

# The Millennium Ecosystem Assessment: Science and Policy for Sustainable Development

CRISTIÁN SAMPER

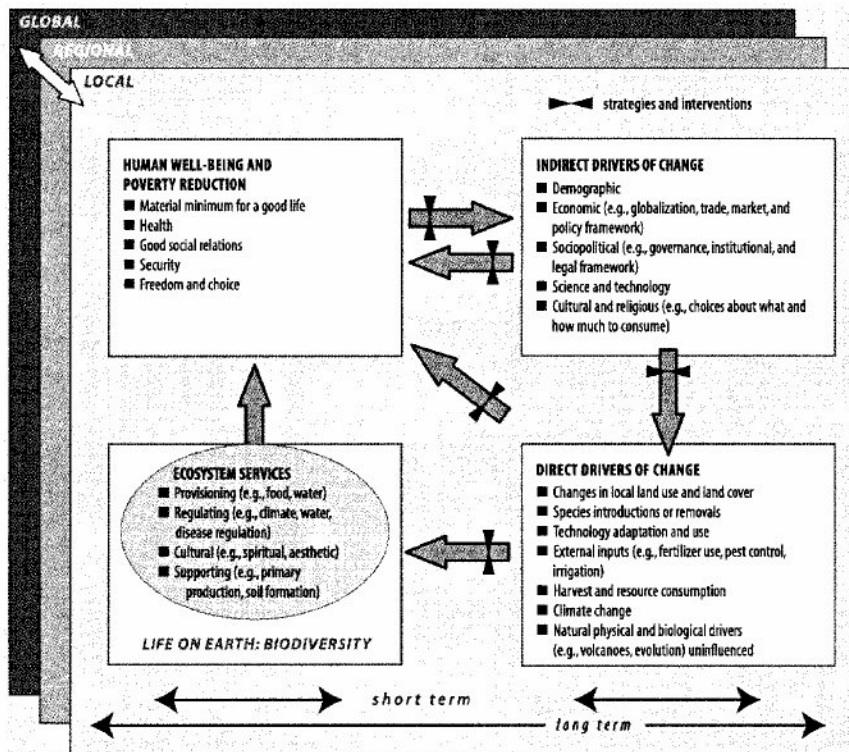
**T**he past two decades have seen a growing worldwide awareness of environmental problems such as loss and degradation of ecological habitats. Nations have responded by adopting multilateral agreements—the United Nations (UN) Framework Convention on Climate Change, for example—and many governments have strengthened environmental policies. Moreover, a growing number of companies are changing their business practices to more explicitly address social and environmental responsibility. Indeed, people everywhere have come to recognize that the environment is one of the pillars of

sustainable development. This is reflected in the the UN General Assembly's adoption of the Millennium Development Goals, one of which is a commitment to ensure environmental sustainability. Yet despite this growing awareness, the gap between science and environmental policy remains large. More needs to be done to ensure that knowledge generated by the scientific community is brought to bear on policy decisions. At the same time, the scientific community must address the key issues that modern society faces.

There have been a number of attempts to strengthen the scientific basis of en-

vironmental policies, including a wide range of assessments of current environmental knowledge and its relevance for decisionmaking. Perhaps the best known is the Intergovernmental Panel on Climate Change (IPCC), which has produced three reports through a process that involves hundreds of scientists worldwide (IPCC 2002). These reports have informed policy decisions adopted in the UN Framework Convention on Climate Change. A similar process was used to conduct the Global Biodiversity Assessment (Heywood and Watson 1995). Efforts to perform a global international water assessment are ongoing, and a global assessment of agriculture is proposed. These efforts to provide a comprehensive synthesis of the scientific knowledge in these areas have, however, had a limited influence on international policy. I believe this is to a large extent because decisionmakers were not given adequate ownership in some of these processes. It is also a consequence of the limitations to scientists' understanding of complex environmental problems.

One area of particular importance involves the linkages between climate change, biodiversity, agriculture, pollution, and other aspects of the environment (Ayensu et al. 2000). The critical nature of this nexus was identified several years ago, leading to the establishment of the Millennium Ecosystem Assessment (MA), a process that involves a wide range of stakeholders and several hundred scientists worldwide (see [www.millenniumassessment.org](http://www.millenniumassessment.org)). The goals of MA are to provide a global assessment of ecosystems, the services they provide, and their importance for



Conceptual framework for ecosystem services, human well-being, and drivers of change. Reprinted from *Millennium Ecosystem Assessment* (2003).

human well-being, and to develop future scenarios to assess the consequences of possible responses. Whereas IPCC was designed to assess responses to a single driver (climate change) in a wide range of fields (such as energy, biodiversity, water, and food supply), MA has been designed to take into account a range of drivers. It will examine the influence of these drivers on multiple ecosystems and the ecosystems' capacity to provide services that affect human well-being. This broad scope is one of MA's strengths, but it may also turn out to be one of its weaknesses. The challenge will be to present the results in a way that can be easily understood and used by a large number of stakeholders.

An important feature of MA is that it has been designed with the active participation of this wide range of stakeholders, including governments, the private sector, and civil society. The Global Biodiversity Assessment (Heywood and Watson 1995) has had a limited impact on the UN Convention on Biological Diversity, largely because the assessment was an exercise driven by the scientific community without the appropriate involvement of key interested parties. The planners of MA, aware of this danger, established it with a very large governing board that includes representation for the main multilateral environmental agreements, UN agencies, governments, scientific societies, nongovernmental organizations, the private sector, and local communities. This critical feature of MA should ensure that the work conducted is driven by the needs of the users and that the products will be helpful for guiding policies and actions.

The first product of MA is a conceptual framework, recently published as *Ecosystems and Human Well-being: A*

*Framework for Assessment* (Millennium Ecosystem Assessment 2003; see figure). This framework is the product of more than a year of deliberations and consultations involving over a hundred scientists from a range of disciplines. It is based on four main concepts:

1. Ecosystems provide a range of services.
2. These services are the basis of human well-being and poverty reduction.
3. Human activities result in a series of indirect drivers of change.
4. These indirect drivers influence a series of direct drivers, which in turn have an impact on ecosystems.

The framework is designed to show the interrelations among these elements and to indicate a range of possible interventions that can influence ecosystems and human well-being. The assessment itself is organized into four working groups, focusing on the status and trends of ecosystems and services, scenarios, subglobal assessments, and response options. The assessment is led by an interdisciplinary panel from the biological and social sciences.

One of the innovations of MA is that it is designed as an assessment at multiple scales. Many environmental factors operate at local or regional scales, and it is important to analyze trends and responses at this as well as at larger scales. MA includes a range of local assessments, from villages in India to cities such as Stockholm, and from watersheds in southern Africa to those in western China. Each of these assessments uses the conceptual framework, adjusting it as needed to reflect the most important services and drivers, and each is controlled by local or national institutions. This multiscale approach is important

because it enables researchers to assess ecological and social processes at the scale in which they operate, and because it involves those with an interest in the assessment's outcome at each scale. The approach will also enable researchers to make comparisons across sites and to learn any common lessons that may be applied in other places.

Scientists and policymakers face many challenges in the new millennium, and there is no doubt that environmental considerations need to be included in building a new model for development. As scientists, we have a responsibility to be active participants, and initiatives such as MA can make an important contribution.

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*Cristián Samper (e-mail: Samper.Cristian@nmnh.si.edu) is director of the Smithsonian Museum of Natural History and cochair of the subglobal working group of the Millennium Ecosystem Assessment.*

### References cited

- Ayensu E, et al. 2000. International ecosystem assessment. *Science* 286: 685–686.
- Heywood VH, Watson RT, eds. 1995. *Global Biodiversity Assessment*. Cambridge (United Kingdom): Cambridge University Press.
- [IPCC] International Panel on Climate Change. 2002. *Climate Change 2001: Synthesis Report*. Cambridge (United Kingdom): Cambridge University Press.
- Millennium Ecosystem Assessment. 2003. *Ecosystems and Human Well-being*. Washington (DC): Island Press.

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