

## ECOLOGY

# Biodiversity Conservation and the Millennium Development Goals

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The Millennium Development Goals (MDGs) were designed to inspire efforts to improve people's lives by, among other priorities, halving extreme poverty by 2015 (1). Analogously, concern about the global decline in biodiversity and the degradation of ecosystem services gave rise in 1992 to the Convention on Biological Diversity (CBD), into which a target "to achieve by 2010 a significant reduction of the current rate of biodiversity loss" (2) was incorporated in 2002. Our lack of progress toward the 2010 target (3, 4) could undermine the achievement of the MDGs in the long term. With growing global challenges, such as population growth, overconsumption and climate change, we need further integration of the poverty alleviation and biodiversity conservation agendas.

The links between poverty and the environment are, unsurprisingly, complex (Fig. 1) [see figure, left]. Some attempts have been made to identify a relation between development and biodiversity, but these have yielded mixed results (5). Action is urgently needed to estimate the elasticity of the link between biodiversity and ecosystem services on the one hand, and poverty reduction on the other, while taking into account the global, regional and local drivers of biodiversity loss in poor areas.

Tackling the root causes of both biodiversity loss and poverty can lead to complementary positive results. For example, reducing population pressure by promoting voluntary

reductions in fertility in impoverished regions could support conservation of biodiversity and faster poverty alleviation (6, 7). However, there may be complex trade-offs, especially in the short term, that may not be readily evident in macro- or global assessments. Economic growth rates could, for instance, initially dip as fertility is reduced, and rebound as pressure on resources is removed.

Similarly, trade liberalization might increase the supply of food commodities and could reduce prices in food-importing countries, which would remove some pressure on these countries' natural habitats. But trade liberalization might also lead to increased agricultural production in food-exporting countries where commercial horticulture can increase vulnerability to pests, diseases, and/or natural disasters, and might reduce the availability of ecosystem services (8, 9). Nevertheless, any countervailing efforts to maintain biodiversity must also be sensitive to human needs if they are to retain public support (10).

With such cases in mind, the scientific and development policy communities should focus on jointly articulating and addressing the critical research questions that, when answered, will help ensure that poverty alleviation and conservation efforts produce win-win outcomes, or at least minimize harm to either agenda. To ensure greater synergies between the development and the conservation agenda, we suggest the following actions.

Attention must focus on constructing and meeting a new biodiversity target for the remaining MDG period between 2010 and 2015, and beyond. The next target should be more specific, similarly time-limited, reasonably achievable, and address the consequences of biodiversity loss globally and for the most vulnerable people and societies. It should be supported by a small set of indicators (11) that measure trends in the state of biodiversity and ecosystem services, drivers of biodiversity loss and activities to safe-

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guard biodiversity.

We need evidence-based interventions that can address both poverty reduction and environmental sustainability. In agriculture, for instance, we can use existing agricultural land more efficiently; we can pursue agricultural development that protects or enhances biodiversity; and we can improve agricultural productivity in ways that maintain ecosystem services, through institutional changes to secure better access to seeds, markets, and expertise, combined with evidence-based and adaptive applications of appropriate technologies (12). Similarly, finance and technology for adaptation, disaster management and reduced emissions from deforestation and forest degradation (13) are particularly important in helping developing countries deal with climate change.

Future development projects should explicitly monitor the impact poverty alleviation efforts have on ecosystems and their services; similarly, conservationists must better document the impact their interventions have on the poor (14). Ideally, encouragement of interdisciplinary science that helps to identify the most cost-effective solutions will ensure that future environment and development projects are implemented, not just simultaneously, but in an integrated fashion.

Both the poverty alleviation and biodiversity agendas need to be presented to policy-makers in an integrated fashion. Establishment of a proposed Inter-Governmental Platform on Biodiversity and Ecosystem Services to complement the existing Inter-Governmental Panel on Climate Change may provide a means to enhance the quality and timeliness of the interactions between scientists and policy-makers at national scales and above. The GLOBE International Commission on Land Use Change and Ecosystems, made up of senior legislators from the G8+5 and several developing countries, provides another opportunity to bring policy-makers and scientists together. Legislators set the agenda by identifying key ecosystems or

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ecosystem services that are essential for human well-being and face degradation, and then work with scientists and economists to identify policy options and legislative solutions. Similar initiatives will also be needed at the subnational scale.

The United Nations will convene a summit in 2010 to consider the second 5-year review of the MDGs and to catalyze action ahead of the 2015 MDG target year. The conservation and development communities need to advise policy-makers and civil society organizations on the most critical initiatives we must undertake to achieve the MDGs without compromising biodiversity and ecosystem services for years to come.

#### References and Notes

1. U.N. Millennium Project, *Investing in Development: A Practical Plan to Achieve the Millennium Development Goals* (Earthscan, New York, 2005).
2. The "2010 Target" has been incorporated into the MDGs as an additional target under MDG 7.
3. B. Collen *et al.*, *Conserv. Biol.* **23**, 317 (2009).
4. G. M. Mace, J. E. M. Baillie, *Conserv. Biol.* **21**, 1406 (2007).
5. S. Dasgupta, B. Laplante, H. Wang, D. Wheeler, *J. Econ. Perspect.* **16**, 147 (2002).
6. M. Q. Dao, *J. Stud. Econ. Econometr.* **32**, 47 (2008).
7. P. Dasgupta, in *Handbook of Environmental Economics: Environmental Degradation and Institutional Responses*, K.-G. Maler, J. R. Vincent, Eds. (Elsevier, London, 2003) pp. 192-240.
8. J. Sachs, *The End of Poverty: Economic Possibilities for Our Time* (Penguin, New York, 2005).
9. R. E. Green, S. J. Cornell, P. W. Scharlemann, A. Balmford, *Science* **307**, 550 (2005).
10. W. M. Adams, J. Hutton, *Conserv. Soc.* **5**, 147 (2007).
11. M. Walpole *et al.*, *Science* **325**, XXX (2009).
12. W. M. Adams *et al.*, *Science* **306**, 1146 (2004).
13. B. Strassburg, R. K. Turner, B. Fisher, R. Schaeffer, A. Lovett, *Glob. Environ. Change* **19**, 265 (2009).
14. M. Walpole, L. Wilder, *Oryx* **42**, 539 (2008).
15. Poverty maps, <http://sedac.ciesin.columbia.edu/povmap>.
16. R. Grenyer *et al.*, *Nature* **444**, 93 (2006).

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[www.sciencemag.org/cgi/content/full/325/5947/PAGE/DC1](http://www.sciencemag.org/cgi/content/full/325/5947/PAGE/DC1)

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**Fig. 1. Map of poverty and potential biodiversity loss**, showing the level of poverty (proxied by the log rate of human infant mortality) combined with the log number of threatened species of mammals, birds, and amphibians per one degree grid square (Behrmann equal-area projection). White areas represent missing data. Data from (15) and (16).