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## Putting a Price on Nature: The Economics of Ecosystems and Biodiversity

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### In Brief:

The Economics of Ecosystems and Biodiversity, or TEEB, was conceived at the meeting of environment ministers in Potsdam in 2007. Its goal is to end the economic invisibility of nature—to help stakeholders and beneficiaries recognize the value of ecosystem services, those benefits that nature provides to the human economy, and to reward responsible custodians of Earth's ecosystems and biodiversity. Understanding the problem of biodiversity loss in its complex social, economic, and policy dimensions is a necessary prerequisite for any proposed solution, and this also underpins the guiding philosophy of TEEB.

Drawing from this approach, TEEB suggests several steps that can help reduce the loss of ecosystem services, while recognizing the extent to which biodiversity policy and development policy are interlinked. Better management needs good measurement, so we argue for improved metrics at a national level. The inclusion of ecosystem services in the UN Statistics division's national accounting guidance would be a positive step in that direction. We encourage reporting and disclosure of subsidies and gradual reduction and removal of perverse subsidies. We argue in favor of evaluating and recognizing the real economics of conservation, including its relevance for climate change and its effects on society. We emphasize valuing public services provided by natural areas as part of the decision-making apparatus for public policy and evidence its increasing use in setting up equitable payment mechanisms to reward responsible management by stakeholders and custodians. Protected areas should be primary components of an ecosystem-based strategy to combat the impacts of climate change on vulnerable communities. Last but not least, the improvement of environmental regulation has an overarching and important role. Two basic principles can guide regulatory changes to reduce losses to society: (1) Make the polluter, rather than society, pay, using instruments such as standards, noncompliance fees and fines, compensation payment requirements, pollution taxes, and product taxes on pesticides and fertilizers. (2) Use the full-cost recovery principle, which ensures that all of the costs of services, such as water supply or timber, are assigned to the corporation or the consumer that benefits from the service.

### Key Concepts:

- Natural resources make important contributions to long-term economic performance and should be considered economic assets.
- We cannot manage what we do not measure. The loss of ecosystem services is often overlooked because most of them, such as soil retention or spiritual values, are public goods and services.
- Subsidies to fisheries, fossil fuel industries, and other potentially harmful activities should be measured and reported annually; the perverse components of these subsidies should be tracked, reduced, and eventually phased out altogether.

As we near the end of the United Nations International Year of Biodiversity, we need to take stock of recent events. We should reflect on increasing ecological risks and disasters and our collective failure to meet biodiversity targets. In 2002,

the world's leaders agreed to drastically cut back on biodiversity loss by 2010. Yet none of the 193 signatories to the UN biodiversity treaty have met their targets for reducing their rates of biodiversity loss.<sup>1</sup>

The last two years have tested us in many ways—with serious price shocks and crises in food, fuel, and finance, a widespread recession, and, at the end of 2009 at Copenhagen, a somewhat surreal denouement of the two-year UN climate change negotiation process. One of the few bright spots from these talks was a four-page document, with almost unanimous agreement: a proposed framework for REDD+, addressing climate change mitigation by providing incentives for tropical developing nations to reduce deforestation and increase afforestation and reforestation. Tropical deforestation accounts for about 14 percent of global greenhouse gas emissions, more than all planes, trucks, trains, and other global transport.<sup>2</sup> To address this issue, REDD (Reducing Emissions from Deforestation and Forest Degradation) was introduced in 2005 to encourage tropical nations to protect their forests and, through that, the world's climate. The new document, REDD+, goes one step further by supporting the sustainable management of working forests and the enhancement of carbon stocks by replanting forests. This cost-effective solution would be delivered through transfer payments from the developed to the developing world. Copenhagen participants agreed on a framework for REDD+ and, importantly, to substantially finance it. Local communities would be involved as partners from the inception in designing and rolling out REDD+.

In many ways, this new consensus on REDD+ captures the changes in thinking and policy analysis embraced by TEEB, the Economics of Ecosystems and Biodiversity. Inspired by the Stern Review's analysis of the costs of climate change, released in October 2006,<sup>3</sup> TEEB was conceived at the meeting of environment ministers in Potsdam the following year. Its goal is to end the economic invisibility of nature—to help stakeholders and beneficiaries recognize the value of ecosystem services and to reward responsible custodians of Earth's living fabric, its ecosystems and biodiversity. TEEB's immediate purpose was to assess the economic impacts of the ongoing loss of biodiversity and the degradation of ecosystems and to explore an economic case for early actions to support the effective conservation of nature. Its broader purpose was to describe the economic and policy context for such action.

### **The Problem and Its Economic and Policy Dimensions**

Humans have been degrading and depleting ecosystems for centuries, even millennia. Yet the process has accelerated in the past fifty years. Many developing countries continue to see widespread habitat destruction and declines in biological diversity. The resulting loss of ecosystem services often has significant social and economic costs. Yet these losses are usually overlooked because most of these services, such as soil retention or spiritual values, are public goods and services. They defy capture in markets, escape pricing, and remain unreflected in the accounts of society. In a business-as-usual scenario, with deforestation continuing at present rates, global human welfare losses have been recently estimated at between \$2 trillion and \$4.5 trillion of natural capital lost each year.<sup>4,5</sup> This is a conservative projection, as not all ecosystem services were included in the calculation.

These losses have dimensions that can extend beyond incomes and capital to livelihoods, health, even survival. The global marine fishing industry, landing a catch just under \$100 billion per year, is at risk of collapse in the next forty years.<sup>6</sup> Also at risk are an estimated 35 million jobs, mainly in small-scale and artisanal fisheries, and the health of more than a billion people in the developing world, who depend on fish as their main or only source of animal protein. The ramifications for the oceans themselves are daunting, with entire ecosystems coming to lack top-level predators such as fish and whales. The hunting of great sharks in the North Atlantic, for example, has resulted in an increase in their prey, cownose rays. These rays have fed on bay scallops, helping to destroy a hundred-year scallop fishery.<sup>7</sup> Such cascading effects have occurred throughout the oceans and on land.

Tropical forests contribute to the livelihoods of more than 1.2 billion people; most do not have ready alternatives to their dependence on forests. Tropical deforestation, meanwhile, has been relentless, about 13 million hectares per year.<sup>8</sup> It is a threat to the limited means and livelihood resources of the poor and is the main cause of current forestry emissions. The associated policy challenge is far-reaching, both global and local, and very complex. It includes addressing the property rights of forest stakeholders, especially those at the bottom of the economic pyramid, as a vitally important social as well as environmental objective. The challenge includes an equitable benefit-sharing implementation of REDD+. There is also a need to address negative consequences of imbalanced rewards as well as to push for the introduction of payments for other ecosystem services, not just carbon storage.

There is an inextricable link between persistent poverty and the loss of ecosystems and biodiversity.<sup>6</sup> Several Millennium Development Goals—including the eradication of extreme poverty and hunger, the improvement of maternal health and women's status in society, the reduction of child mortality, and economic development—are at risk from the neglect and

deterioration of biodiversity. TEEB maintains that it is essential to focus on the bottom of the economic pyramid: win-win solutions can target the world's poor while reducing the loss of biodiversity and damage to ecosystems. Wildlife tourism is just one way of bringing money into communities that border conservation areas, creating opportunities for jobs and small enterprises. The importance of all ecosystem services to the poor can be very high, comprising 40 to 80 percent of household incomes, including food, fuelwood, and other harvests and, most importantly, nutrient and freshwater flows that benefit subsistence farmers. The income from these services can be supplemented with payments from neighboring businesses and government projects.

### **REDD and Smits Model Reforestation**

By: [Eric Rasmussen](#)

Climate alterations are already making several areas of the globe increasingly inhospitable to continued human occupation, and environmental refugees are becoming a measurable fraction of the world's displaced populations. Despite the clarity of the data, mitigation strategies around climate change have been difficult to implement. At the same time, climate research over the last decade has revealed unexpected and potentially rewarding opportunities to improve the circumstances of some of the world's most vulnerable people.

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Policymakers and administrators constantly make trade-offs concerning land conversion and ecosystem management. These decisions are usually made without fully accounting for what will be lost—often public goods and services from natural ecosystems—and with a one-sided representation of what is gained—usually private-sector profits and employment. We believe that the crisis of biodiversity loss can only be addressed in earnest if the values of biodiversity and ecosystem services are recognized and represented in decision making. This may reveal the true nature of the trade-offs being made: between different ecosystem services, such as food provision and carbon storage; between different beneficiaries, such as private gain by some versus public loss to many; across different scales, from local costs to global benefits and between short- and long-term gains. When the value of ecosystem services is understood and included, what may have looked like an acceptable trade-off might appear quite unacceptable. Private gain resulting in public loss is a major driver behind much of biodiversity loss.

### **Retargeting Subsidies**

Fossil fuel subsidies are estimated at \$240–\$310 billion per year,<sup>9</sup> and agricultural subsidies amount to another \$255–\$275 billion.<sup>10</sup> Subsidies for fisheries are estimated at \$27 billion annually—a smaller number, but economically significant as it represents a third of the value of landed catch.<sup>11</sup> Collectively, these subsidies are more than 1 percent of global GDP. It's a poignant statistic. The Stern Review proposed investing 1 percent of global GDP per year in efforts to prevent climate change; such an investment could offset damages to the global economy in the future, damages which could cost as much as 20 percent of global GDP.<sup>3</sup> Ed Barbier, an economics professor at the University of Wyoming, has also recommended that developed nations invest 1 percent of their GDP in measures to reduce carbon dependency, by way of a green stimulus package.<sup>12</sup>

We should get rid of damaging subsidies and reward activities that maintain natural ecosystems. Subsidies should be measured and reported annually so that the perverse components of these subsidies are recognized, tracked, reduced, and eventually phased out altogether. Not all subsidies are bad for the environment. Some subsidy programs are already being used to encourage ecosystem benefits, such as transfer programs in agriculture or forestry that reward the adoption of less harmful production methods by compensating for lost revenue or making payments for desired outcomes. Yet even green subsidies can distort economies and markets, or they may not be well targeted or cost effective. They require transparency and careful evaluation.

The reform process needs to focus on those subsidies that have clearly outlived their purpose, are not targeted toward their stated objectives, or do not reach their objectives in a cost-effective or environmentally responsible manner. Phasing out ineffective subsidies frees up funds or raises new funds that can be directed to areas with more pressing funding needs. In particular, these funds can be used to reward the unrecognized benefits of ecosystem services and biodiversity.

### **Rescuing Global Fisheries**

Subsidies to fisheries and agriculture can have devastating consequences: there are too many boats at sea traveling too far to make their catch, often at government expense, and farm policies often increase damaging chemical fertilizer runoff to the coasts. Both practices have direct and devastating impacts on global fish stocks and on marine ecosystems. There is an urgent need to establish marine protected areas (MPAs). If appropriately designed and managed, with local community understanding and targeted financial assistance to fisheries-dependent local communities during transition periods, MPAs can play an important role in supporting the recovery and maintenance of fish stocks.

Potential output losses of fisheries have been estimated at \$50 billion per year due to unsustainable fishing. Over a 30-year period it is estimated that \$3 trillion of potential output from fisheries has been lost, in addition to spillover effects and serious livelihood costs to poor and vulnerable fishing communities.<sup>6</sup> An open-access regime in the high seas and counterproductive subsidies that encourage overfishing are the main causes, coupled with destructive fishing in some areas. There are solutions: improved fishing regimes that delegate the sustainable management of fisheries within national waters to local communities. Kosterhavet National Park in Sweden now operates in such a manner. Marine protected areas can increase fish stocks in areas that are open to harvesting. The haddock recovery in Georges Bank Closed Areas, off Newfoundland, supplies Canadian and U.S. markets. Such solutions can be replicated in other communities and countries.

### **Recognizing the Compelling Economics of Conservation**

The case of global fisheries highlights the combined economic and ecological opportunity in setting up marine protected areas. Unlike MPAs, which occupy a miniscule 0.5 percent of the seas (only about an eighth of these are actually protected from fishing in no-take zones), land-based protected areas cover about 14 percent of the earth's land surface.<sup>13</sup> Worldwide, nearly 1.1 billion people—a sixth of the world's population—depend on protected areas for a significant percentage of their livelihoods.<sup>14</sup>

The global benefits of protecting natural systems far outweigh costs.<sup>9</sup> Policy actions addressing the distribution of benefits and costs must include—and go beyond—a site-level search for win-wins based on sustainable use. Protected areas become attractive when they are an integral part of wider strategies for sustainable development and contribute to the management of wider landscapes and seascapes. Successful community-based conservation often has exclusion powers and access rights that are returned to local communities. Policy challenges often result from ill-defined or denied rights of access to local communities, inadequate recognition of the economic role of these areas, and underinvestment by the state. Such challenges need to be addressed transparently and with the direct involvement of local communities.

The largest economic cost of conservation is the private opportunity cost, the giving up of development rights—for example, in a wetland or forest slated for protection. For all strictly managed areas in developing countries, this has been estimated at \$5 billion per year; the expansion of this protected-area network to meet the goals of safeguarding a range of ecosystem services would increase opportunity costs to greater than \$10 billion per year over at least the next 30 years.<sup>6</sup> According to the most widely cited estimates, an expanded protected-area network covering 15 percent of the land and 30 percent of the sea would cost approximately \$45 billion per year, including effective management, compensation for direct costs, and payment of opportunity costs for acquiring new land. Compare that to the goods and services that such protection would deliver: a net annual value of \$4.5–\$5.2 trillion, a hundred times greater than the costs.<sup>15</sup> Let's consider an actual example: in Bolivia, protected-area tourism generates more than 20,000 jobs, indirectly supporting over 100,000 people; conservation is a conservative—but still compelling—10 to one ratio of benefits to costs.<sup>16</sup>

### **Measuring What We Manage**

We do not pay for or trade most of the services provided by the natural environment, so they are not captured by GDP or other conventional economic indicators. Nonetheless, natural resources make important contributions to long-term economic performance, and they should be considered economic assets.

Consider tropical forests: They are a source of products with direct market values such as timber and fuelwood. They also provide ecosystem services: regulating local and regional climate, providing freshwater, preserving soil cover, storing carbon, and sustaining habitat for biodiversity. Since most markets do not price these services, they are not measured by conventional economic accounts such as the international standard used by the United Nations, the System of National Accounts (SNA). Under the SNA, man-made assets are depreciated over time, but the wear and tear on natural assets, as they are used and abused, is not reflected at all. We believe this is one of the many reasons why

natural-capital losses remain largely hidden from policymakers.

TEEB recommends a rapid upgrade to the SNA; the UN Statistics Division should include ecosystem services in its national accounting.<sup>17</sup> In particular, the inclusion of physical accounts for forest carbon stocks must be prioritized, which would be consistent with the evolution of an emissions control regime that includes REDD+. We recommend a dashboard of indicators that is based on an inclusive or extended notion of wealth, involving tracking per capita physical, natural, human, and social capital on an ongoing basis. The urgent inclusion of forest carbon in national accounts is part of this solution, but it is not meant to substitute for the gradual and full inclusion of other forms of natural capital.

Better macroeconomic and societal indicators are needed that reflect the contribution of ecosystem services to human well-being: the most thorough recent evaluation of all available alternative metrics is found in the report by Stiglitz, Sen, and Fitoussi for the president of France.<sup>18</sup> Although the authors recognize the need to measure present and future conditions of environmental sustainability as one of their dimensions of human well-being, they remain unconvinced by any of the better-known metrics of environmentally sustainable development—such as Green GDP and eaNDP (environmentally adjusted Net Domestic Product)—which take into account the contribution of ecosystem services to human well-being. TEEB contends that this gap must be addressed urgently with appropriate monetization based on the principles of ecosystem accounting. This would require the introduction of satellite accounts for forest biomass and the assignment of economic values to its measured increase or depletion. Carbon values could be inferred from biomass, measured consistently with national performance measures used for REDD+, and eventually integrated with SNA. Similarly, as location-specific understanding of ecosystem dynamics and data recording improve, ecosystem services other than carbon storage could be mapped through satellite accounts and, eventually, valued and integrated with SNA.

Distributional considerations can further accentuate the divergence between the reality of well-being after adjusting for environmental losses, on the one hand, and per capita GDP, on the other. Rural and forest-dependent communities depend most significantly on ecosystem services as a source of livelihood; they are the most vulnerable to local losses of biodiversity and ecosystem services. Measuring the importance of these services to rural incomes and livelihoods—and, conversely, the impact of their reduction or removal from what we define as the GDP of the rural poor—can help policymakers target changes to these highly vulnerable sectors of society, especially in countries with mixed economies where average per capita GDP is of limited use even as a measure of goods and services flows.

Another concept that has been fleshed out over recent years is the ecological footprint, a potentially useful tool for evaluating policy objectives.<sup>19</sup> As it is measured at a national level, it has been criticized for reflecting an inherently antitrade bias, because it focuses on the ecological deficit or surplus at a local or national level, not at a global level.<sup>12</sup> The ecological deficit for a country, however, is a way to measure a country's risk from the potential deterioration under free-trade conditions of the flow of ecological resources such as food, water, fuel, and fiber. A national ecological deficit and its risk-assessment context have parallels to national financial indebtedness and its risk-assessment context, regularly evaluated by international rating agencies. In both instances, exposures arise when prevailing benign conditions are removed, as experienced in 2008 by indebted nations at increasing risk of repayment defaults after the credit markets froze. This was recognized and addressed by the actions of the London G20 meeting in April 2009, with trade finance lines amounting to more than \$1 trillion. We have not yet witnessed the ecological equivalent of the credit crisis, but that risk is not trivial: an appropriately calculated country-level ecological footprint is, in our view, a defensible and worthwhile metric to be included on the dashboard of indexes.

### **Paying for Ecosystem Services**

Climate change has been described as the single largest market failure, but an entire landscape of market failures besets ecosystems and biodiversity. Indeed the economic invisibility of nature and its ecosystem services is a key driver of their ongoing and relentless depletion.

There is a high level of interest in tools that can capture the value of natural ecosystems by implementing payments for ecosystem services. Some of these tools have had significant success to date and, if designed properly and scaled appropriately, have real potential. Payments for ecosystem services have already been instituted from South Africa to Germany. They cover an array of services—from enhancing and purifying freshwater, the most commonly contracted ecosystem service, to sea turtle conservation on Mafia Island, Tanzania—and a diverse range of buyers. Nestlé Waters pays the farmers of the Vosges Mountains in France to extract pure mineral water. New York City pays farmers and foresters in the Catskills to protect its municipal water supply. Since 1997, in the first national program of its kind, Costa Rica has been paying landowners to sequester carbon, protect watersheds and biodiversity, and preserve the scenic heritage of the country. Payments for ecosystem services are no panacea—evidence from Mexico, for example, indicates that the landowners who were most likely to take the payments to preserve their forests were those who had

few opportunities to make money any other way. Payments went to areas where the risks of deforestation were relatively low.<sup>20</sup> But as freshwater scarcity becomes more commonplace, and targeting at-risk areas improves, the trend toward payments could accelerate.

Through the sustained efforts of a working group under the UN Framework Convention on Climate Change and with the support and input of a wide community of technical experts on forestry, satellite monitoring technology, law, finance, and policy, REDD+ has emerged as a front-runner for effective and large-scale mitigation in a post-Kyoto climate regime. We see the emergence of REDD+ credits and permitted offsets as a key part of the climate solution. “Carbon capture and storage” does not just mean expensive and somewhat controversial carbon removal technologies: it also means valuing the function of forests—time-tested, safe, cheap, and laden with corollary benefits. Tropical and subtropical forests store 25 percent of the carbon in terrestrial natural areas,<sup>21</sup> so they deserve the focus of climate negotiators seeking to reward developing countries, where most of these forests are found, for improved conservation. These ecosystems also deliver many other benefits that are highly valuable to society: food, fiber, fuelwood, freshwater and soil nutrients, flood prevention and drought control, buffering against natural hazards, ecotourism opportunities, and numerous cultural values from recreation to worship in sacred groves.

Other markets are also starting to take the value of ecosystem services into account: ecotourism and bio-trade markets often reflect the value of these services. Similarly, the demand for certified or labeled products—whether in forestry, fisheries, or organic produce—can stimulate the adoption of sustainable agriculture and ensure the continued provision of ecosystem services. Governments can also support the sustainable management of ecosystems by developing appropriate standards for products. Tax breaks and ecological fiscal transfers should be considered, as they provide incentives for private- and public-sector actors to conserve rather than consume land and nature. Markets for medicinal products already build on the value of ecosystems, but there is not yet an international regime to ensure equitable access to the riches of biodiversity.

### **The Importance of Environmental Regulation**

Environmental regulation has been and will remain central to addressing pressures on biodiversity and ecosystems, and the use of bans, standards, and requirements for monitoring and investment offers major benefits. A well-defined and comprehensive regulatory framework, if enforced, is not only effective but is also a basic precondition for further solutions based on robust markets—including introducing instruments such as biodiversity-offset requirements and habitat banking. The issue here is not regulation versus market-based instruments—it is about smart combinations.

Rewarding biodiversity and ecosystem services and reforming subsidies are necessary components of good natural resource management. They may not be sufficient, however, because they do not normally address the “free-rider” problem associated with the use of natural areas. Nor do they necessarily counteract the economic pressures arising from the undertaxed externalities of business, such as waste, pollutants, greenhouse gas emissions, and the reduction in public benefits from the private extraction of goods from natural areas. Regulations and fiscal measures need to be put in place to make the economic costs of biodiversity loss and ecosystem degradation visible to and felt by those who are making these changes.

Two basic principles can guide policy design to reduce losses to society: (1) Make the polluter, rather than society, pay. This principle—which can be implemented through noncompliance fees and fines, compensation payment requirements, pollution taxes, and product taxes on pesticides and fertilizers—helps prevent ecosystem degradation and biodiversity loss by reflecting the value of natural resources within decision making. (2) Use the full-cost recovery principle, which ensures that all the costs of services, such as water supply, mineral resource extraction, or timber, are assigned to the corporation or the consumer that benefits from the service. Although there have been many successes in applying market-based policy instruments, their potential has yet to be fully realized. Environmentally based standards, combined with flexible market-based approaches, may offer the lowest cost solutions to environmental problems. Biodiversity offsets and banking schemes can ensure that no net losses result from these policies; at best, they may even result in biodiversity gains. Putting prices on resource use by introducing taxes or tradable permits can increase the visibility of the value of biodiversity and ecosystem services. For these market-based methods to work, a clearly defined regulatory framework is necessary for the private sector.

### **Investing in Ecological Infrastructure for Climate Change Adaptation**

Climate change adaptation cannot and should not be addressed exclusively by man-made infrastructure. This was recognized in 2008, when the Fourteenth Conference of the Parties to the UN Framework Convention on Climate Change, or COP14, introduced the term *ecosystem-based adaptation*. Yet the contributions of protected areas to these

adaptations remain in the background. Given the important role of protected areas in biodiversity conservation, and by extension in increasing ecosystem resilience, TEEB argues that protected areas should be primary components of an ecosystem-based adaptation strategy.

Investment in restoring or conserving ecological infrastructure that delivers ecosystem services can significantly enhance agricultural sustainability, especially in developing countries. It can improve freshwater supply resilience and reduce future freshwater insecurity. It can considerably reduce the impacts of natural hazards such as cyclones, storms, floods, and droughts. All of these are widely understood as adaptation benefits,<sup>22</sup> and they can and should be valued as public-service benefits that have to be delivered through increased public investment in climate change adaptation measures. The questions to be addressed are: What kind of investment? Does it achieve resilience and adaptation effectively and at a low cost? And does it simultaneously improve skills and create decent jobs in poor communities? Ecological restoration across a range of different biomes meets these conditions. For example, mangrove restoration improves food security (fish nurseries restored), energy security (more fuelwood for coastal communities), and physical security (protection against increasingly frequent and violent storms and cyclones as the climate changes). Wetland restoration improves water security as well as food security through increased fishing potential. Therefore TEEB recommends significant investment in such ecological infrastructure—forests, wetlands, reefs, and so on—as a contribution to both climate change mitigation and adaptation.

### Valuation and the Twenty-first Century Framework

Developing the knowledge base and valuation techniques to integrate natural capital into cost-effective decision making is vitally important. At the same time, in this century, we must seek to avoid ecosystem thresholds at which point a habitat, after years of abuse, changes abruptly and often irreversibly. This needs to be accomplished on regional as well as national and international levels. TEEB recommends a system of indicators for ecosystem health that enables early warnings to be broadcast and quickly acted upon. The costs of sustaining biodiversity and ecosystem services, both generally and through conservation areas, can be significantly lower than the costs of policy inaction.<sup>6</sup>

Two important threads are woven throughout our work: the need to include ecosystem and biodiversity valuations when conducting policy assessments and the need to recognize ecological infrastructure as a legitimate and priority area of public investment. Such investments yield high social returns: mangroves can protect lives, marine protected areas can save fisheries, forests can protect livelihoods. By making these benefits visible to all of society, we can protect nature as well as ourselves.

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### References

1. Secretariat of the Convention on Biological Diversity. *Global Biodiversity Outlook 3* (Secretariat of the Convention on Biological Diversity, Montréal, 2010).
2. Pachauri, RK & Reisinger A, eds. *Climate Change 2007: Synthesis Report* (Intergovernmental Panel on Climate Change, Geneva, 2007).
3. Stern, N. *Stern Review on the Economics of Climate Change* (Cambridge University Press, Cambridge, UK, 2006).
4. Braat, L et al., eds. *The Cost of Policy Inaction: The Case of Not Meeting the 2010 Biodiversity Target* (report submitted to the European Commission, Wageningen/Brussels, 2008).
5. The Economics of Ecosystems and Biodiversity (TEEB). *The Economics of Ecosystems and Biodiversity for Local Policy Makers and Administrators* [online] (2010). [www.teebweb.org](http://www.teebweb.org).
6. World Bank and UN Food and Agriculture Organization. *Sunken Billions: The Economic Justification for Fisheries Reform* (World Bank, Washington DC, 2008).
7. Myers, RA, Baum, JK, Shephard, TD, Powers, SP & Petersen CH. Cascading effects of the loss of apex predatory sharks from a coastal ocean. *Science* 315, 1846–1850 (2007).
8. UN Food and Agricultural Organization. *Global Forest Resources Assessment 2005: Progress toward Sustainable Forest Management* (Food and Agriculture Organization of the United Nations, Rome, 2006).
9. International Energy Agency. *World Energy Outlook 2008* (OECD Publications, Paris, 2008).
10. Organisation for Economic Co-operation and Development (OECD). *Agricultural Policies in OECD Countries: Monitoring and Evaluation* (OECD, Paris, 2009).
11. Sumaila, UR et al. in *Catching More Bait: A Bottom-up Re-estimation of Global Fisheries Subsidies*. Fisheries

- Centre Research Report 14 (Sumaila, UR & Pauly, D, eds), Ch. 3, 49–53 (UBC Fisheries Centre, Vancouver, 2006).
12. Barbier, EB. *Rethinking Economic Recovery: A Global Green New Deal* (UN Environment Program, Geneva, 2009).
  13. Coad, L, Burgess, ND, Bomhard, B & Besançon, C. Progress towards the Convention on Biological Diversity's 2010 and 2012 targets for protected area coverage. *Parks: The International Journal for Protected Area Managers* 17, 35–72 (2009).
  14. UN Millennium Project. *Environment and Human Well-Being: a Practical Strategy*. Report of the Task Force on Environmental Sustainability (Earthscan, London, 2005).
  15. Balmford, A et al. Economic reasons for conserving wild nature. *Science* 297, 950–953 (2002).
  16. Pabon-Zamora L, Escobar, J, Calvo LM & Emerton, L. *Valuing Nature: Why Bolivia's Protected Areas Matter for Economic and Human Well-being* (The Nature Conservancy, Arlington, VA, 2009).
  17. Integrated Environmental and Economic Accounting. UN Statistics Division (2003).
  18. Stiglitz, JE, Sen, A & Fitoussi, JP. *Report by the Commission on the Measurement of Economic Performance and Social Progress* (Commission on the Measurement of Economic Performance and Social Progress, 2009).
  19. Wackernagel, M in *Measuring Sustainable Production*, Ch. 5, 49–60 (OECD Publishing, 2008).
  20. World Wildlife Fund. PES InfoExchange no. 19 [online] (2010). [assets.panda.org/downloads/pesnewsletter19.pdf](http://assets.panda.org/downloads/pesnewsletter19.pdf).
  21. Kapos, V et al. *Carbon and Biodiversity: A Demonstration Atlas* (UNEP-WCMC, Cambridge, UK, 2008).
  22. Sukhdev, P et al. *TEEB 2009 Climate Issues Update* (The Economics of Ecosystems and Biodiversity, September 2009).

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