BANKING ON NATURE'S ASSETS

How Multilateral Development Banks Can Strengthen Development by Using Ecosystem Services

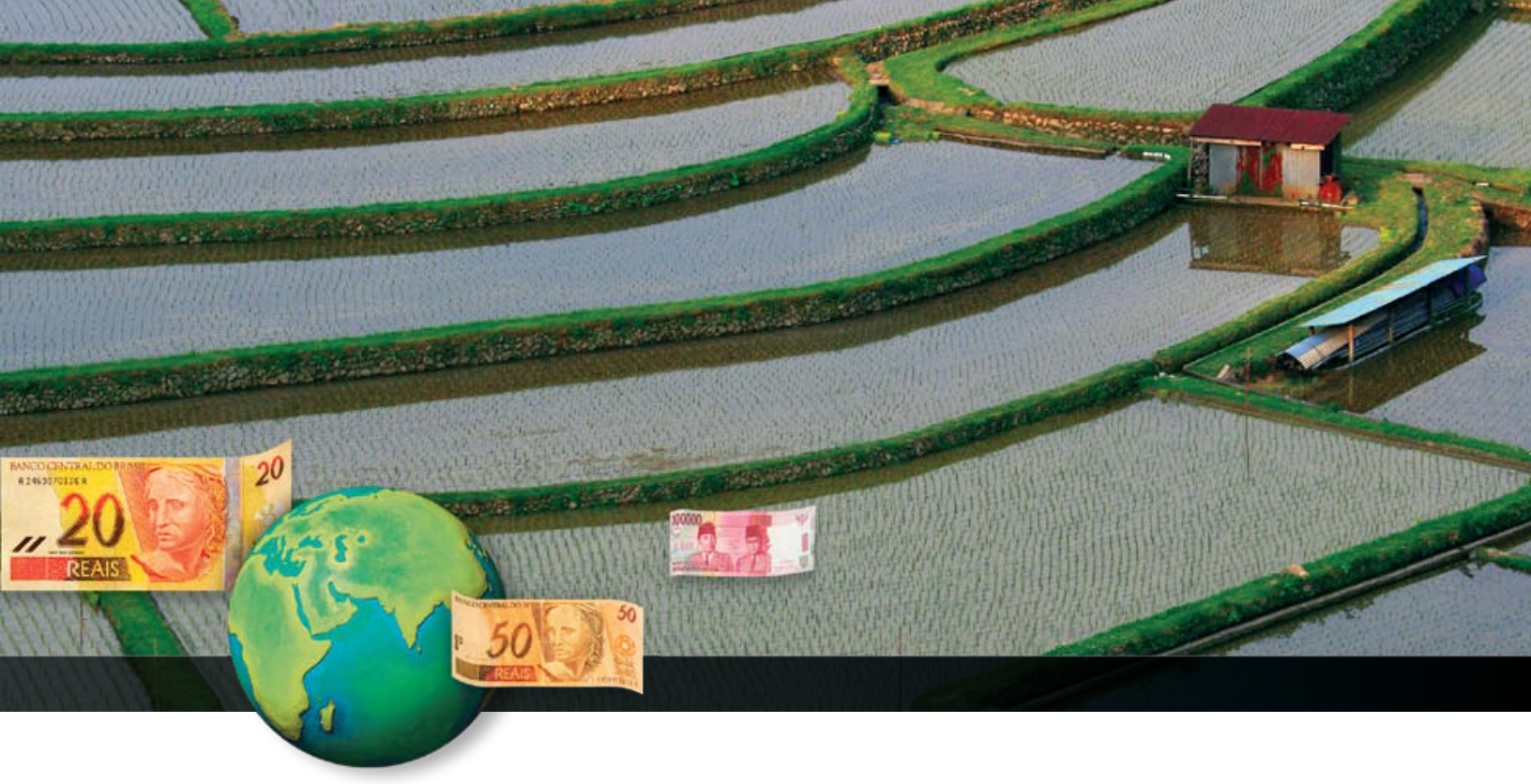
JANET RANGANATHAN

FRANCES IRWIN

CECILIA PROCOPÉ REPINSKI

WORLD RESOURCES INSTITUTE


BANCO CENTRAL DO BR
100
100
REAIS



BANKING ON NATURE'S ASSETS

How Multilateral Development Banks Can Strengthen Development by Using Ecosystem Services

JANET RANGANATHAN

FRANCES IRWIN

CECILIA PROCOPÉ REPINSKI

WORLD
RESOURCES
INSTITUTE

COVER AND TITLE PAGE IMAGES:
Brazilian currency by sxc.hu/Afonso Lima
Indonesian currency by sxc.hu/lilieks
Nigerian currency by Flickr/Danny McL
Globe by Photodisc
Rice paddies by Flickr/el fotopakismo
Page 1: Flickr/ellievanhoutte
Page 5: Flickr/ellievanhoutte
Page 9: Flickr/yewenyi
Page 19: Flickr/nicholas T
Page 23: Flickr/shenghung lin

The full report is available online at www.wri.org

ISBN 978-1-56973-734-7

Table of Contents

NOTE: *All dollar amounts are U.S. dollars, unless otherwise indicated.*

Foreword

Humanity depends on nature for sustenance and survival. From food and fuel to climate regulation and water purification, nature's services underpin our prosperity, well-being, and security.

And nature's health increasingly depends on humanity. Virtually every development or investment decision made around the world has an impact on nature somewhere, somehow. Over the past half century, that impact has been increasingly obvious and generally destructive, degrading two thirds of ecosystems services—that is the benefits nature provides—worldwide.

Reconciling development and nature has therefore become an urgent imperative.

Multilateral Development Banks (MDBs) can and should play a pivotal role in this effort. Their work focuses on poverty-stricken countries where rural communities depend directly on ecosystem services for their well-being and livelihoods. The World Bank and others have already begun to experiment with ecosystem service concepts in development planning and practice, providing an example to governments and the private sector.

Building on these promising foundations, MDBs can stake out innovative ground in development finance by mainstreaming an ecosystem services approach throughout their strategic priority setting, advisory services, and investments. New players in developing country finance, for whom environmental considerations are not yet a priority, would also benefit from such leadership. By positioning themselves as standard bearers for high environmental standards, the World Bank, and the Asian, Inter-American, and African Development Banks can maintain and enhance their influence and impact as well as better serve the poorest of the poor.

This report provides the tools for systematically integrating an ecosystem services approach into the economic development strategies of MDBs and their partner countries. To date MDB efforts to take natural capital into account when making economic development decisions have tended to focus on a single ecosystem service such as freshwater, climate regulation or fuelwood supply. Such an approach, however, has pitfalls. In Thailand, for example, efforts to enhance a single ecosystem service approach—aquaculture—led to record frozen shrimp exports. But clearing mangrove forests to make way for shrimp farms was a disaster for coastal villages, resulting in falling fish catches, and increased storm damage, water pollution, and mosquito infestations.

By taking the next step from a single ecosystem approach to one that systematically factors multiple ecosystem services into decision-making, the MDBs can avoid such adverse trade-offs. In doing so, they can also move closer to the ultimate goal of reconciling environment and development.

Banking on Nature's Assets provides a roadmap for such a course. It makes the case and identifies entry points for mainstreaming ecosystem services into MDBs' core operations. In addition, it presents a range of tools and policy options that MDBs can use to help country partners sustain their precious natural capital.

Managing human use of natural systems to sustain the services upon which people depend provides immediate economic benefits, and will strengthen the resilience of those systems in the face of the effects of climate change. And, of course, sustaining natural systems—especially forests—can help to counter climate change by reducing emissions of greenhouse gases. A recent World Bank report argues that ecosystem-based approaches are an "essential pillar in national strategies to address climate change". We agree, and we hope that the World Bank and other MDBs will use and build on the concrete guidance in *Banking on Nature's Assets* to embed an ecosystem services approach across all their operations.

Scaling up such tools and policies is urgent, both for multilateral banks and national governments. The present worldwide economic crisis is paralleled by an ecological crisis, but with one crucial difference. Unlike the global economy, nature does not do bailouts.

Jonathan Lash
President, World Resources Institute

Executive Summary

Humanity depends on nature for physical and spiritual sustenance, livelihoods, and survival. Ecosystems provide numerous benefits or "ecosystem services" that underpin economic development and support human well-being. They include provisioning services such as food, freshwater, and fuel as well as an array of regulating services such as water purification, pollination, and climate regulation. Healthy ecosystems are a prerequisite to sustaining economic development and mitigating and adapting to climate change.

The UN-led Millennium Ecosystem Assessment audited the health of 24 ecosystem services globally and reported that two-thirds had been degraded over the past half century. This degradation is undermining development progress. However, by accounting for and managing ecosystem service trade-offs, multilateral development banks (MDBs) and partner countries can improve development outcomes, help address climate change, and reduce costs to people and economies. Toward this end, a growing number of tools are emerging to help factor ecosystem services into economic development decisions.

Traditionally, development planners have focused narrowly on provisioning services with a value in the market place while overlooking regulating services. Expansion of aquacultures has increased shrimp production, for example, but at the same time degraded the fish spawning ground and storm protection services provided by mangroves. Construction of dams has increased power and freshwater for irrigation while leading to downstream loss of wetlands and their purification and flood protection services.

FLICKR/EL FOTOPAKISMO

MDBs have already begun to experiment with ecosystem service concepts in development planning and practice. This report makes the case for expanding beyond the current focus on single services and "add-on" projects. The authors recommend a more systematic approach, one that would take into account multiple ecosystem services in all development operations from the earliest stages of the planning process. Such an approach will enable MDBs to make the links among climate, environment, and development and identify risks and opportunities associated with development plans. *Banking on Nature's Assets* identifies entry points for mainstreaming ecosystem services in MDBs' core operations of strategic direction setting, advisory services, and investments and describes a portfolio of tools to help. It also presents a range of policy options that MDBs can help country partners implement to sustain critical ecosystem services.

The report concludes with five interrelated recommendations to scale up MDB and partner-country application of ecosystem services:

- Incorporate into environment strategies;
- Integrate into core operations;
- Build capacity to implement an ecosystem services approach;
- Empower local authorities, organizations, and communities; and
- Strengthen policies and incentives.

Acknowledgments

This publication builds on the wealth of knowledge accumulated by World Resources Institute's Mainstreaming Ecosystem Services Initiative (MESI). We thank all the MESI staff for their contributions to this publication; without them this publication would not have been possible. We would also like to extend a special thanks to Marcus Lee at the World Bank and Daniel Fromm and Colin Rees at the Inter-American Development Bank for their helpful guidance on how to make the report more relevant to multilateral development banks.

We are also grateful to the following colleagues and friends who provided critical review and other valuable contributions to this publication: Maria Athena Ronquillo-Ballesteros (WRI), Manish Bapna (WRI), Virginia Barreiro (WRI), Karen Bennett (WRI), Jan Bojö (World Bank), Emily Chessin (WRI), Steve Danyo (World Bank), Janine Ferretti (IDB), Polly Ghazi (WRI), Robert Goodland (WRI), Craig Hanson (WRI), Peter Hazlewood (WRI), Norbert Henninger (WRI), Will Irwin (IUCN Commission on Environmental Law), Florence Landsberg (WRI), Christian Layke (WRI), Eirivelthon Lima (IDB), Kathy MacKinnon (World Bank), William Magrath (World Bank), Isabel Munilla (WRI), Smita Nakhooda (WRI), Ruth Nogueron (WRI), Chris Perceval (WRI), Ricardo Quiroga (IDB), Fred Stolle (WRI), Dan Tunstall (WRI), Jacob Werksman (WRI), and Jeffrey Wielgus (WRI).

FLICKR/MCKAYSAVAGE

The publication process was helped along by Hyacinth Billings, Jennie Hommel, Logan Yonavjak, and Nick Price. We also thank Caroline Taylor for copyediting the report.

We are indebted to the Danish International Development Agency, Netherlands Ministry of Foreign Affairs, Irish Aid, Charles Stewart Mott Foundation, Rockefeller Brothers Fund, Swedish International Biodiversity Programme (SwedBio), and Swedish International Development Agency for providing generous financial support for this undertaking.

Any deficiencies are entirely the responsibility of the authors.

CHAPTER 1

Introduction

We all depend on ecosystem services for our well-being. Failure to take into account the full range of these vital services jeopardizes the achievement of economic development goals and people's well-being and livelihoods, especially in rural communities in developing countries which depend heavily on nature's assets. At the same time, the capacity of ecosystems to provide services is closely tied to climate change. The good news is that the tools needed to factor ecosystem services into development and climate policy and management decisions are becoming available (Kareiva et al. forthcoming; Ranganathan and Hanson 2009; Daily et al. 2009).

This report moves beyond the traditional focus on how to enhance a single ecosystem service to how to incorporate multiple ecosystem services into the development process. At the same time, it seeks to expand the development mind-set from viewing the environment as something that needs to be *protected* from the impacts of development to recognizing that successful sector and regional strategies *depend on* healthy ecosystems. The report highlights how, by treating ecosystems as assets that generate benefits, MDBs can help

Box 1: Key Terms

Ecosystem Services: The benefits that people derive from nature. Examples include freshwater, timber, hazard protection, climate regulation, recreation, and aesthetic values. Ecosystem services are also sometimes referred to as environmental services.

Ecosystem Service Dependencies: Dependencies exist when an ecosystem service serves as an input or creates/enhances the conditions necessary for a successful development outcome.

Ecosystem Service Impacts: Impacts are changes in the quantity and quality of ecosystem services. These changes can be positive or negative.

Ecosystem: A functional unit that consists of a dynamic complex of living organisms and their interaction with the nonliving environment. Examples include a rain forest, desert, coral reef, or a cultivated system. Ecosystems can be relatively undisturbed by people, such as virgin rain forests, or can be modified by human activity, such as farms and urban areas.

Natural Capital: The living and nonliving resources (including minerals and ecosystem services) derived from the Earth.

Biodiversity: The variability among living organisms within species, between species, and between organisms. Biodiversity is not itself an ecosystem service, but rather supports the supply of *all* services.

Multilateral Development Banks (MDBs): Multilateral and regional international financial institutions established and financed by governments to provide loans and grants to eligible developing countries to promote economic development. These include the World Bank, Inter-American Development Bank, African Development Bank, and Asian Development Bank.

partner countries sustain their natural capital—an essential foundation for their social and economic capital. (Box 1 defines key terms.) Although the focus is primarily on the World Bank, the analysis and recommendations are relevant to all MDBs. Specifically, the report—

- Makes the case that a systematic consideration of all ecosystem services in play can strengthen development strategies and suggests key MDB entry points for considering them;
- Describes a portfolio of tools that can be used to identify, prioritize, measure, map, and value multiple ecosystem services;
- Presents a range of policies that can help sustain ecosystem services; and
- Recommends steps to scale up the application of ecosystem services in MDB operations and partner processes.

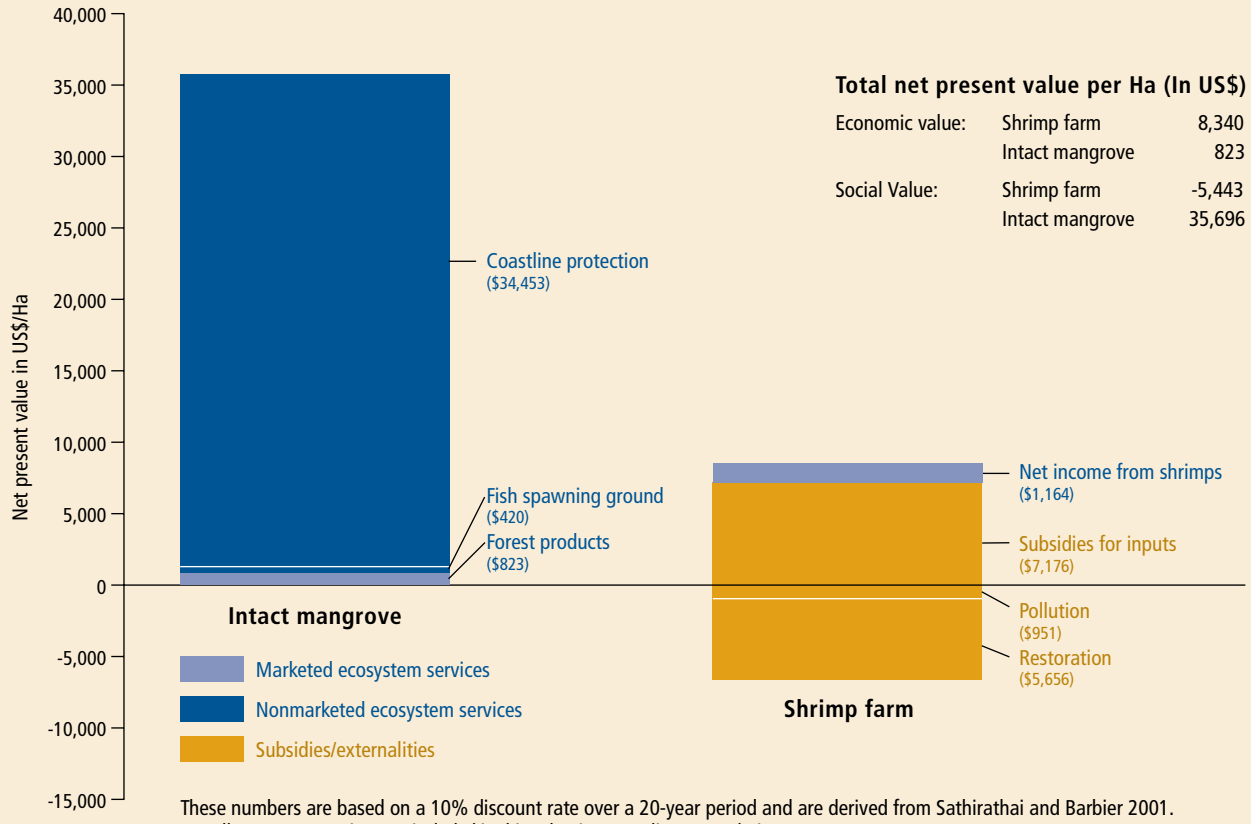
A CASE STUDY ON THE PITFALLS OF OVERLOOKING ECOSYSTEM SERVICES

The experience in Tha Po village in Surat Thani province on the coast of Thailand illustrates how focusing on a single ecosystem service can lead to degradation of other services and an imbalance in the sharing of costs and benefits. In contrast, treating all kinds of ecosystem services as assets and looking at the trade-offs among multiple services has the potential to lead to development that is more equitable and sustainable.

In the 1980s, Thailand's government, initially supported by the World Bank, focused on a single ecosystem service—aquaculture—to supply a growing frozen shrimp export industry. Shrimp farms rapidly replaced the mangroves surrounding fishing communities. By 2007, Thailand was exporting seven times more volume of frozen shrimp than 20 years before (FAO 2009). However, coastal villages, such as those in Thailand's Surat Thani Province, experienced declines in their catches of fish, increased storm damage, water pollution, and mosquito infestations as the services provided by the mangroves—spawning ground for wild fish, filtering pollution, and a protective barrier during storms—declined. At the same time, Thailand became one of the 12 countries most at risk from flooding as a result of climate change and rising sea levels (World Bank 2009a).

A retrospective analysis of the conversion of mangroves to shrimp farms demonstrated that this decision was

Figure 1 **Comparing the Economic and Social Value of Mangroves and Shrimp Farms**



These numbers are based on a 10% discount rate over a 20-year period and are derived from Sathirathai and Barbier 2001. Not all ecosystem services are included in this valuation e.g., climate regulation.

Source: Ranganathan et al. 2008.

Table 1 The Condition of Ecosystem Services

Ecosystem Services	Degraded	Mixed	Enhanced
Provisioning	Capture fisheries Wild foods Wood fuel Genetic resources Biochemicals Freshwater	Timber Fiber	Crops Livestock Aquaculture
Regulating	Air quality regulation Regional and local climate regulation Erosion regulation Water purification Pest regulation Pollination Natural hazard regulation	Water regulation (e.g., flood protection) Disease regulation	Carbon sequestration*
Cultural	Spiritual and religious values Aesthetic values	Recreation and ecotourism	

Source: Ranganathan et al. 2008 (adapted from MA 2005a).
*Carbon sequestration has recently been enhanced globally, due in part to the regrowth of forests in temperate regions, although previously deforestation had been a net source of carbon dioxide emissions.

economically beneficial only if the analysis was limited to the values of the shrimp harvest and the mangrove's marketable forest products (Figure 1) (Sathirathai and Barbier 2001). When the analysis was extended to cover the value of several nonmarketed ecosystem services, including coastline protection and a nursery for wild fish, maintaining intact mangroves became the sound economic development choice.

There were also inequities in who received the benefits and who paid the costs in these two development choices. Conversion to shrimp farms primarily benefited a limited set of shrimp farm operators as well as consumers in other countries who paid lower prices for "subsidized" shrimp imported from Thailand. In contrast, coastal communities bore the costs of aquaculture pollution, reduced fishery yields, and increased storm damage. Furthermore, the average productive life of a typical commercial shrimp farm in Thailand is only five years, after which yields decline dramatically, and disease increases (Sathirathai and Barbier 2001).

In recent years, following wide documentation of the problems associated with shrimp farming in mangroves, recognition has grown that this approach is not a sustainable use of ecosystem services. In response, industry aquaculture leaders formed certification programs to develop more sustainable aquaculture practices. The Global Aquaculture Alliance codes of practice, for example, state that new shrimp farms should not be developed in mangroves. They also encourage industry-government cooperation to develop regulations on restoration of mangroves as well as measures that promote the livelihoods of dependent communities (Global Aquaculture Alliance 2001). Retailers, in turn, have spurred adoption of these management practices. For example, Walmart aims to have all its foreign shrimp suppliers comply with Best Aquaculture Practices by 2011 (Walmart 2009).

GLOBAL ECOSYSTEM DEGRADATION JEOPARDIZES DEVELOPMENT GOALS

The experience with shrimp aquaculture in Thailand is not an isolated case. Countries and their partners at MDBs face rapidly declining trends in the condition of many ecosystem services. The Millennium Ecosystem Assessment (the Assessment), supported by the United Nations and the World Bank among other institutions, completed a comprehensive and systematic global survey of the health of ecosystem services in 2005. It found that two-thirds of the services it assessed were degraded (Table 1). The few enhanced services tended to be those with an easily measured market value. These trends, in large part, reflect the preoccupation of economic development with intensifying use of single services while overlooking the trade-offs and contributions of other services.

Box 2: Examples of Ecosystem Service Trade-offs

Desertification in Darewadi, India. Overuse of natural resources in Darewadi, Maharashtra, degraded the village's watershed in the early 1990s, limiting its ability to regulate scarce rainwater, prevent soil erosion, and support crop production. Crops could only be supported three to four months a year. The village was on the brink of desertification, forced to depend on water tankers during drought periods. Young people were leaving the village to seek work elsewhere (D'Souza and Lobo 2004; WOTR 2002; WOTR 2005).

Water flows in Costa Rica. In the 1990s, landowners in Costa Rica were clearing forested slopes for livestock and agriculture. With the trees gone, heavy rains increased soil erosion and river sedimentation, which lowered dam reservoir capacity and power output for hydropower and reduced water availability and quality for people downstream (Malavasi and Kellenberg 2003; Chomitz et al. 1998).

Forest burning in Cerrado, Brazil. Spurred by high soy prices, triggered in part by U.S. policies that shifted the use for corn from food to fuel, soy farmers in the Cerrado wooded grassland region in Brazil are buying up large expanses of cleared land from ranchers. The displaced ranchers then purchase areas 10 times as large on the forest frontier, contributing to large-scale deforestation. The trees, cleared and burned, release carbon dioxide into the atmosphere, contributing to global warming and affecting local air quality (Sawyer 2008).

Wetland conversion in Kampala, Uganda. Urbanization and changing rainfall patterns have threatened the water supply of 2 million residents in the Ugandan capital Kampala. Rapid population growth has led to the conversion of much of the city's once expansive wetlands to industrial use, semi-slum residential housing, or drainage channels for crop production. Viewed as idle land by developers, these wetlands formerly provided crucial groundwater recharge, water storage, and industrial wastewater purification services to the city (Wetlands Management Department et al. 2009).

The Assessment found that the degradation of ecosystems presents a significant barrier to achieving the Millennium Development Goals that world leaders agreed to at the United Nations in 2000 to reduce poverty and improve human well-being by 2015. Although economic wealth was growing according to conventional indicators, the Assessment showed that some countries were actually getting poorer when the loss of natural resources was considered (MA 2005a).

Ecosystem services are relevant to all development planners but especially those focused on alleviating poverty in rural areas where the poor depend heavily on these services (WRI et al. 2005). Development policies and land and water management practices can create unexpected ecosystem service trade-offs that undermine MDB efforts to pursue longer-term environmental sustainability. (See Box 2 for examples.) As in Surat Thani, these trade-offs can be separated in time and space from the development actions that triggered them. And those affected by the trade-offs are often not the same as those who benefit from the changes to ecosystems, thus jeopardizing favorable development outcomes, especially for the resource-dependent poor.

MDBs are especially well positioned to spearhead efforts to systematically integrate ecosystem service risks and opportunities into development decisions.

MDBs CAN PROVIDE LEADERSHIP ON ECOSYSTEM SERVICES

MDBs can play a leadership role in integrating ecosystem services into development. The World Bank alone provides between $25 and $35 billion annually through loans (World Bank Treasury 2009). Through the influence they exercise in partner countries by providing strategic priority setting, finance, and advisory services, MDBs are especially well positioned to spearhead efforts to systematically integrate ecosystem service risks and opportunities into development decisions, including those that focus on climate change.

A recent World Bank report, for example, argues that ecosystem-based approaches are a "third and essential pillar in national strategies to address climate change" (World Bank 2009a). Work on adaptation to climate change under the World Bank Group's 2008 Strategic Framework on Development and Climate Change provides a significant opportunity to address ecosystem services. Some country partnerships on climate change already plan to address ecosystem services. For example, India's adaptation priorities include investment in climate-resilient infrastructure and livelihoods—an approach that can include the ecosystem services of water filtration and hazard protection (World Bank 2009b).

Drawing on their analytical/operational skills and development experience, MDBs can test, improve, and scale up the integration of multiple ecosystem services into development strategies, building capacity within countries, and sharing lessons learned about ways to address the intertwined challenges of ecosystem degradation, climate change, and development. The next chapter describes the benefits of integrating ecosystem services into development decisions and identifies entry points in MDB processes for achieving this.

Using Ecosystem Services

MDB development services can benefit from incorporating a more systematic approach to managing ecosystems in their strategic priority setting, analytical and advisory services, and investment. They have already started down this path by taking significant steps to integrate environmental sustainability into development initiatives. For example, in 2001, the World Bank endorsed its first formal Environment Strategy to support its overall poverty reduction mission. The strategy focused on improving quality of life, enhancing quality of growth, and protecting the regional and global commons (World Bank 2001). The Inter-American Development Bank (IDB) adopted an Environment and Safeguard Policy in 2006 (IDB 2009). The World Bank has also pioneered work on single ecosystem services. The Forest Carbon Partnership Facility, for example, helps forest-rich developing countries participate in markets for the ecosystem service of climate regulation—how forests sequester and store carbon from the atmosphere (Forest Carbon Partnership 2009). A key next step is to scale up existing efforts beyond single services and add-on projects to integrate a consideration of multiple services in all strategic direction-setting, investment, and advisory services (Table 2).

HOW ECOSYSTEM SERVICES CAN HELP

As the World Bank develops a new Environment Strategy and seeks ways to mainstream environment and climate change into its operations and as other MDBs refine their own approaches, they can draw on recent experiences of managing multiple ecosystem services by public and private-sector players. (See Box 3 for examples.) Based on lessons learned from these and other efforts, the World Resources Institute has identified three effective elements of a more expansive approach to ecosystem services: making the case that ecosystems matter to development; managing ecosystem service trade-offs; and informing the selection of policies for sustaining ecosystem services.

(i) Making the case that ecosystems matter to development

By treating nature's benefits as wealth-creating assets that support development, MDB staff can strengthen the case for investing in the restoration, maintenance, and enhancement of ecosystem services. Traditionally, society has put economic development and nature in separate boxes: separate academic disciplines, separate government agencies, and correspondingly separate laws and policies. By making the connection between ecosystems and people, the language of ecosystem services can help reframe country dialogues on environment and development from "do no harm" to "do good."

Box 3: Experience with Treating Ecosystem Services as Natural Assets

The **UNDP-UNEP Poverty-Environment Initiative** (PEI) provides financial and technical support to developing-country governments to mainstream poverty-environment links into national development planning and implementation. National or local ecosystem service assessments and economic valuations are conducted to identify links between ecosystems, the livelihoods of the poor, and economic growth. The resulting information supports the inclusion of ecosystem services in Millennium Development Goal-based national development and poverty reduction strategies (PEI 2009a).

The Millennium Ecosystem Assessment **Sub-global Assessment Network** is a global group of experts and practitioners, many based in developing countries, conducting assessments on the links between ecosystems and human well-being. These assessments are designed to inform decision making by identifying ecosystem service trade-offs and assessing their consequences.

Usually development programs focus on creating jobs and then get to addressing environmental issues. The **Indo-German Watershed Development Program** and Indian NGO **Watershed Organization Trust** reverse this approach in participatory watershed development projects that teach villagers techniques to conserve water and soil regulating services. Villages contribute labor and impose temporary bans on tree felling and livestock grazing. As the land is restored, incomes and jobs increase. In Darewadi, agricultural income grew fivefold with higher-yield crops, milk sales, higher wages, and more days of available work. As of late 2004, the overall program had provided $21.9 million in support on 165,439 hectares of land, affecting about 190,000 people (WRI et al. 2005; WOTR 2009).

The World Resources Institute's (WRI) **Corporate Ecosystem Services Review** (ESR) is a structured methodology for corporate managers to actively develop strategies for managing business risks and opportunities arising from their company's dependence and impact on ecosystems. WRI has helped more than 30 companies, including Syngenta (agribusiness), Mondi (paper and packaging), Akzo Nobel (chemicals and coatings), Rio Tinto (mining), and BC Hydro (power) to use the ESR in their operations. These included corporate operations in India, South Africa, Brazil, Hungary, Trinidad, and Thailand (Hanson et al. 2008).

The range of benefits provided by nature includes—

- *Provisioning services:* the goods or products obtained from ecosystems such as food, freshwater, and timber;
- *Regulating services:* the often overlooked benefits obtained from an ecosystem's control of natural processes such as climate, disease, erosion, water flows, and pollination, as well as protection from natural hazards;
- *Cultural services:* the nonmaterial benefits obtained from ecosystems such as recreation, spiritual values, and aesthetic enjoyment; and
- *Supporting services:* the natural processes, such as nutrient cycling and primary production, which maintain the other services.

Table 2 Entry Points for Integrating Ecosystem Services into MDB Operations

Entry Point	Description	How ecosystem services can be integrated (not exhaustive)
Strategic direction and priority-setting		
Thematic, Sector, and Regional Strategies	Strategic frameworks/plans to guide overall MDB direction, priorities, and operations e.g., Environment Strategy, Climate Change Framework, Energy Strategy, Africa Action Plan, Africa Climate Change Strategy. Output is a strategy document. Outcome is operations are guided accordingly in the medium term.	• Use list of ecosystem services to identify potential risks and opportunities arising from strategy's dependence and impact on ecosystem services. • Include measures for addressing risks and opportunities in strategy and incorporate in targets, indicators, and results framework.
Poverty Reduction Strategy Papers (PRSPs)	PRSPs define a country's medium-term priorities for macroeconomic, structural, and sectoral policies and programs and governance reforms to promote growth and reduce poverty, as well as associated domestic and external financing needs. PRSPs are country-owned and developed, with the MDBs and other development partners providing technical assistance and support. Output is PRSP document. Outcome is MDBs and other development partners respond with programs to help implement PRSPs and achieve their objectives.	• Include analysis of ecosystem service conditions and trends and links to poverty in the assessment of poverty and its key determinants. From this analysis, identify priority ecosystem services. • Support an analysis of sector and subnational policies and institutions relevant to the priority ecosystem services. • Incorporate ecosystem services in development targets, indicators, and long-term monitoring of poverty trends and impact of government policies and programs. • Include training on use of ecosystem service tools in priorities for capacity-building efforts. • Support the development of institutions, policies, and financing mechanisms to restore, sustain, and enhance priority ecosystem services in the policy matrix.
Country Assistance Strategies (CAS)	MDBs response to PRSP. Developed in cooperation with partner country, often in response to country's PRSP where available. Sets out broad framework on priority sectors and activities for MDB support with specific results targets. Output is CAS document. Outcome is all MDB interactions in-country are guided by CAS.	• If ecosystem services are integrated effectively in PRSPs, CASs will reflect them accordingly. • If not, use list of ecosystem services to identify potential risks and opportunities arising from strategy's dependence and impact on ecosystem services. Then include measures for addressing risks and opportunities in strategy and incorporate in targets, indicators, and results framework.

Table 2 Entry Points for Integrating Ecosystem Services into MDB Operations (continued)

Entry Point	Description	How ecosystem services can be integrated (not exhaustive)
Analytical and advisory activities		
Strategic Environmental Assessments (SEA)	A "continuum" rather than a single methodology; the means by which environment is mainstreamed into operations. Can be used in a variety of situations when delivering product/services to partner countries. Range of outputs and outcomes depending on goals.	• Use OECD/DAC advisory note on how to incorporate ecosystem services into SEAs. • Inform understanding of risks to ecosystem services on which development proposals depend. • Identify opportunities to reduce impacts and invest in regulating services. For example, using wetlands for water filtration rather than man-made infrastructure such as water treatment plants.
Country Environmental Analysis (CEA)	Country-level analytical tool to integrate environmental issues into PRSP, CAS, DPL, etc. Output is CEA report. Outcome is that the design/content of reports and projects is influenced by environmental considerations identified in the CEA.	• Use list of ecosystem services to identify risks and opportunities for country development goals and priority services. • Conduct assessment of condition and trends of priority ecosystem services and drivers of change. • Identify policies, incentives, and institutions for sustaining priority ecosystem services. • Inform the design of monitoring programs.
Economic and Sector Work (ESW)	Studies and analytical reports prepared by in-country MDB staff to support policy dialogue with governments and development of lending programs. Output is an ESW report. Outcome is subsequent investment operations based on/informed by ESW analysis and recommendations.	• Use list of ecosystem services to identify risks and opportunities in economic and sector policies and programs arising from dependence and impact on services. Identify priority services. • Assess conditions and trends of priority ecosystem services, including direct and indirect drivers of change and contribution of sector to drivers of change. • Incorporate ecosystem service risks and opportunities in sector strategies and policies.
Technical Assistance (TA)	Advisory services provided to partner countries that do not involve original analytical effort, e.g., advice on strategies and plans, policy design, policy implementation, reviews of partner-country documents, and knowledge-sharing workshops. Output dependent on nature of TA. Outcome is strengthening of partner-country capacity.	• Include explicit consideration of ecosystem services in non-ecosystem-focused TA where relevant. • Include training on ecosystem service assessments and use of other ecosystem service-based tools.
Investment operations		
Development Policy Loans (DPLs)	Direct budgetary support, usually contingent on policy reforms, not tied to a specific project.	• Include ecosystem service-based tools in MDB toolkits aimed at facilitating analysis of the direct and indirect effects of development policy reforms on the natural environment. • Consider the need to sustain priority services in any conditions applied to loans.
Investment Loans and Grants	These can be specific investment loans (SILs) for specific projects or adaptable program loans (APLs) for a series of projects. Source can be IDA credits, IBRD loans, etc. Grants, such as those from the Global Environment Facility, can be combined with investment loans and usually target specific projects.	• Incorporate an assessment of ecosystem service dependencies and impacts and associated risks/opportunities in project design phase, including the selection of the project itself. • Include ecosystem service-related targets and indicators in results framework (logframe).
Safeguards	Not stand-alone, but an integral part of project preparation and supervision of investment in projects. Project design must comply with all applicable guidelines on safeguard policies, including environmental assessment, protected areas, involuntary resettlement, indigenous peoples, etc.	• Incorporate ecosystem services into environmental assessments. Identify ecosystem service dependencies and impacts and associated risks/opportunities and use results to guide baseline data needs, stakeholder engagement, assessment of cumulative impacts, and evaluation of alternative development strategies.

(ii) Managing ecosystem service trade-offs

By systematically assessing the full range of ecosystem service dependencies and impacts of any given policy or plan, MDBs can actively manage trade-offs and take advantage of synergies that may arise from their economic development programs. Because ecosystem service-related trade-offs and synergies are often separated in time and space from the interventions that give rise to them, they can easily be overlooked in the planning process. The way in which a community meets its immediate needs for fuel and fiber through a forest's provisioning services, for example, may enhance or jeopardize future income from that forest's

long-term climate regulation service or reduce downstream water quality.

The regulating services are especially at risk of being overlooked in development decisions. Services such as water filtration or hazard protection tend to be taken for granted because they are less visible than the provisioning services of fish or forests and typically do not have a market value. Returning to the Tha Po example, if the original analysis of converting mangroves to shrimp farms had taken into account all ecosystem services—including the regulating services of storm protection, climate regulation, and a nursery for wild fish—might a different, more sustainable economic development choice have been made?

(iii) Informing the selection of policies for sustaining ecosystem services

Highlighting priority ecosystem services up-front in development programs or projects can inform the design and coordination of effective policies and institutions to restore, sustain, or enhance them. While it may be possible to address some ecosystem service risks through changes to the design of development strategies, other risks may emerge from actions taken by others at different scales or in different sectors. Effective policies to sustain priority ecosystem services often require coordination across scales, sectors, and institutions and must be capable of addressing the relevant drivers of ecosystem change.

As described later the types of policies for sustaining ecosystem services extend beyond the often cited payments for ecosystem services (e.g., carbon markets for forests) to include ecosystem management best practices, land-use zoning, establishment of ecosystem service protected areas, and limits on practices that degrade services. Also important are markets and fiscal incentives—taxes, subsidies, and fees as well as payments—that encourage actions that sustain ecosystem services and deliver development benefits, particularly among poor and vulnerable groups.

Across all MDB and partner country operations, a more comprehensive understanding of ecosystem services can help identify which stakeholders are most deeply dependent on and knowledgeable about these services. Ensuring that the full range of local, regional, and national perspectives—representing relevant rights, dependencies, expertise, and disciplines—is represented in the assessment and design of a development strategy and selection of policies can help improve the fairness and effectiveness of outcomes. For example, both upstream and downstream communities should be engaged in discussions to ensure that each has access to water of sufficient quantity and quality for drinking and sanitation.

ENTRY POINTS FOR USING ECOSYSTEM SERVICES

MDBs can incorporate ecosystem service considerations across the full spectrum of both early planning and later project activities. Integrating ecosystem service risks in country and sector strategies may, in fact, offer the most potential to strengthen development and prevent unintended consequences. Table 2 identifies and describes types of entry points and ways that ecosystem services can be integrated into existing products and services of the MDBs, with a special focus on the World Bank. The next chapter describes a range of ecosystem service-based tools, including some mentioned in Table 2, that can help MDB staff and their partner countries undertake this integration.

CHAPTER 3

Tools for Integrating Ecosystem Services

This chapter introduces a selection of emerging ecosystem service-based tools that MDBs can use to incorporate information on ecosystem services into their policies, plans, and projects. The list is not exhaustive but, rather, illustrates the variety of tools available. MDBs can play an important role in improving and building on them. MDBs can also incorporate ecosystem services into their existing decision support tools, such as biodiversity maps, or combine them with the tools listed below.

MDB staff and partners may have concerns about whether sufficient data on ecosystem services are available or about the costs of collecting such data. In working with companies and governments around the globe, WRI has found that data on many services already exist. Where there are gaps, interviews with experts from academia and nongovernmental organizations can help. When no quantitative data exist, as can be the case for some regulating and cultural services, qualitative information and expert advice can still yield valuable insights. Box 4 gives examples of ecosystem service data sources used by two companies that undertook assessments of the business risks associated with ecosystems.

In working with companies and governments around the globe, WRI has found that data on many ecosystem services already exist.

For any given decision or entry point, it will often be necessary to use more than one tool. Three of the examples below are guides that include a combination of tools.

Box 4: Examples of Ecosystem Service Data Sources

Mondi, a leading international paper and packaging group, leveraged existing in-house analyses and external research reports to assess ecosystem services at three of its plantations in South Africa. To complement this input, managers interviewed two to four experts for each of the six ecosystem services that Mondi identified as priorities. Interviewees came from a variety of backgrounds, including—

- Forestry consulting firms with an existing working relationship with the company;
- Regional universities, such as the University of Kwa Zulu Natal;
- Regional research institutes, such as the Council for Scientific and Industrial Research, the Plant Protection Research Institute, and the Centre for Environment, Agriculture, and Development;
- Millennium Ecosystem Assessment scientists with expertise in South African ecosystems; and
- Nongovernmental organizations.

Syngenta, a global agribusiness, complemented its in-house knowledge when assessing ecosystem service risks for farmers in southern India by consulting a range of research reports and interviewing relevant experts for each priority service, including—

- Agricultural professionals from the India Agricultural Research Center and the International Rice Research Institute;
- Professors from the University of Maryland, Kerala Center for Development Studies, and the Indian Institute of Technology in Mumbai;
- Experts from research institutions, including the International Food Policy Research Institute and the Consultative Group on International Agricultural Research;
- Agricultural experts from multilateral organizations, including the Food and Agriculture Organization and the World Bank; and
- Environmental nongovernmental organizations, such as the World Wide Fund for Nature-India, the World Conservation Union, and the Ashoka Trust for Research in Ecology and the Environment.

ECOSYSTEM SERVICES AND HUMAN WELL-BEING FRAMEWORK

WHAT: The Millennium Ecosystem Assessment provides a powerful framework for linking people and the environment through the lens of ecosystem services (Figure 2).

APPLICATION: By displaying the various connections between nature and people, human well-being and drivers of change, this framework can help MDBs and their partners have a shared dialogue with stakeholders with different interests and objectives. For example, those working in MDBs to improve human well-being can start from initiatives to improve health, access to clean water, or food and make the connections to the relevant ecosystem services. Similarly, those focused on the environment or conservation can start with the ecosystem services present in a location and use the framework to assess the contribution of healthy ecosystems to human well-being and livelihoods. The Millennium Ecosystem Assessment used the framework to organize ecosystem assessments at different scales from local to global.

RESOURCES: MA 2005a; MA 2005d; Ash et al. forthcoming (chapter 3)

LIST OF ECOSYSTEM SERVICES

WHAT: A comprehensive list of ecosystem services is the most basic tool for enabling decision makers to identify and consider the full range of services. Table 3 provides a list of services that builds on those used in the Millennium Ecosystem Assessment, their definition, and examples.

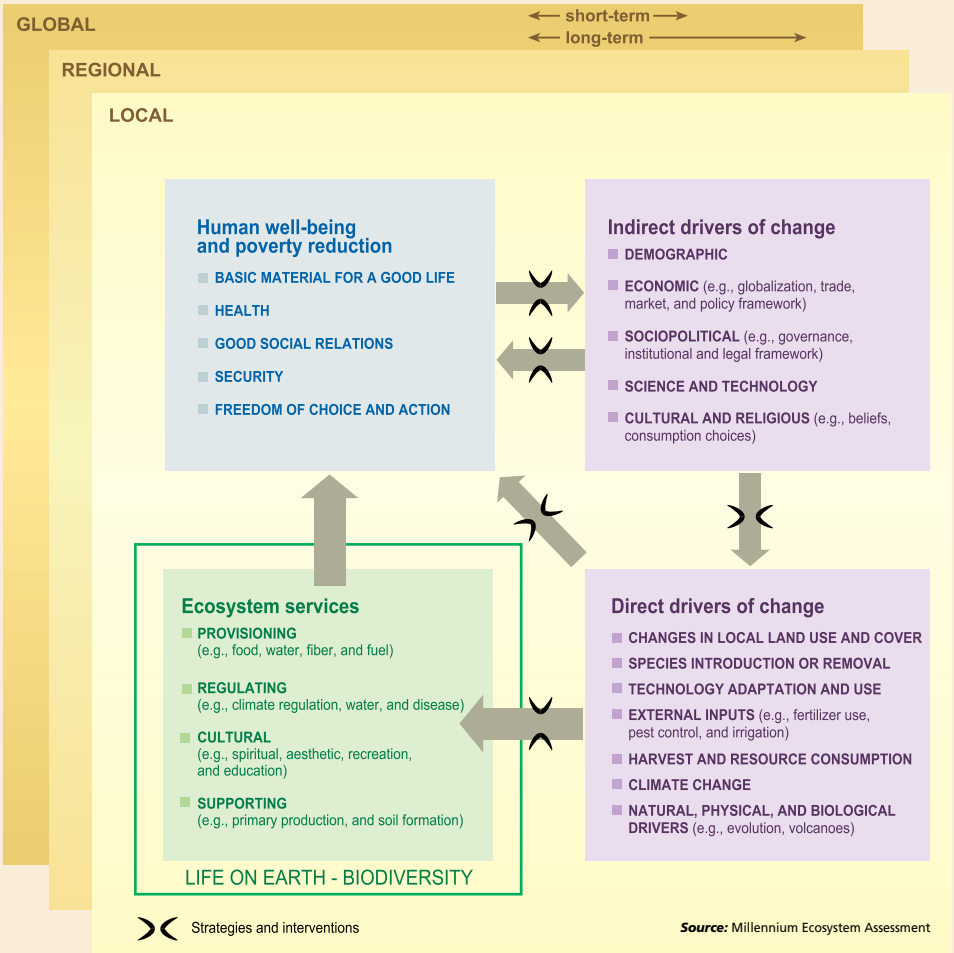
APPLICATION: The ecosystem service list provides a systematic checklist for identifying the ecosystem services present in the geographic focal area of interest. The list also provides the foundation for several other ecosystem service tools.

RESOURCES: An up-to-date list of ecosystem services is maintained at WRI's Web site at http://pdf.wri.org/esr_definitions_of_ecosystem_services.pdf

ECOSYSTEM SERVICE PRIORITIZATION

WHAT: Ecosystem service prioritization involves the use of a structured set of questions to identify the most important ecosystem services for any given decision or plan. Developed by the World Resources Institute, ecosystem service prioritization uses the previous list of ecosystem services as a starting point. Prioritization is then based on the degree of dependence of the decision/plan on ecosystem services and the degree to which ecosystem services are affected either negatively (risks) or positively (opportunities) by a decision. Ecosystem service dependencies exist if a service functions as

Figure 2: Millennium Ecosystem Assessment Conceptual Framework



an input or it enables, enhances, or influences the conditions required for a successful development outcome. Ecosystem service impacts are changes to the quantity or quality of one or more services.

APPLICATION: Ecosystem prioritization is a useful tool for any decision that relies on or affects ecosystem services. It helps decision makers focus their limited assessment resources on those services most critical to the success of a development goal. This tool could also be expanded and adapted for use by MDBs as a rapid trade-off screening tool. The Puget Sound Partnership in Washington State, United States, a public-private authority tasked with restoring the Puget Sound's environmental health by 2020, prioritized water supply, water regulation, recreation, ecotourism, and ethical and existence values (Iceland et al. 2008). These priorities enabled the Partnership to define and communicate their environmental restoration goals more clearly, select indicators for measuring and monitoring the health of the Sound, and focus their strategies and actions.

RESOURCES: An Excel spreadsheet tool that includes the list of ecosystem services and questions for evaluating ecosystem service dependence and impacts is available at WRI's Web site at http://docs.wri.org/esr_dependence_impact_assessment_tool.xls

Table 3 List of Ecosystem Services

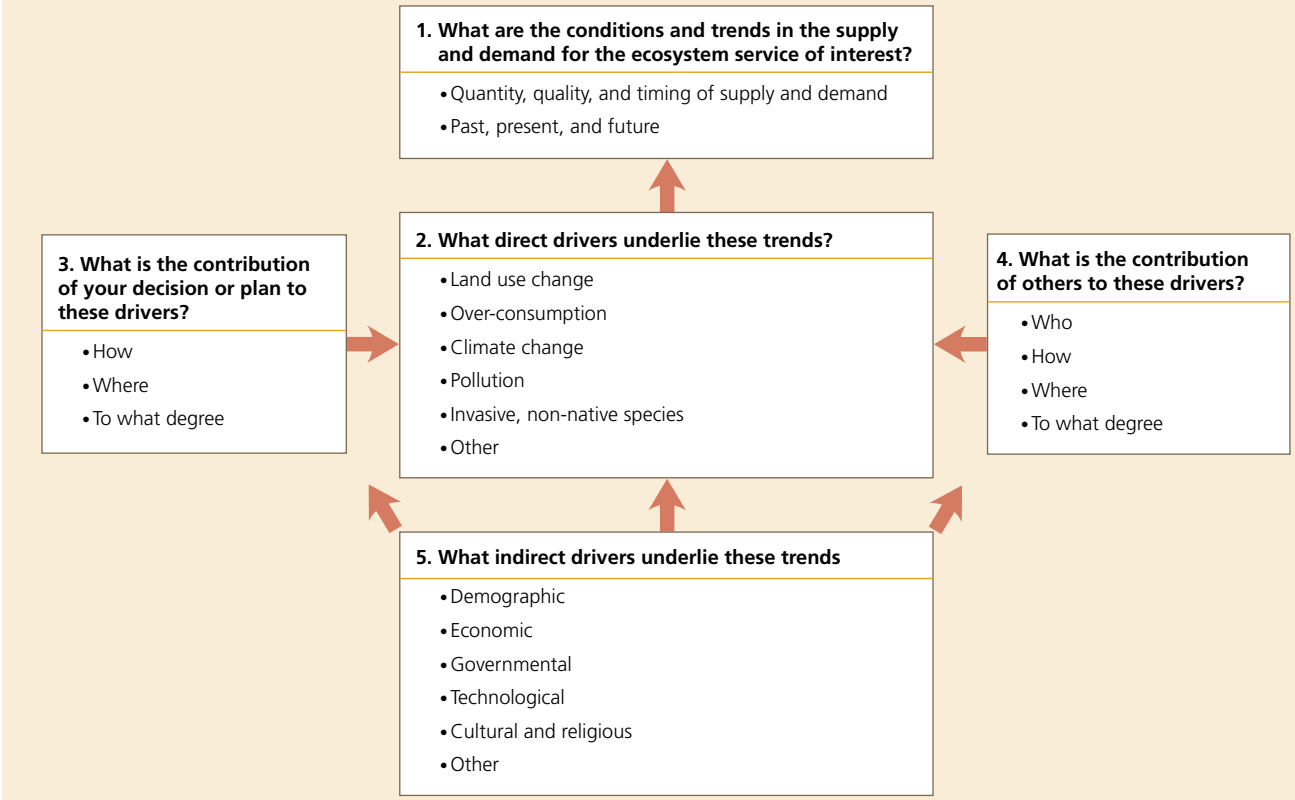
Service	Sub-category	Definition	Examples
Provisioning services: The goods or products obtained from ecosystems.			
Food	Crops	Cultivated plants or agricultural produce harvested by people for human or animal consumption as food	• Grains • Vegetables • Fruits
	Livestock	Animals raised for domestic or commercial consumption or use	• Chicken • Pigs • Cattle
	Capture fisheries	Wild fish captured through trawling and other non-farming methods	• Cod • Crabs • Tuna
	Aquaculture	Fish, shellfish, and/or plants that are bred and reared in ponds, enclosures, and other forms of fresh- or salt-water confinement for purposes of harvesting	• Shrimp • Oysters • Salmon
	Wild foods	Edible plant and animal species gathered or captured in the wild	• Fruits and nuts • Fungi • Bushmeat
Biological raw materials	Timber and other wood products	Products made from trees harvested from natural forest ecosystems, plantations, or non-forested lands	• Industrial roundwood • Wood pulp • Paper
	Fibers and resins	Nonwood and nonfuel fibers and resins	• Cotton, silk, hemp • Twine, rope • Natural rubber
	Animal skins	Processed skins of cattle, deer, pig, snakes, sting rays, or other animals	• Leather, rawhide, cordwain
	Sand	Sand formed from coral and shells	• White sand from coral • Sand from shells
	Ornamental resources	Products derived from ecosystems that serve aesthetic purposes	• Tagua nut, wild flowers, coral jewelry
Biomass fuel		Biological material derived from living or recently living organisms – both plant and animal – that serves as a source of energy	• Fuelwood • Grain for ethanol production • Dung
Freshwater		Inland bodies of water, groundwater, rainwater, and surface waters for household, industrial, and agricultural uses	• Freshwater for drinking, cleaning, cooling, industrial processes, electricity generation, or mode of transportation
Genetic resources		Genes and genetic information used for animal breeding, plant improvement, and biotechnology	• Genes used to increase crop resistance
Biochemicals, natural medicines, and pharmaceuticals		Medicines, biocides, food additives, and other biological materials derived from ecosystems for commercial or domestic use	• Echinacea, ginseng, garlic • Paclitaxel as basis for cancer drugs • Tree extracts used for pest control
Regulating services: The benefits obtained from an ecosystem's control of natural processes.			
Air quality regulation		Influence ecosystems have on air quality by emitting chemicals to the atmosphere (i.e., serving as a "source") or extracting chemicals from the atmosphere (i.e., serving as a "sink")	• Lakes serve as a sink for industrial emissions of sulfur compounds • Vegetation fires emit particulates, ground-level ozone, and volatile organic compounds
Climate regulation	Global	Influence ecosystems have on the global climate by emitting greenhouse gases or aerosols to the atmosphere or by absorbing greenhouse gases or aerosols from the atmosphere	• Forests capture and store carbon dioxide • Cattle and rice paddies emit methane
	Regional and local	Influence ecosystems have on local or regional temperature, precipitation and other climatic factors	• Forests can impact regional rainfall levels

Table 3 List of Ecosystem Services (continued)

Service	Sub-category	Definition	Examples
Regulating services (continued)			
Water regulation		Influence ecosystems have on the timing and magnitude of water runoff, flooding, and aquifer recharge, particularly in terms of the water storage potential of the ecosystem or landscape	• Permeable soil facilitates aquifer recharge • River floodplains and wetlands retain water—which can decrease flooding during runoff peaks—reducing the need for engineered flood control infrastructure
Erosion regulation		Role vegetative cover plays in soil retention and coral reefs in maintaining coasts	• Vegetation such as grass and trees prevents soil loss due to wind and rain and prevents siltation of waterways • Forests on slopes hold soil in place, thereby preventing landslides
Water purification and waste treatment		Role ecosystems play in the filtration and decomposition of organic wastes and pollutants in water; assimilation and detoxification of compounds through soil and subsoil processes	• Wetlands remove harmful pollutants from water by trapping metals and organic materials • Soil microbes degrade organic waste rendering it less harmful
Disease regulation		Influence that ecosystems have on the incidence and abundance of human pathogens	• Some intact forests reduce the occurrence of standing water—a breeding area for mosquitoes—which lowers the prevalence of malaria
Soil quality regulation		Role ecosystems play in sustaining soil's biological activity, diversity and productivity; regulating and partitioning water and solute flow; storing and recycling nutrients and gases; among other functions	• Some organisms aid in decomposition of organic matter, increasing soil nutrient levels • Some organisms aerate soil, improve soil chemistry, and increase moisture retention • Animal waste fertilizes soil
Pest regulation		Influence ecosystems have on the prevalence of crop and livestock pests and diseases	• Predators from nearby forests—such as bats, toads, snakes—consume crop pests
Pollination		Role ecosystems play in transferring pollen from male to female flower parts	• Bees from nearby forests pollinate crops
Natural hazard regulation		Capacity for ecosystems to reduce the damage caused by natural disasters such as hurricanes and tsunamis and to maintain natural fire frequency and intensity	• Mangrove forests and coral reefs protect coastlines from storm surges • Biological decomposition processes reduce potential fuel for wildfire
Cultural services: The nonmaterial benefits obtained from ecosystems.			
Recreation and ecotourism		Recreational pleasure people derive from natural or cultivated ecosystems	• Hiking, camping and bird watching • Going on safari
Ethical values		Spiritual, religious, aesthetic, intrinsic, "existence," or other values people attach to ecosystems, landscapes, or species	• Spiritual fulfillment derived from sacred lands and rivers • Belief that all species are worth protecting regardless of their utility to people—"biodiversity for biodiversity's sake"
Supporting services: The underlying processes that are necessary for the production of all other ecosystem services.			
Nutrient cycling		Flow of nutrients (e.g., nitrogen, sulfur, phosphorus, carbon) through ecosystems	• Transfer of nitrogen from plants to soil, from soil to oceans, from oceans to the atmosphere, and from the atmosphere to plants • Soil deposition by rivers
Primary production		Formation of biological material by plants through photosynthesis and nutrient assimilation	• Algae transform sunlight and nutrients into biomass, thereby forming the base of the food chain in aquatic ecosystems
Water cycling		Flow of water through ecosystems in its solid, liquid, or gaseous forms	• Transfer of water from soil to plants, plants to air, and air to rain

Source: Adapted by the World Resources Institute from the reports of the Millennium Ecosystem Assessment, 2005; TEEB (The Economics of Ecosystems and Biodiversity), 2008; Hanson et al. 2008

Figure 3 Assessing Ecosystem Services Trends and Drivers



Source: Hanson et al. 2008

ASSESSMENT OF ECOSYSTEM SERVICES CONDITIONS, DRIVERS, AND TRENDS

WHAT: Assessing the condition and trends of ecosystem services involves applying a variety of methodologies to assess the supply, demand, and drivers of change for the ecosystem services of interest. The five questions in Figure 3, developed as part of World Resources Institute's Corporate Ecosystem Service Review (see below), can help guide an assessment.

APPLICATION: An ecosystem services assessment can provide decision makers with a sufficient amount of relevant information and insights to identify risks and opportunities that may arise from current conditions and trends as well as how their own actions may modify these trends.

RESOURCES: Ranganathan et al. 2008 (chapter 3); Hanson et al. 2008 (step 3); Ash et al. forthcoming (chapter 4)

POVERTY AND ECOSYSTEM SERVICE MAPS

WHAT: Poverty and ecosystem service maps have been used by World Resources Institute to overlay geo-referenced socio-economic information (such as population and household expenditures) with spatial data on ecosystems and their services (water availability, wood supply, wildlife populations).

APPLICATION: These maps can be used to explore the spatial links between nature and the poor to yield a picture of how land, people, and prosperity are related. This information can inform poverty reduction strategies and sector policies for water resources management, agriculture production, and other development outcomes. Using maps can strengthen the targeting of social expenditures and direct ecosystem interventions so that they reach the areas of greatest need. Maps are also a powerful tool for visually communicating information and findings to experts in multiple disciplines as well as to the public. Figure 4 shows that highly affected

wetlands in Uganda are located in areas with both low and high poverty levels. Policy makers can use this information to flag certain subcounties where close coordination between wetlands management and poverty-reduction efforts could be beneficial for both wetlands and local populations dependent on their services.

RESOURCES: WRI et al. 2007; Wetlands Management Department, Ministry of Water and Environment, Uganda et al. 2009; Natural Capital Project 2009

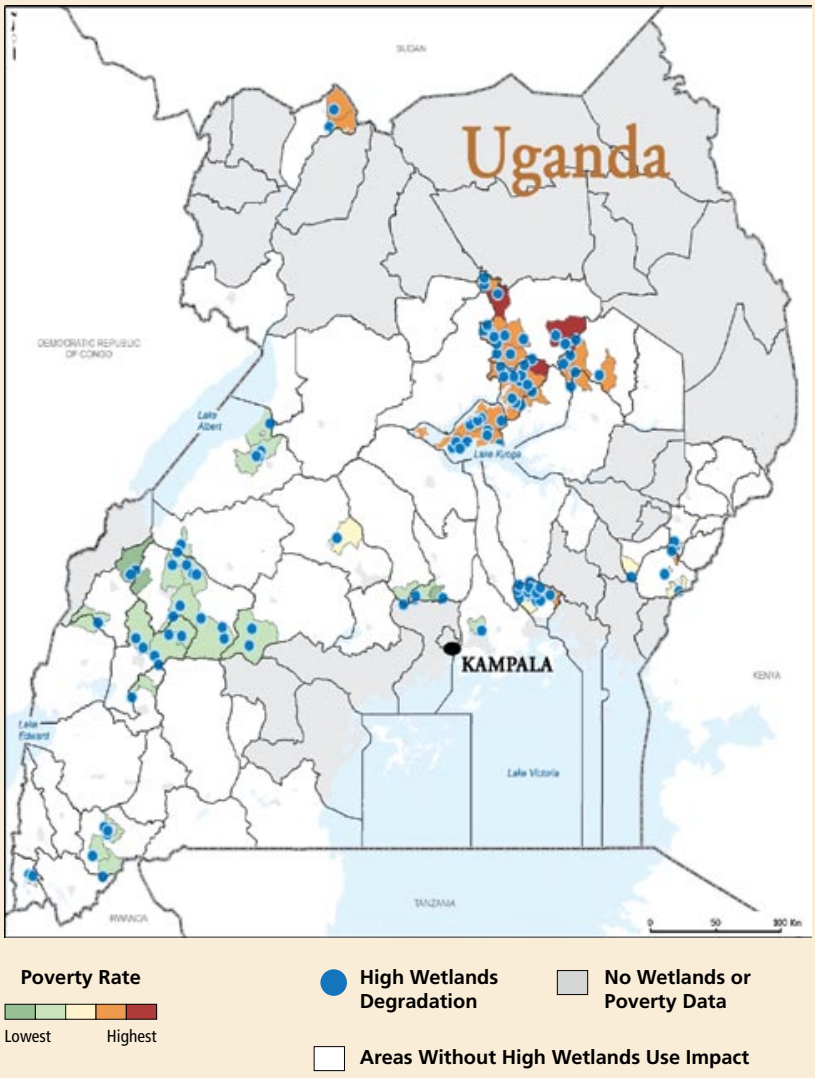
ECOSYSTEM SERVICE-BASED SCENARIOS PLANNING

WHAT: Scenarios are stories told as a set of "plausible alternative futures" about the relationship between today's decisions and the future. Scenarios develop a variety of possible futures reflecting important uncertainties, rather than attempting to decide on one accurate prediction of an outcome. Scenarios can be built using qualitative methods (based on expert knowledge of local land users, government officials, scientists, or others) or be based on quantitative, scientific modeling approaches.

APPLICATION: By explicitly considering how decisions today may shape the future, and how future trends may differ from the past, scenarios planning helps policy makers avoid or manage unintended consequences. It can be used to explore how societies and ecosystems could change in various plausible futures or to create various future pathways as a test of possible policy options. Scenarios are also well-suited to participatory decision making because scenarios can be particularly responsive to the concerns of stakeholders affected by a decision and can incorporate their knowledge on the issue. By considering various interactions and future changes in society and ecosystem services, decision makers can identify the policies and measures most likely to achieve their goals. The Millennium Ecosystem Assessment used this approach, creating four global scenarios of ecosystem service change.

RESOURCES: Ash et al. forthcoming (chapter 5); Nelson et al. 2009; Ranganathan et al. 2008 (chapter 4); MA 2005c.

Figure 4 Wetland Degradation and Poverty in Uganda



Source: Wetlands Management Department, Ministry of Water and Environment, Uganda et al. 2009

ECONOMIC VALUATION OF ECOSYSTEM SERVICES

WHAT: Economic valuation involves assigning quantitative economic values to ecosystem services, including those that are only partially captured by the market and those that are not currently valued in the marketplace at all, such as many of the regulating ecosystem services, e.g., natural hazard regulation, erosion control, and climate regulation. Economic valuation has been used by the World Bank and other MDBs.

APPLICATION: By drawing attention to the economic value of ecosystem services that might otherwise be ignored, valuation can serve a number of purposes (see Table 4), including—

- Communicating the value of ecosystem services by highlighting their economic contributions to societal goals. These values can be helpful to governments when deciding how land should be used;
- Comparing the cost-effectiveness of an investment;
- Evaluating the ecosystem service-based risks and opportunities of development policies. This could include evaluating the ecosystem service costs associated with habitat conversion, runoff, or pollutant discharge. It could also include looking at the benefits of increased investment in enforcing environmental regulation and in strengthening resource management; and
- Building markets for ecosystem services.

RESOURCES: Ranganathan et al. 2008 (Chapter 3); PEI 2008; http://www.ecosystemvaluation.org; Ash et al. forthcoming (section 4.4)

GUIDE TO USING ECOSYSTEM SERVICES IN STRATEGIC ENVIRONMENTAL ASSESSMENTS

WHAT: This advisory note provides guidance on how to incorporate ecosystem services into countries' existing Strategic Environmental Assessment (SEA) processes. At their October 2008 meeting, the Organisation for Economic Co-operation and Development's Development Assistance Committee Network on Environment and Development Cooperation endorsed the note.

APPLICATION: Like environmental impact assessments at the project level, SEAs have usually focused more on environmental impacts than on the dependencies of human well-being on ecosystem services. The OECD DAC Advisory Note is designed to help development practitioners assess dependencies as well as impacts and thus lead to more sustainable policies and programs.

RESOURCES: Strategic Environmental Assessment and Ecosystem Services is available online at http://www.oecd.org/dataoecd/24/54/41882953.pdf (DAC 2008); Slootweg and van Beukering 2008.

FLICKR/LITTLE RICKY

ECOSYSTEM SERVICES: A GUIDE FOR DECISION MAKERS

WHAT: This guide developed by World Resources Institute and its partners introduces ecosystem services. Targeted at policy makers, the guide details a variety of processes that can be used to incorporate ecosystem services into development decisions, including the use of the Millennium Ecosystem Assessment framework, ecosystem services prioritization, assessing conditions and trends, scenarios planning, and choosing policies to sustain ecosystem services.

APPLICATION: The guidance can help policy makers make the case for and integrate ecosystem services in their decisions. The guide includes a fictional story about how the leaders of an imaginary city reconcile development and environmental change by managing ecosystem service trade-offs. It also includes a CD-ROM containing the technical volumes of the Millennium Ecosystem Assessment and a PowerPoint presentation with illustrative figures and graphics that can be used to help make the case for mainstreaming ecosystem services in decision making.

RESOURCES: The guide is available at WRI's Web site at www.wri.org/publication/esa (Ranganathan et al. 2008)

Table 4 Applications of Ecosystem Service Economic Valuation

Study	Ecosystem services valued	Valuation figure	How information influenced decision making
National assessment in Cambodia	Single service: capture fisheries	The national Fisheries Department calculated that total fish catch is worth up to $300 million, or 10% of GDP (PEI 2008).	Fisheries are now near the top of the Ministry of Finance's agenda, both in terms of budget allocations and in conversation with overseas donors (PEI 2008). Fisheries are valued both for their direct economic benefit and for their ability to reduce poverty. Fisheries provide employment to over 2 million people, many of whom are the poorest in the nation (FAO 2005). Fish also account for 75% of the protein and calcium intake of Cambodians (MAFF 2007).
Local study of Nakivubo wetland in Uganda	Multiple services: water purification and waste treatment	The government's Wetlands Inspectorate Division estimated that Nakivubo delivered approximately $2 million through water quality services to residents of Kampala (Emerton et al. 1998). The study took into account costs of achieving the same level of service through artificial means.	The government was planning to drain and reclaim Nakivubo for housing and industry. These plans were cancelled following the release of valuation numbers. Ugandan officials instead listed Nakivubo as part of the city's greenbelt zone (PEI 2008).
Local analysis of Spain's Ebro Delta	Multiple services: capture fisheries, aquaculture, crops, and ecotourism	About $180 million (Slootweg and van Beukering 2008).	Following the numbers' release, the national government reversed a plan to divert water from the Ebro Basin to four other rivers in the east of Spain. Instead, officials recognized the economic contribution of the Ebro delta through a new water policy (Slootweg and van Beukering 2008).
National valuation in Namibia	Single service: ecotourism	The Ministry of Environment and Tourism, with support from the GEF and UNDP, estimated the GDP contribution from visitors to Namibia's protected area system to be $1.2–2.5 million (Turpie et al. 2005).	Following the valuation, Namibia's Government increased Protected Areas' budget allocations from $6.1 to 13.5 million (PEI 2009b).
Global valuation	Single service: pollination	French and German researchers analyzed the dependence on insect pollination of 100 crops grown around the world for human consumption. From this, they calculated the impact of a total loss of pollination services on production levels as about $190 billion (Gallai et al. 2008).	Policy makers worldwide are authorizing funding to research and evaluate problems associated with insect decline, including £10 million made available by various sections of the UK government (DEFRA 2009).
National study in Algeria	Multiple services: fresh water, recreation, ecotourism, and climate regulation	The Cost of Environmental Degradation program, an initiative of the World Bank, found average annual costs of environmental degradation to be 4.8% of GDP. This study used only existing data and analyzed them through commonly used impact assessment methodologies (Sarraf 2004).	Led to new investments of around $450 million being made in environmental protection (PEI 2008).
Local analysis of forests in Borneo	Multiple services: climate regulation, forest fire regulation, and crops	An international NGO assessed values of carbon sequestration and fire regulation in terms of avoided damages along with economic benefits from agroforestry. The analysis discovered these services to be worth up to $3.4 billion (Naidoo et al. 2008).	A proposed 1.8 million ha oil palm project, backed by Chinese investors, in the Borneo highlands was cancelled by the Indonesian government (Naidoo et al. 2008).

CORPORATE ECOSYSTEM SERVICES REVIEW

WHAT: Developed by the World Resources Institute, World Business Council for Sustainable Development, and the Meridian Institute, the corporate ecosystem services review is a set of guidelines for identifying and developing strategies to manage the business risks and opportunities arising from a company's dependence and impact on ecosystem services. The guidelines include the list of ecosystem services, a prioritization tool, guidance on assessing the condition and trends of priority ecosystem services, and developing business strategies to address the resulting risks and opportunities.

APPLICATION: Businesses can use the corporate ecosystem services review as a stand-alone process or integrate it into their existing environmental management systems. Using the guidance, Mondi, an international paper and packaging company, identified water scarcity as a key risk at its plantation in South Africa that was driven by climate change and the spread of water-thirsty invasive species. In response, Mondi invested in programs to clear invasive trees and use them as biomass fuel and, in doing so, created jobs for local communities.

RESOURCES: The corporate ecosystem services review is available at WRI's Web site at www.wri.org/project/ecosystem-services-review.

Policies to Sustain Ecosystem Services

MDBs can play a key role in helping partner countries develop and implement policies for sustaining those ecosystem services deemed critical for development. As noted earlier, the World Bank already champions payment for ecosystem service schemes. Table 5 illustrates the wider range of policies available to influence the drivers of ecosystem management in ways that sustain services and improve livelihoods. It describes how these policy options work, highlights considerations in their design and implementation, and provides examples of their use. In some cases, government regulation or direct provision of resources may be needed. In other situations, using existing markets or creating new ones can provide the necessary incentives. Engaging the public is critical to identifying and putting into practice an appropriate mix of policies. Some analysis of the effectiveness of these policies is beginning to be available and should help build support for their implementation (Huberman 2008; WRI et al. 2008).

Engaging the public is critical to identifying and putting into practice an appropriate mix of policies.

Table 5 Policies for Sustaining Ecosystem Services

Policy option	How it works	Design and implementation considerations	Examples of experience
Regulation			
Link decisions on granting licenses to ecoregions and use of environmentally and socially sound management practices	Assesses how proposed activities will affect ecosystem services and local populations and uses this information in determining conditions of licenses.	Requires designating priority ecoregions on basis of their ecosystem services and obtaining more detailed information on development impacts. Also requires research to improve ability to link ecosystem services to production functions and best management practices and incentives to spur adoption of these practices.	Colombia plans to use its ecoregions in deciding where to license oil and gas extraction, mining, and infrastructure to avoid, mitigate, and compensate for environmental damages. (H. Tallis, personal communication, 2008).
Ban or limit activities	Protects ecosystem services by stopping or reducing damaging practices. May relocate activities or require different technology or management practices.	May need to be combined with technology standards and assistance to business.	To avoid erosion and protect fisheries and tourism, the Republic of the Marshall Islands banned reef blasting and near-shore dredging, set technology standards requiring use of suction rather than clam-shell dredges, and subsidized local business to use equipment offshore (McKenzie et al. 2006).
Establish standards and regulations for liability	Provides incentive for avoiding accidents that harm ecosystem services.	Continuing to improve ability to assign economic values to ecosystem services.	The government of Belize is suing the owners and/or the charterers of a container ship that in 2008 grounded on a coral reef in Caye Glory Marine Reserve for $26.9 million. The destroyed reef is in a Marine Protected Area that is an important draw for divers, snorkelers, and sport fishermen and also includes spawning areas that maintain stocks of key commercial species that supply food. The fines would be put into the Belize Barrier Reef Fund established under the Coastal Zone Management Act to be used for restoration (personal communication from Emily Cooper, Aug. 20, 2009).
Direct government provision			
Establish and maintain protected areas for ecosystem services	Conserves ecosystems and their services by preventing overexploitation and conversion.	Incorporating goal of sustaining ecosystem services into site selection and linking with biodiversity conservation goal. Including local communities in making decisions. Taking a landscape approach that recognizes the direct and indirect drivers of change outside the protected area. Ensuring financial sustainability for management.	In 1986, St. Lucia designated marine reserves with involvement of local people and businesses, leading to regeneration of mangrove forests and their associated services (WRI et al. 2000). Recognizing its páramo, high mountain ecosystems, as "water-producing zones," Colombia has established various regulations to protect these ecosystems from destructive activities (Procuraduría Delegada para Asuntos Ambientales y Agragrios 2008)
Rehabilitate ecosystem services	Restores ecosystems and their services.	Raising funds to support rehabilitation. Linking to development goals. Monitoring results of restoration.	Since 2000, South Africa's Working for Wetlands program has provided jobs that generate income and provide new skills to women, youth, and the disabled as they rehabilitate wetlands and improve the ecosystem service of water quality (IIED 2007).
Use ecosystem services instead of man-made structures	Usually provides co-benefits for other services such as climate regulation (carbon storage) and recreation.	Procuring time and funds for negotiations and continued maintenance. Dealing with limited knowledge about flows of regulating and cultural services.	China is using the water filtration capacity of restored wetlands in Hubei Province for waste treatment, recognizing that restoration was cheaper than building treatment plants and that wetlands would also reduce flooding (WWF 2008).

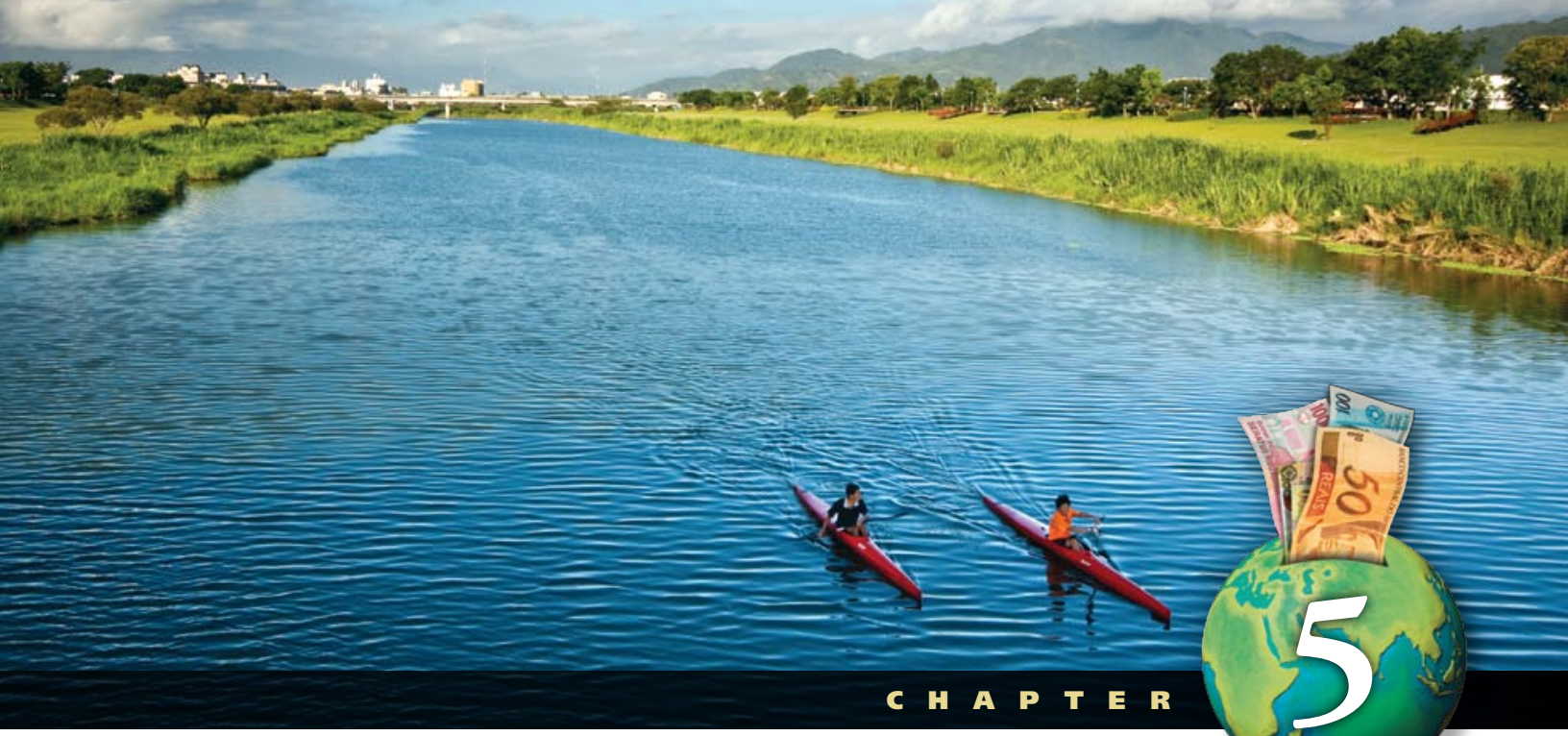
Table 5 Policies for Sustaining Ecosystem Services (continued)

Policy option	How it works	Design and implementation considerations	Examples of experience
Engaging the public			
Clarify or strengthen local community rights to use and manage ecosystem services	Enables participation of stakeholders who may depend on ecosystem services for their immediate livelihood and well-being.	Identifying who represents the community, clarifying the role of traditional authorities, ensuring that women and the poor are included.	Under Vietnam's 1994 Land Law, households, organizations, and individuals have rights to manage 5 million ha of forest, which has both protected the forest and allowed families to use nontimber products for their livelihoods (FAO 2000).
Provide public access to information and participation	Allows the public to participate in decisions and hold decision makers accountable for actions related to ecosystem services.	Requires investment in building capacity of individuals, civil society, and government to produce, analyze, disseminate, and use accurate information. Need for institutional reform to facilitate public participation in policy formation and decision making. Need to be prepared to deal with backlash against transparency and to address problems highlighted in public information.	The federal environment agency's 2003 report on seawater pollution endangering the ecosystem services of ecotourism and recreation of Mexico's beaches played a key role in creating public awareness and political will to establish and carry out the Clean Beaches Program, which has improved water quality through investment in treatment facilities. Local residents and civic society help implement the program. Environmental groups use data to call for improved performance (Foti et al. 2008).
Eco-labeling	Educates the public and if combined with certification or procurement schemes can provide incentive for producers to adopt best management practices.	Educating purchasers about labels. Ensuring development of transparent, scientifically valid standards and their adoption. Reducing transaction costs that may limit participation.	More than 5,000 farmers participate in an organic cotton project founded in 1991 by Swiss cotton trader Remei AG, which uses the bioRe copyrighted label. The project provides sustainable livelihoods while rehabilitating water and soil ecosystem services (Benguerel 2007). Under Mexico's Clean Beaches Program, beach owners can earn high quality beach certificates that tourists and other members of the public can use to choose which beaches to visit (Foti et al. 2008).
Introduce education or extension programs on good practices	Provides knowledge so that those using ecosystem services can improve their practices.	Providing economic incentives for participation.	The University of the South Pacific worked with Ucunivanua, a Fijian village, to restore a clam fishery (WRI et al. 2005). In Kenya, the Green Belt Movement provides technology and training to community forest associations to replant and sustainably manage protected reserves threatened by logging and cultivation (World Bank 2009a).
Develop and use indicators for ecosystem services	Provides information about the state of ecosystem services and shows where practices need to be changed.	Obtaining funding to develop indicators, link them to targets, track and disseminate results, and use to adjust policies.	South Africa's National Water Resource Strategy includes indicators such as total water yield and water yield from surface water and from ground water (South Africa Department of Water Affairs and Forestry 2004).

Table 5 Policies for Sustaining Ecosystem Services (continued)

Policy option	How it works	Design and implementation considerations	Examples of experience
Using and creating markets			
Eliminate or reduce perverse subsidies	Removes incentives for maintaining or enhancing one service (e.g., provisioning services) at the expense of others (e.g., regulating and cultural services).	Must overcome vested interests in maintaining subsidies and create ways to transfer subsidies toward maintaining services that provide societal benefits such as the regulating and cultural services.	As a result of the degradation of freshwater and coastal ecosystem services by eutrophication, some countries have reduced fertilizer subsidies, including Pakistan (from $178 million to $2 million per year), Bangladesh ($56 million to $0), and the Philippines ($48 million to $0) (Myers 1998).
Use taxes or other public funds to maintain regulating and cultural services	Creates economic incentive for the private sector to supply services that do not normally have a market value.	How to avoid maintaining one service at the expense of others. How to handle equity issues such as ineligibility because of lack of tenure. Need market infrastructure such as quantification, verification, monitoring tools. Need to inform public about use of funds to provide accountability.	A Costa Rican fund mainly from fuel tax revenues pays forest owners for watershed protection (Perrot-Maître and Davis 2001). Belize charges foreign tourists a conservation fee that funds a trust dedicated to sustainable management and conservation of protected areas (CFA 2003).
Use tax deductions and credits to encourage investment in and purchase of ecosystem services	Provides economic incentive to manage ecosystems in ways that sustain ecosystem services.	How to avoid equity issues. How to avoid enhancing one service at the expense of others.	U.S. law gives landowners tax deductions for donating conservation easements, which restrict use of the property to protect ecosystems and their services (Rasband et al. 2009).
Payments for ecosystem services	Provides economic incentive to landowners to maintain ecosystem services. Sources of funding include fees, for example, on users of services such as water; taxes, for example on fuel, earmarked for conservation; and direct funding by government or NGOs.	How to make design flexible to allow the program to evolve as it learns from experience. How to ensure broad access to a program—beyond larger landowners. Poor people may not have property rights or be able to afford to meaningfully participate in schemes that put far-reaching restrictions on land use such as grazing or agro-forestry. How to ensure any transaction costs of entering a scheme are not too high for the poor (WRI et al. 2005).	The World Bank's work on payments for ecosystem services has experimented with paying landowners for the provision of services, for example for maintaining water flows in several Central and South American countries (Pagiola 2006).
Set limits and establish trading systems for use of ecosystems and their services	Achieves more cost-effective improvements in ecosystem services than conventional regulatory approaches.	Limit must be stringent enough to provide incentive to participate. Unclear property rights may make it difficult to allocate permits or credits. Transaction costs may be high, especially for nonpoint sources.	Greenhouse gas emissions trading programs set limits on emissions and permit climate regulation service of forests to be used to offset emissions (CBO 2009).

This table is adapted from Table 5.1 of *Ecosystem Services: A Guide for Decision Makers* (Ranganathan et al. 2008) and Table 5.3 in *Mainstreaming Poverty-Environment Linkages into Development Planning: A Handbook for Practitioners* (PEI 2009b)



Recommendations

What steps will enable MDBs and partner countries to build expertise in managing trade-offs among ecosystem services in order to achieve better and more "pro-poor" development outcomes? This chapter makes five interrelated recommendations to support the World Bank and other MDBs in moving beyond experimental and add-on projects to systematically integrate ecosystem services into core operations from the earliest stages of strategy, policy, and project planning processes.

1. INCORPORATE INTO ENVIRONMENT STRATEGIES

Broad adoption of the ecosystem service-based tools described in this report can help overcome a crucial constraint in incorporating the environment into development strategies, policies, and investment decisions: insufficient government commitment to environmental goals and weak capacity to implement them (World Bank 2008a). The tools can help reveal the critical links between ecosystem services and development goals and strengthen the case for investing in ecosystems. The tools can enable a systematic approach to identifying the values and interests essential to managing complex trade-offs. Better information on ecosystem service trade-offs and the policies available to manage them can help give the environment more prominence in country and sector assistance strategies while complementing the application of environmental safeguards.

As MDBs, including the Inter-American Development Bank (IDB) and the World Bank, revise their strategies for linking the environment more closely to development, ecosystem services should be front and center. The IDB has formed an Independent Advisory Group on Sustainability, which began its work in August 2009 to review implementation of its environment and safeguard policy and to recommend changes, including how IDB can play a leadership role on sustainability (Inter-American Development Bank 2009). The World Bank Group expects to complete a draft of a new environment strategy in the fall of 2010. The original environment strategy noted the opportunity to learn from the Millennium Ecosystem Assessment, which the World Bank sponsored (World Bank 2001). In revising their approaches, MDBs can use the findings of the Assessment to put natural assets—not only the provisioning services such as timber and fisheries, but also the regulating services such as climate regulation and water purification—at the heart of country and sector planning. Revised strategies should promote the use of ecosystem services in the entry points described in Table 2 and build on the ecosystem service tools listed in this report to ensure that MDB staff can identify and value the multiple ecosystem services that development programs and projects depend on and affect.

2. INTEGRATE INTO CORE OPERATIONS

To facilitate integration of ecosystem services across strategic direction and priority-setting as well as analytical and advisory activities and investments, MDBs will need a champion in each sector and regional program to build and share expertise on the use of ecosystem service-based tools and policies. An early step will be including ecosystem services in environmental impact assessments (see Box 5) and incorporating a more systematic approach to managing trade-offs among ecosystem services into existing toolkits, such as those assessing environmental aspects of development policy lending (World Bank 2008b).

MDBs will need a champion in each sector and regional program to build and share expertise on the use of ecosystem service-based tools and policies.

Knowledge about ecosystem services is already growing among MDB staff, particularly those with environmental expertise in areas including biodiversity, sustainable land management, coastal management, and climate change. Experts can foster cross-sectoral coordination with sectors such as energy, transportation, urban wildlife, tourism, water, and agriculture. For example, such experts can provide information on how ecosystems can replace or complement man-made structures in infrastructure development by providing services, such as water purification, flood protection, and water regulation. Experts can highlight other co-benefits associated with ecosystem infrastructure investments, such as carbon storage and the provision of cultural and recreational services. They can also make more explicit the links between ecosystem services and climate change mitigation and adaptation.

FLICKR/NICHOLAS T

3. BUILD CAPACITY TO IMPLEMENT AN ECOSYSTEM SERVICES APPROACH

The World Bank and other MDBs can tap their growing array of "knowledge services" to raise awareness of the importance of ecosystem service-poverty links among staff and within partner countries. Within the MDBs, it is particularly important to engage country directors and sector leaders who maintain close working relationships with senior country officials, so that poverty reduction and country assistance strategies take into account the dependence of the poor on ecosystem services. For example, country and agricultural sector leaders can adopt an active approach to managing ecosystem service trade-offs in sub-Saharan Africa (Box 6). Another opportunity is to forge closer collaboration with the joint UNDP-UNEP Poverty-Environment Initiative. The PEI can help build capacity by sharing material and lessons learned from its work supporting countries in ecosystem service assessments and mainstreaming poverty-environment linkages in national development policy planning and implementation processes (PEI 2009b).

The MDBs can also support training and pilot tests on the use of ecosystem services in partner countries to create the enabling conditions for effective management of ecosystems. The Inter-American Development Bank's Innovation Loans,

Box 5: Incorporating Ecosystem Services into Environmental Assessments

Environmental assessments serve as a valuable tool in integrating environmental safeguards during project preparation and implementation. However, their full potential has yet to be realized in ensuring a systematic evaluation of a project's impacts *and* dependencies on ecosystem services, their future availability, and making the link between impacts, drivers, and the well-being of communities affected by the project.

To address these limitations, MDBs should pilot test the inclusion of a systematic approach to ecosystem services in actual environmental assessments. This could involve using the ecosystem service framework to reconceptualize assessments, making more explicit the links between a project and ecosystem service impacts, dependencies, drivers of change, and human well-being. It could also involve exploring how ecosystem services can strengthen individual elements of an assessment, such as—

- **Scoping:** Providing a more rigorous delineation of project assessment boundaries by identifying which ecosystem services are affected by the project, the stakeholders dependent on them, the services the project depends on, and the drivers affecting them. The results can inform the assessment's terms of reference and help prioritize stakeholder engagement.
- **Screening:** Identifying how people may be affected by changes in ecosystem services as a result of the project.
- **Analysis of project alternatives:** Assessing the impacts and dependencies of alternatives on ecosystem services and their associated risks (e.g., siting and choice of technology).
- **Baseline establishment:** Helping to prioritize data collection based on ecosystem services dependencies and impacts.
- **Evaluation and impact analysis:** Improving understanding of the project's impacts on direct and indirect drivers of ecosystem change and their consequences for affected communities; elucidating the complexity of ecosystems and improving assessment of cumulative impacts; providing a basis for establishing impact significance; and indicating when a more in depth assessment is necessary.
- **Mitigation action plan:** Guiding the development of strategies to avoid, restore, remedy, or compensate for impacts on ecosystem services.
- **Monitoring and reporting:** Providing data on multiple ecosystem services on which to assess the efficacy of mitigation plans, inform mid-course corrections, and report progress to stakeholders.

Box 6: Managing Ecosystem Service Trade-offs in Agriculture in sub-Saharan Africa

Implementing the "agriculture for development" agenda in Sub-Saharan Africa presents one opportunity to explicitly consider trade-offs among ecosystem services (such as how fertilizers affect the quality of groundwater used for drinking) and, conversely, identify and create synergies. These synergies might include, for example, how tree-planting can restore important watersheds that support increased irrigation and hence agricultural output. Although the successes of the 1960s Green Revolution came with high environmental and social trade-offs (MA 2005b), the 21st Century African Green Revolution (Zoellick 2007) aims to support a sustainable transformation of Africa's agricultural sector with long-term contributions to human well-being. Explicitly considering ecosystem services will help reveal and make trade-offs with other development needs. The Millennium Ecosystem Assessment found that new agricultural sciences (such as safe and appropriate biotechnology), combined with effective ecosystem and natural resource management (such as agroecology and efficient water pricing for irrigation), can support an agricultural revolution that meets development needs (MA 2005b).

for example, could be tapped for piloting and building capacity around new approaches to incorporating ecosystem services into development planning. The World Bank Institute has already begun offering training sessions on payments for ecosystem services. This should be expanded to include other ecosystem service-based policies and tools.

4. EMPOWER LOCAL AUTHORITIES, ORGANIZATIONS, AND COMMUNITIES

Greater involvement of local communities in decisions affecting ecosystem services can strengthen ecosystem management because local communities have a vested interest in maintaining and restoring the ecosystem services that they depend on for their livelihoods and well-being (Irwin and Ranganathan 2007). The 2008 World Resources Report, supported and endorsed by the World Bank, examined the conditions needed for ecosystem management to improve rural livelihoods and accelerate pro-poor rural growth. It identifies three elements required for success: providing poor people with the authority to manage local ecosystems, building poor people's capacity to generate income from ecosystem services, and helping poor people to develop enterprises based on ecosystem services into mature businesses (WRI et al. 2008).

There are many ways in which the MDBs can mainstream ecosystem services by empowering rural communities to participate in decisions. In particular, they can design development policy loans (DPLs) that promote decentralization

Table 6 From Goods to Services—Imagining the Revenue Potential of Tomorrow's Forests

Ecosystem Service	Share of Revenue 2008	Share of Revenue in 2018	Customer
Timber sales	100%	22%	Chinese furniture manufacturer
Forest Stewardship Council timber price premium	0	3%	Chinese furniture manufacturer
Ecotourism/hunting	0	10%	Eco-tours Indonesia Ltd
Climate regulation	0	10%	NextPower, Indiana, US
Water regulation Erosion control	0	35%	Municipal Water Authority user fees
Flood protection	0	5%	Provisional government credit
Nontimber forest products	0	10%	Local markets
Biodiversity credit*	0	5%	Biodiversity Offset Exchange

Source: Adapted from Irwin and Ranganathan 2007.
*not an ecosystem service

of natural resource management decision making to local authorities and support the development and scaling up of local ecosystem-based enterprises that benefit the poor. For example, the Brazil and Mexico DPLs for sustainability could include a focus on identifying and managing ecosystem service trade-offs in communities. In their own operations, the MDBs can enable the rural poor to influence the design of project investments that affect their local natural assets.

5. STRENGTHEN POLICIES AND ECONOMIC INCENTIVES

Past experience—including the earlier example of converting mangroves to shrimp aquaculture—demonstrates the misalignment of financial incentives with sustaining ecosystem services. This is because many ecosystem services—particularly the regulating services, such as water purification, water regulation, and natural hazard protection—seemingly have no economic value until they are lost and must be replaced by built infrastructure. MDBs can introduce partner countries to the range of economic and policy measures described in Table 5 to help align incentives with ecosystem service stewardship and promote good governance of ecosystems. These measures include eliminating perverse subsidies that support activities that contribute to ecosystem degradation; reforming taxation policies to target those who benefit from or degrade services; payments to landowners for maintaining ecosystem services; and certification programs for sustainably produced goods such as timber, biofuel, and shrimp. The World Bank is already helping countries prepare for a global carbon market through its Forest Carbon Partnership Facility. The MDBs can build on this work, expanding it to other types of ecosystem services and incentive mechanisms.

In the not too distant future, it is possible to imagine MDBs working with country partners to transform the way landowners manage natural assets—moving from reliance on a single ecosystem service, such as crops or timber, to capturing the value of multiple services. Farmers could earn their living from providing a variety of goods and services, such as reducing downstream flooding or mitigating climate change through carbon storage, as well as by growing crops and raising livestock. Table 6 illustrates how a community-owned and harvested 3,000 hectare forest in Indonesia might change in the future to include income from a bundle of ecosystem services not currently captured in the balance sheet (Irwin and Ranganathan 2007).

Conclusion

By focusing on the ecosystem-service dependencies and impacts of their strategies, MDBs and their partner countries can reconcile development and environment goals and achieve both. Building on existing experience with single ecosystem services, MDBs can move ecosystem services from the periphery to the mainstream in their strategic direction and priority setting, advisory services, and investments. By adopting a systematic approach to multiple ecosystem services, MDBs can make a stronger case for investing in ecosystems, actively manage ecosystem service trade-offs, and help make development more environmentally sustainable.

A number of promising ecosystem service-based tools are emerging to help MDBs. These include a checklist of ecosystem services, prioritization of ecosystem services in development decisions based on dependencies and impacts, mapping, scenarios planning, and economic valuation. MDBs can build capacity to use these tools among their own staff and those in partner countries. They can also help partner countries select from a variety of policies and incentives, to ensure that these services are sustained.

Ecosystem services are a fundamental pillar in climate change strategies. With two thousand petagrams of carbon stored in terrestrial systems, forests and other land use types are a key focus in climate mitigation. At the same time, the physical impacts of climate change manifest themselves through alterations to the flow of ecosystem services. Architects of climate change policy will need to keep the broader set of ecosystem services in mind to ensure that their decisions maximize the co-benefits of managing multiple ecosystem services for both mitigation and adaptation goals.

FLICKR/LOUISA CATLOVER

By adopting a systematic approach to multiple ecosystem services, MDBs can make a stronger case for investing in ecosystems.

References

Ash, N., H. Blanco, C. Brown, K. Garcia, T. Henrichs, N. Lucas, C. Raudsepp-Hearne, R. D. Simpson, B. Scholes, T. Tomich, B. Vira and M. Zurek. Forthcoming. *Ecosystems and Human Well-being—A Manual for Assessment Practitioners.* Washington, DC: Island Press.

Benguerel, Rene. 2007. Presentation at Regional Expert Meeting on the Development of an African Eco-Labelling Scheme, UNEP/UNECA, Addis Ababa, June 11–13.

CBO (Congressional Budget Office). 2009. *The Use of Offsets to Reduce Greenhouse Gases*, Economic and Budget Issue Brief. Washington, DC: U.S. Congressional Budget Office.

CFA (Conservation Finance Alliance). 2003. *Belize: Protected Areas Conservation Trust (PACT).* Switzerland: Conservation Finance Alliance.

Chomitz, K. M., E. Brines and L. Constantino. 1998. "Financing Environmental Services: The Costa Rican Experience and its Implications." Online at: http://www.eci.ox.ac.uk/~dliverma/articles/Chomitz%20FinancingEnvironmentalServicesTheCostaRicanExperienceandItsImplications1998.pdf

Cooper, Emily. 2009. Personal communication.

DAC (Development Assistance Committee) Network on Environment and Development Cooperation (ENVIRONET). 2008. *Strategic Environmental Assessment and Ecosystem Services.* Paris: Organisation for Economic Co-operation and Development. Online at: http://www.oecd.org/dataoecd/24/54/41882953.pdf

Daily, G. C., Stephen Polasky, Joshua Goldstein, Peter M. Kareiva, Harold A. Mooney, Liba Pejchar, Taylor H. Ricketts, James Salzman, and Robert Shallenberger. 2009. "Ecosystem Services in Decision Making: Time to Deliver." *Front Ecol Environ* 2009: 7(1):21-28, doi:10.1890/090025.

DEFRA (United Kingdom Department for Environment, Food and Rural Affairs). 2009. "£10 Million Initiative Launched to Tackle Bee and Pollinator Decline." Online at: http://www.defra.gov.uk/news/2009/090421a.htm (April 21).

D'Souza, M. and C. Lobo. 2004. "Watershed Development, Water Management and the Millennium Development Goals." Presented at the Watershed Summit, Chandigarh, India, November 25–27. Ahmednagar, India: Watershed Organization Trust. Cited in WRI et al. 2005.

Emerton, L., L. Iyango, P. Luwum, and A. Malinga. 1998. *The Present Economic Value of Nakivubo Urban Wetland, Uganda.* Nairobi and Kampala: IUCN, Eastern Africa Regional Office and National Wetlands Programme, Wetlands Inspectorate Division, Ministry of Water, Land and Environment.

FAO (Food and Agriculture Organization of the United Nations). 2000. "Asia and the Pacific National Forestry Programmes." Update 34. Rome: Food and Agriculture Organization of the United Nations.

FAO (Food and Agriculture Organization of the United Nations). 2005. "FAO Fishery Country Profile—The Kingdom of Cambodia." Online at: http://www.fao.org/fi/oldsite/FCP/en/KHM/profile.htm (July 7 2009).

FAO (Food and Agriculture Organization of the United Nations) Fisheries and Aquaculture Information and Statistics Service. 2009. "FAO Fisheries and Aquaculture Global Production, Overview." Online at: http://www.fao.org/fishery/statistics/global-production/en.

Forest Carbon Partnership. 2009. "Home." Online at: http://www.forestcarbonpartnership.org/fcp/ (June 25).

Foti, Joseph with Lalanath de Silva, Heather McGray, Linda Shaffer, Jonathan Talbot, and Jacob Werksman. 2008. *Voice and Choice.* Washington, DC: World Resources Institute. Box 3.3 Mexico: Cleaner Beaches with Participation and Partnership by Tomas Severino and Valeria Enriquez.

Gallai, N., J. Salles, J. Settele, B. E. Vaissière. 2008. "Economic Valuation of the Vulnerability of World Agriculture Confronted with Pollinator Decline." *Ecological Economics* 68(3): 810-821. Online at: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VDY-4T4J0BG-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=d7e44fab16280b73396db2935957dc93

Global Aquaculture Alliance. 2001. Individual Codes of Practice: Mangroves. http://www.gaalliance.org/code1.html.

Hanson, C., J. Ranganathan, C. Iceland, and J. Finisdore. 2008. *The Corporate Ecosystem Services Review: Guidelines for Identifying Business Risks and Opportunities Arising from Ecosystem Change.* Washington, DC: World Resources Institute.

Huberman, D. 2008. "A Gateway to PES: Using Payments for Ecosystem Services for Livelihoods and Landscapes. Markets and Incentives for Livelihoods and Landscapes," Series No. 1, Forest Conservation Programme. Gland, Switzerland: International Union for the Conservation of Nature (IUCN).

Iceland, C., C. Hanson, and C. Lewis. 2008. "Identifying Important Ecosystem Goods and Services in Puget Sound: Draft Summary of Interviews and Research for the Puget Sound Partnership." Online at: http://www.psp.wa.gov/downloads/AA2008/ecosystem_services_analysis.pdf

IIED (International Institute for Environment and Development). 2007. "Watershed Markets." http://www.watershedmarkets.org/casestudies/South_Africa_Working_for_Wetlands.html.

Inter-American Development Bank. 2009. "Independent Advisory Group Named to Examine the Implementation of IDB's Environment Policy." Online at: http://www.iadb.org/topics/environment/sustainability/independent.cfm?lang=en

Irwin, F. and J. Ranganathan. 2007. *Restoring Nature's Capital: An Action Agenda to Sustain Ecosystem Services.* Washington, DC: World Resources Institute.

Kareiva, P., G. Daily, T. Ricketts, H. Tallis, and S. Polasky, eds. Forthcoming. *The Theory & Practice of Ecosystem Service Valuation in Conservation.* Oxford University Press.

MA (Millennium Ecosystem Assessment). 2005a. *Ecosystems and Human Well-being: Synthesis.* Washington, DC: Island Press.

MA (Millennium Ecosystem Assessment). 2005b. *Ecosystems and Human Well-being: Volume 3*. Policy responses. Washington, DC: Island Press.

MA (Millennium Ecosystem Assessment). 2005c. *Ecosystems and Human Well-being: Volume 2. Scenarios.* Washington, DC: Island Press.

MA (Millennium Ecosystem Assessment). 2005d. *Ecosystems and Human Well-being: Health Synthesis.* Geneva: World Health Organization.

MAFF (Ministry of Agriculture, Forestry and Fisheries), Cambodia. 2007. "Fisheries Administration." Online at: http://www.maff.gov.kh/eng/depts/fia.html#a3 (July 7 2009)

Malavasi, E. O., and J. Kellenberg. 2003. "Program for Payments for Ecological Services in Costa Rica." Online at: http://www2.gsu.edu/~wwwcec/special/lr_ortiz_kellenberg_ext.pdf

McKenzie, E., A. Woodruff, and C. McClennen. 2006. "Economic Assessment of the True Costs of Aggregate Extraction in Majuro Atoll, Republic of the Marshall Islands." *Technical Report 383*. Suva: South Pacific Applied Geoscience Commission.

Myers, N. 1998. "Lifting the Veil on Perverse Subsidies." *Nature* 392: 327-328 (March 26).

Naidoo, R., T. Malcolm, and A. Tomasek. 2008. "Economic Benefits of Standing Forests in Highland Areas of Borneo: Quantification and Policy Impacts." *Conservation Letters* 2: 35-44. Online at: http://www3.interscience.wiley.com/cgi-bin/fulltext/121560625/PDFSTART

Natural Capital Project. 2009. "Natural Capital Project." Online at: http://www.naturalcapitalproject.org/california_prim.html (July 7).

Nelson, E., M. Guillermo, J. Regetz, S. Polasky, H. Tallis, R. Cameron, K. Chan, G. Daily, J. Goldstein, P. Kareiva, E. Lonsdorf, R. Naidoo, T. Ricketts, and R. Shaw. 2009. "Modeling Multiple Ecosystem Services, Biodiversity Conservation, Commodity Production, and Tradeoffs at Landscape Scales." *Ecol. Environ* 2009; 7(1): 4-11.

Pagiola, S. 2006. "Payments for Environmental Services: An Introduction." Washington, DC: World Bank Environment Department.

PEI (UNDP-UNEP Poverty-Environment Initiative). 2008. *Making the Economic Case: A Primer on the Economic Arguments for Mainstreaming Poverty-Environment Linkages into National Development Planning.* Nairobi: UNDP-UNEP Poverty-Environment Initiative. Online at: http://www.unpei.org/PDF/Making-the-economic-case-primer.pdf

References

PEI (UNDP-UNEP Poverty-Environment Initiative). 2009a. "United Nations Poverty-Environment Initiative." Online at: http://www.unpei.org/ (July 8).

PEI (UNDP-UNEP Poverty-Environment Initiative). 2009b. *Mainstreaming Poverty-Environment Linkages into Development Planning: A Handbook for Practitioners.* Nairobi: UNDP-UNEP Poverty-Environment Initiative. Online at: http://www.unpei.org/PDF/PEI-full-handbook.pdf

Perrot-Maître, D., and P. Davis. 2001. *Case Studies of Markets and Innovative Financial Mechanisms for Water Services from Forests.* Washington, DC: Forest Trends.

Procuraduría Delegada para Asuntos Ambientales y Agragrios. *Panorama y Perspectivas Sobre la Gestión Ambiental de los Ecosistemas de Páramo.* 2008. Bogota: Procuraduría General de la Nación. Online at: http://fundacionecoan.org/Documentos/Eventos/libro5.pdf#page+18

Ranganathan, J., C. Raudsepp-Hearne, N. Lucas, F. Irwin, M. Zurek, K. Bennett, N. Ash, and P. West. 2008. *Ecosystem Services: A Guide for Decision Makers.* Washington, DC: World Resources Institute.

Ranganathan, J., and C. Hanson. 2009. "A Natural Progression. Public Service Review." *Science and Technology* 4: 164-167.

Rasband, James, James Salzman, and Mark Squillace. 2009. *Natural Resources Law and Policy.* New York: Foundation Press.

Sarraf, M. 2004. "Assessing the Costs of Environmental Degradation in the Middle East and North Africa Region." *Environmental Strategy Notes* 9. Washington, DC: World Bank. Online at: http://irispublic.worldbank.org/85257559006C22E9/All+Documents/85257559006C22E985256F48006E78E1/$File/EnvStrategyNote9EnvDegMENA2004.pdf

Sathirathai, S., and E. B. Barbier. 2001. "Valuing Mangrove Conservation in Southern Thailand." *Contemporary Economic Policy* 19 (2): 109-22.

Sawyer, D. 2008. "Climate Change, Biofuels and Eco-social Impacts in the Brazilian Amazon and Cerrado." *Philosophical Transactions of Royal Society B: Biological Sciences.* 363(1498): 1747–1752. Online at: http://rstb.royalsocietypublishing.org/content/363/1498/1747.full.pdf+html

Slootweg, R., and P. van Beukering. 2008. V*aluation of Ecosystem Services and Strategic Environmental Assessment: Lessons from Influential Cases.* Utrecht, Netherlands: Netherlands Commission for Environmental Assessment. Online at: http://docs1.eia.nl/mer/diversen/valuation.pdf

South Africa Department of Water Affairs and Forestry. 2004. *National Water Resource Strategy*. Pretoria, South Africa: Department of Water Affairs and Forestry.

Tallis, H. 2008. Personal communication.

TEEB (The Economics of Ecosystems and Biodiversity). 2008. *Interim Report*. Wesseling, Germany: Welzel+Hardt.

Turpie, J., G. Lange, R. Martin, R. Davies and J. Barnes. 2005. *Namibia's Protected Areas: Their Economic Worth and the Feasibility of Their Financing.* Windhoek, Namibia: Directorate of Environmental Affairs, Ministry of Environment and Tourism. Online at: http://www.met.gov.na/publications/research/RDP73.pdf

Walmart, July 2009. "Seafood and Agriculture Fact Sheet." Online at: http://www.walmartstores.com/download/3869.pdf

Wetlands Management Department, Ministry of Water and Environment, Uganda; Uganda Bureau of Statistics; International Livestock Research Institute; and World Resources Institute. 2009. *Mapping a Better Future: How Spatial Analysis Can Benefit Wetlands and Reduce Poverty in Uganda.* Washington, DC, and Kampala: World Resources Institute. Online at: http://www.wri.org/publication/mapping-a-better-future

World Bank. 2001. *Making sustainable commitments. An Environment Strategy for the World Bank.* Washington, DC: The World Bank.

World Bank, 2008a. "Environmental Sustainability: An Evaluation of World Bank Group Support." Washington, DC: World Bank.

World Bank, 2008b. "Assessing the Environmental, Forest, and Other Natural Resource Aspects of Development Policy Lending: A World Bank Toolkit." Washington, DC: World Bank.

World Bank 2009a. "Convenient Solutions to an Inconvenient Truth: Ecosystem-based Approaches to Climate Change." Washington, DC: World Bank Environment Department.

World Bank 2009b. "Development and Climate Change: The World Bank Group at Work." Online at: http:// www.worldbank.org/climatechange

World Bank Treasury. 2009. "The World Bank Treasury." Online at: http://treasury.worldbank.org/index.html (June 25).

WOTR (Watershed Organisation Trust). 2002. *Darewadi Watershed Project.* Project summary paper. Ahmednaga, India: WOTR. Online at: http://www.wotr.org. Cited in WRI et al. 2005.

WOTR (Watershed Organisation Trust). 2005. "Darewadi Project Benefits 1996-2005." Unpublished table. Cited in WRI et al. 2005.

WOTR (Watershed Organisation Trust). 2009. "Watershed Organisation Trust." Online at: http://www.wotr.org/ (July 8).

WRI (World Resources Institute); Department of Resource Surveys and Remote Sensing, Ministry of Environment and Natural Resources, Kenya; Central Bureau of Statistics, Ministry of Planning and National Development, Kenya and International Livestock Research Institute. 2007. *Nature's Benefits in Kenya: An Atlas of Ecosystems and Human Well-Being.* Washington, DC, and Nairobi: WRI.

WRI (World Resources Institute), United Nations Development Programme, United Nations Environment Programme, and World Bank. 2000. *People and Ecosystems: The Fraying Web of Life.* Washington, DC: World Resources Institute.

WRI (World Resources Institute), United Nations Development Programme, United Nations Environment Programme, and World Bank. 2005. *World Resources 2005: The Wealth of the Poor—Managing Ecosystems to Fight Poverty.* Washington, DC: World Resources Institute.

WRI (World Resources Institute), United Nations Development Programme, United Nations Environment Programme, and World Bank. 2008. *World Resources 2008: Roots of Resilience—Growing the Wealth of the Poor.* Washington, DC: World Resources Institute.

WWF (World Wide Fund for Nature). 2008. *Water for Life: Lessons for Climate Change Adaptation from Better Management of Rivers for People and Nature.* Gland, Switzerland: World Wide Fund for Nature.

Zoellick, R. 2007. "Catalyzing the Future: An Inclusive and Sustainable Globalization." Annual meetings 2007, Board of Governors of the World Bank Group, remarks of Robert B. Zoellick, President, World Bank Group (October 22).

About the Authors

FLICKR/ASH LOUREY

Janet Ranganathan is the Vice President for Science and Research at the World Resources Institute.

Frances Irwin is a former Fellow in the Institutions and Governance Program at the World Resources Institute.

Cecilia Procopé Repinski is a former Associate in the Institutions and Governance Program at the World Resources Institute.

About WRI

FLICKR/HAKAHANU

The World Resources Institute is an environmental think tank that goes beyond research to create practical ways to protect the Earth and improve people's lives. Our mission is to move human society to live in ways that protect the Earth's environment and its capacity to provide for the needs and aspirations of current and future generations.

Because people are inspired by ideas, empowered by knowledge, and moved to change by greater understanding, WRI provides—and helps other institutions provide—objective information and practical proposals for policy and institutional change that will foster environmentally sound, socially equitable development. Our programs meet global challenges by using knowledge to catalyze public and private action:

- **People and Ecosystems:** Reverse rapid degradation of ecosystems and ensure their capacity to provide humans with needed goods and services.
- **Governance:** Empower people and support institutions to foster environmentally sound and socially equitable decision making.
- **Climate Protection:** Protect the global climate system from further harm due to emissions of greenhouse gases and help humanity and the natural world adapt to unavoidable climate change.
- **Markets and Enterprise:** Harness markets and enterprise to expand economic opportunity and protect the environment.

In all its policy research, and work with institutions, WRI tries to build bridges between ideas and actions, meshing the insights of scientific research, economic and institutional analyses, and practical experience with the need for open and participatory decision making.


CHARLES STEWART
MOTT FOUNDATION


Irish Aid
Government of Ireland
Rialtas na hÉireann


Ministry of Foreign Affairs of Denmark


Buitenlandse Zaken
Ontwikkelings samenwerking
Netherlands Ministry for Development Cooperation


Rockefeller Brothers Fund
Philanthropy for an Interdependent World


Sida
SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY


SwedBio
A Sida-funded programme at the Swedish Biodiversity Centre

WORLD
RESOURCES
INSTITUTE

10 G Street, NE
Suite 800
Washington, DC 20002
www.wri.org

ISBN-978-1-56973-734-7