in New Zealand

In 2014, the New Zealand Parliament granted Te Urewera National Park legal personhood, with Crown ownership of the park transferred to the land itself as a legal person.⁵² The Te Urewera Board was established to manage and act on behalf of Te Urewera, with six

⁴⁹ Ibid., at p. 10.

⁵⁰ United States Forest Service, *A Citizen's Guide to National Forest Planning Tri-fold Pamphlet* (2016),

https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd530776.pdf.

⁵¹ <https://www.open.edu/openlearn/nature-environment/hope-changing-climate>

⁵² A similar example is Thaiden Nënë, a 26,376 sq. km. Indigenous Protected Area established in 2019 in the transition between boreal forest and tundra in the Northwest Territories, Canada. It includes a national park reserve, a territorial protected area and a wildlife conservation area and is co-managed around sustainability principles by the Lutsël K'é Dene First Nation and the Canadian government. A CAD\$30 million trust fund was established by the government of Canada and an NGO, Nature United, to support the co-management arrangement. <http://www.landoftheancestors.ca>

Indigenous Tūhoe members and three government members. The purpose of the Act establishing Te Urewera as a legal person is “to establish and preserve in perpetuity a legal identity and protected status for Te Urewera for its intrinsic worth, its distinctive natural and cultural values, the integrity of those values, and for its national importance, and in particular to (1) strengthen and maintain the connection between Tūhoe and Te Urewera; (2) preserve as far as possible the natural features and beauty of Te Urewera, the integrity of its Indigenous ecological systems and biodiversity, and its historical and cultural heritage; and (3) provide for Te Urewera as a place for public use and enjoyment, for recreation, learning, and spiritual reflection, and as an inspiration for all.”⁵³

Marine ecosystem management in Bonaire and Madagascar

- Bonaire National Marine Park, Bonaire:⁵⁴ Bonaire National Marine Park was established in 1979 to protect the coral reef, seagrass and mangrove ecosystems in the marine waters surrounding Bonaire and Klein Bonaire from high tide to 60 meters deep. Establishment of the park followed earlier successes with sea turtle protection starting in 1961 and the prohibition of spear fishing in 1975. The park is an International Coral Reef Action Network demonstration site and a leading example of how to protect marine ecosystems while allowing recreational and other commercial uses. The Bonaire National Marine Park Management Plan provides details on the park and its successful management.⁵⁵
- Velondriake Locally Managed Marine Area (LLMA), Madagascar: The Velondriake LLMA is one of a series of collaborative LLMAs in Madagascar. It has successfully used government-recognized customary laws (Dina) to design and implement “effective rules that can be enforced locally to ban destructive fishing practices, protect endangered species and designate priority marine areas for protection.”⁵⁶ The Mihari

⁵³ <https://www.ngaituhoe.iwi.nz/te-urewera-governance>. A related example is the Whanganui River in New Zealand. In 2014, the Indigenous Whanganui Iwi people entered into a settlement with the government of New Zealand that resolved a long history of disagreements over the implementation of the 1840 Treaty of Waitangi. The settlement and resulting legislation gave legal personality to the Whanganui River and created a guardianship with Iwi and State representation to act on behalf of the river. The settlement gives paramount importance in the law to the Iwi’s view of the river as an integrated, indivisible whole whose well-being is intrinsically interconnected with the wellbeing of the people in its watershed. <https://www.ngatangatiaki.co.nz/our-story/ruruku-whakatupua/>. In this way, the settlement establishes a legally binding ecosystem-centred approach for future management of the river.

⁵⁴ <https://stinapabonaire.org/bonaire-national/>

⁵⁵ <https://stinapabonaire.org/wp-content/uploads/2018/10/BNMP-managementplan-preamble-and-contents.pdf>

⁵⁶ <https://ipbes.net/policy-support/case-studies/velondriake-locally-managed-marine-area-llmma>; See also Reef Resilience Network, Madagascar – Medios de vida sostenibles (2010), <https://reefresilience.org/es/case-studies/madagascar-sustainable-livelihoods/>.

network has developed a user guide for the use of LLMAs, with a focus on sustainable development and the conservation of fisheries for future generations.⁵⁷

Stakeholder engagement: The restoration, protection and rights of the River Ethiope, Delta State, Nigeria

The River Ethiope Trust Foundation (RETFON) has been working for over 25 years to bring together diverse stakeholders, including community, local, state and federal public sector officials, to build community-based commitments to restore and protect this damaged river and its watershed. RETFON's approach is centred on (1) partnership and collaboration; (2) stakeholder mobilization and sensitization; (3) holistic emphasis; (4) planning, evaluation and monitoring; and (5) long-term sustainability, all practiced under the principles of Eco-hydrology, Integrated Water Resource Management and a Global Memorandum of Understanding. Recent work has focused on using this stakeholder network to declare and harness support for Indigenous people and legislative recognition at the local, state and federal level of the rights of the River Ethiope. In 2021, the River Ethiope Basin Institute was established, with community, local, state and federal support, at Delta State University, Abraka, to support research, education, restoration, protection, river rights and related ecosystem-based approaches to promote the sustainable and wise use of the river and its watershed.⁵⁸

Peer-to-peer learning and research

The following resources, listed by topic, are useful sources for peer-to-peer learning, research and networking to support the use of ecosystem management to promote intergenerational equity.

Capacity building for national and regional ecosystem assessments

The UNEP-World Conservation Monitoring Centre (UNEP-WCMC) supports capacity building for policy-relevant national ecosystem assessments, beginning in 2017 with four pilot countries (Cameroon, Colombia, Ethiopia and Viet Nam), and continuing with eight additional countries (Azerbaijan, Bosnia and Herzegovina, Cambodia and Grenada in Phase 2, and Argentina, Dominican Republic, Malawi and Thailand in Phase 3).⁵⁹ These assessments not only support the overarching international work of the IPBES, but also identify knowledge gaps that need to be addressed to support improved ecosystem management at the national

⁵⁷ <https://mihari-network.org/wp-content/uploads/2020/01/Guide-de-référence-des-LMMA-à-Madagascar.pdf>

⁵⁸ <https://www.earthlawcenter.org/blog-entries/2018/2/rights-for-the-river-ethiope-nigeria>;
<https://oasismagazine.com.ng/2021/09/gov-okowa-inaugurates-river-ethiope-basin-institute-in-abraka-assures-of-support/>

⁵⁹ Conference of the Parties to the Convention on Biological Diversity, *Building Capacity for National Ecosystem Assessment*, CBD/COP/14/INF/28 (9 November 2018), <https://www.unep-wcmc.org/system/comfy/cms/files/files/000/001/408/original/cop-14-inf-28-en.pdf>

and sub-national levels. On the strategic planning side, regional, subnational and local biodiversity strategy and action plans supplement national biodiversity strategy and action plans through the Convention on Biological Diversity and the 2011–2020 Aichi Targets.⁶⁰ Another regional assessment with follow-up recommendations and action planning focused on ecosystem restoration is The Action Plan for Ecosystem Restoration in Latin America and the Caribbean (2021).⁶¹ The IPBES also supports regional and national assessments.

Ecosystem management knowledge and practitioner networks

- Ecosystem management NGOs around the world:
<https://seas.umich.edu/ecomgt/Resources/international.htm>
- IUCN – Global Ecosystem Management Programme
<https://www.iucn.org/theme/ecosystem-management/our-work>
- UNEP – International Ecosystem Management Partnership, whose mission is “To provide science, policy and capacity support to developing countries to integrate ecosystem management approaches into their national policies and development plans to enhance the delivery of ecosystem services for human well-being.”
http://www.unep-iemp.org/article_10.html

Regenerative agriculture and agroecological systems

Foodtank, a not-for-profit thinktank focusing on sustainable food systems, identified 17 organizations from around the world (including in Australia, Central America, India, Malawi and South Africa) that promote regenerative agriculture, including agroecology, in which farming practices are designed to maintain healthy soil, protect biodiversity, reduce water stresses, build resilience to climate change and achieve other ecosystem benefits while also supporting sustainable agricultural communities.⁶²

IUCN Commission on Ecosystem Management

The IUCN Commission on Ecosystem Management is “a network of professionals whose mission is to act as a source of advice on the environmental, economic and cultural factors that affect natural resources and biological diversity.”⁶³ The Commission has 14 specialty groups organized around agro-ecosystems, the Arctic, coastal and marine ecosystems, deep sea mining, desert and oasis ecosystems, dryland ecosystems, forests, Holarctic steppes, island

⁶⁰ The CBD regularly reports on the status of subnational or local plans, <https://www.cbd.int/nbsap/related-info/sbsap/>, as well as regional plans, <https://www.cbd.int/nbsap/related-info/region-bsap/>

⁶¹ <https://www.unep.org/resources/policy-and-strategy/action-plan-decade-ecosystem-restoration-latin-america-and-caribbean>

⁶² Foodtank, 2018, “17 Organizations Promoting Regenerative Agriculture Around the Globe,” <https://foodtank.com/news/2018/05/organizations-feeding-healing-world-regenerative-agriculture-2/>

⁶³ <https://www.iucn.org/commissions/commission-ecosystem-management>

ecosystems, Mediterranean ecosystems, mountain ecosystems, peatland ecosystems and urban ecosystems.⁶⁴

Ecological footprint, HANPP and biodiversity: metrics and indicators relevant to ecosystem management

Ecological footprint and Human Appropriation of Net Primary Production (HANPP) (i.e., human appropriation of biomass) are two indicators used in connection with ecosystem management and ecosystem-based approaches to sustainable development.

- The Global Footprint Network is the main peer network for development and use of ecological footprint methodologies: <https://www.footprintnetwork.org>
- A leading research centre on the measurement and use of HANPP, including in connection with biodiversity and ecosystems, is the Institute for Social Ecology in Vienna: <https://boku.ac.at/en/wiso/sec>

International development cooperation

International cooperation can help to overcome obstacles to effective ecosystem management, and to support efforts that can be implemented in countries where effective governance for ecosystem management has not yet been achieved. The following are key focal points for international cooperation on ecosystem management.

- CBD – The CBD, in conjunction with UNEP, is the primary hub for international cooperation on ecosystem management and programmes and initiatives that support ecosystem management and ecosystem approaches to sustainable development. The CBD’s list of thematic programmes and cross-cutting issues gives details on the range of its programmes and initiatives that support ecosystem management: <https://www.cbd.int/programmes/>
- UNEP – An overview of UNEP’s work on ecosystems and biodiversity is available here: <https://www.unep.org/explore-topics/ecosystems>
- IPBES – <https://www.unep-wcmc.org/featured-projects/national-ecosystem-assessments>
- United Nations Decade on Ecosystem Restoration: 2021–2031. Much international cooperation on ecosystem restoration in the near term is organized through the United Nations Decade on Ecosystem Restoration: <https://www.decadeonrestoration.org>
- The Association of Southeast Asian Nations (ASEAN) supports regional cooperation on environmental issues, including programmes on land and biodiversity, oceans and freshwater: <https://environment.asean.org>. This work includes a programme on the

⁶⁴ <https://www.iucn.org/commissions/commission-ecosystem-management/our-work/cems-specialist-groups>

- conservation and sustainable management of biodiversity and natural resources: <https://environment.asean.org/awgnb/>
- Commission for Environmental Cooperation (CEC – North America): The CEC supports cooperation among Canada, Mexico and the United States on ecosystem-focused issues, including ecosystem management: <http://www.cec.org/category/ecosystems/>
 - European Union: The European Commission supports European cooperation on protecting nature and reversing the degradation of ecosystems: https://ec.europa.eu/international-partnerships/topics/ecosystems-and-biodiversity_en
 - OECD – The Organisation for Economic Co-operation and Development (OECD) supports cooperation on biodiversity and ecosystems, primarily from an economic perspective: <https://www.oecd.org/environment/resources/biodiversity/>
 - IUCN – Global Ecosystem Management Programme <https://www.iucn.org/theme/ecosystem-management/our-work>
 - Global Environment Facility (GEF): The GEF provides financial support in conjunction with the CBD, the UNFCCC, the Stockholm Convention on Persistent Organic Pollutants, the United Nations Convention to Combat Desertification and the Minamata Convention on Mercury. Each member country of the GEF has a focal point to coordinate GEF activities within the country. Many of GEF's projects support ecosystem management or ecosystem approaches: <https://www.thegef.org/>

Acknowledgements

This guidance note was prepared by Dr. Geoffrey Garver, McGill University, Canada. During its preparation, consultations were carried out with selected international experts: Dr. Gray Cox, College of the Atlantic, United States; Irikefe Dafe, Executive Director, River Ethiopia Trust Foundation, Nigeria; Dr. James Fyles, McGill University, Canada; Keith Helmuth, independent publisher, New Brunswick, Canada; Hans Hermann, Mare Nostrum, Mexico; Dr. Nicholas Kosoy, McGill University, Canada; Judy Lumb, Producciones de la Hamaca, Belize; Dr. Margaret McCasland, Environmental Educator, Ithaca, United States; Dr. Jamie Reaser, President/CEO of Giving Voice to Resilience and George Mason University, United States; Carolyn Raffensperger, Science & Environmental Health Network, United States; Dr. Iván Darío Vargas Roncancio, McGill University, Canada; and Vincent Zelazny, The Nature Trust of New Brunswick, Canada. Additional input was received at a presentation of the draft note to the Summer Research Seminar of the Quaker Institute for the Future in August 2021.