The World Bank’s Field Guides Program has now contributed to the production of 110 local-language field guides across Asia, Africa, Latin America, and the Caribbean. The field guides are supported through Bank projects, Bank-Netherlands Partnership Program, and grants from the MacArthur Foundation. They are tools in promoting environmental awareness and capacity building in developing countries. They provide accessible information in local languages for strengthening biodiversity training and park ranger capacity and for improving environmental assessments of development projects.

The program has supported guides on numerous plant and animal groups, such as the trees of Thailand and Sri Lanka; mountain flora of Java; amphibians of Borneo, Honduras, and Madagascar; reptiles of India and Southeast Asia; the seahorse of East Africa; and the snails and crabs of Sri Lanka. A substantial number of guides focus on birds, including the birds of Iraq, which marked a sign of hope for that war-torn country.

Many of the field guide projects have been implemented through and co-funded by local and international NGOs, in collaboration with national scientific agencies and amateurs. Calls for proposals in 2004 elicited more than 500 submissions from around the world. It is encouraging that some regular Bank projects are now also producing local-language guides, but much more needs to be done to build local capacity.

Field guides may encourage young scientists and local communities so that they can better promote and benefit from natural resources and biodiversity, as well as from alternative livelihoods based on sound biodiversity management. As part of the World Bank’s safeguard project reviews. In addition, some of the field guides are being utilized at the local level by village ecotourism guides, teachers, and young professionals to increase their own knowledge and strengthen the services and information they can provide to others.

Local-language field guides contribute to overall capacity for environmental management and impact assessment. Moreover, by providing access to information in local languages, they provide tools for environmental activists to monitor and improve government-led development programs.

The World Bank is currently exploring with an international publisher the feasibility of creating an online compendium of the field guides.
is the International Year of Biodiversity, a time for the nations of the world to take stock of how well we are taking care of our planet. Over the past 50 years, people have changed ecosystems more rapidly and extensively than at any comparable period in our history. These changes have contributed to many development gains, but with notable environmental costs: biodiversity loss, land degradation, and reduced access to adequate water and natural resources for many of the world’s poorest people.

I believe we can—and must—have strong economic growth, help poor people overcome poverty, and serve as stewards of our common environmental heritage. But to accomplish these mutual goals, we need smart development and growth. The mission of the World Bank Group (WBG) is to overcome poverty and support inclusive and sustainable development. The conservation and sustainable use of natural ecosystems and biodiversity are critical to fulfilling these objectives. Biodiversity is the foundation and mainstay of agriculture, forests, and fisheries, as well as soil conservation and water quality.

Biological resources provide the raw materials for livelihoods, sustenance, medicines, trade, tourism, and industry. Genetic diversity provides the basis for new breeding programs, improved crops, enhanced agricultural production, and food security. Forests, grasslands, freshwater, and marine and other natural ecosystems provide a range of services, often not recognized in national economic accounts but nevertheless vital to human welfare: regulating water flows, flood control, pollination, decontamination, carbon sequestration, biodiversity conservation, and nutrient and hydrological cycling. Terrestrial and oceanic ecosystems play a significant role in the global carbon cycle. Protection and sound management of natural ecosystems maintain carbon sinks and provide natural solutions and services that enable societies to adapt to climate change.

Biodiversity and ecosystem services contribute to environmental sustainability, a Millennium Development Goal and a central pillar of World Bank Group assistance. Over the last 20 years, the WBG has built up a rich portfolio of biodiversity projects, worth more than $6 billion, making the WBG one of the largest international funding sources for biodiversity worldwide. A substantial amount of that investment has been dedicated to protected areas, but there is an increasing focus on improving natural resource management and mainstreaming biodiversity into forestry, coastal zone management, and agriculture.

Despite these and other donor and government efforts, the world’s biodiversity is threatened. The IUCN Red List now shows that one in four mammals face extinction, as well as one in eight birds and one in every three amphibians and corals. Accordingly, new initiatives at the World Bank are lending support to species conservation.

We built a coalition to launch the Global Tiger Initiative in June 2008 to mobilize additional support for conservation of this charismatic species. As an umbrella species, the health of wild tiger populations is an indicator of biodiversity and a barometer for sustainability. Conservation of wild tigers therefore also means the preservation of the habitats in which they live and the prey populations that support them.

The World Bank and other partners, including tiger-range countries and international NGOs, will come together at a Tiger Summit in September in Russia this year to celebrate the Year of the Tiger and promote solutions for sustainable tiger conservation. The Bank is also a leading partner in the Save Our Species project, which was launched with the Global Environment Facility and IUCN to catalyze new funding from the private sector for conservation of threatened species. Another partnership with civil society, the Critical Ecosystem Partnership Fund, is now investing in conservation of threatened species and local livelihoods in 18 biodiversity hotspots around the world.

Biodiversity underpins every aspect of human life. Species and habitats are the building blocks on which human livelihoods depend and the foundation for forests, fisheries, and agricultural crops. Of course, biodiversity warrants our respect, even separate from the connections to people. As stewards of our planet and its resources, human societies share a larger responsibility to protect our natural heritage. We need a paradigm change so that the value of sensitive ecosystems and wilderness is factored into the equation of development; at the WBG, we endeavor to mainstream these values into our own work. The International Year of Biodiversity provides an occasion to celebrate successes and partnerships, but also an opportunity to renew commitments and efforts to maintain a healthy world for a sustainable future.
This issue of Environment Matters celebrates the 2010 International Year of Biodiversity and describes some of the challenges and opportunities in protecting biodiversity for the benefit of humankind.

From the world’s highest mountain ranges to the lowland plains, and from the great oceans and coastal wetlands to agricultural landscapes, nations and communities rely on the bounty and services of natural ecosystems. Biological resources and the goods and ecosystem services they provide underpin every aspect of human life and livelihoods, from food and water security to general well-being and spiritual fulfillment.

In many countries, it is the poorest of the poor who are most dependent on these benefits. Yet, as the Millennium Ecosystem Assessment showed, biodiversity is under severe threat, as ecosystems are being lost and degraded more rapidly and extensively than at any comparable period in our history. Habitat loss and fragmentation, overexploitation of resources, pollution, invasive alien species, and, increasingly, climate change will all lead to further biodiversity loss. One of the key challenges of the coming decades will be how to reconcile biodiversity conservation and development if we are to achieve the twin goals of poverty alleviation and a sustainable future for all.

The World Bank is already a major global funder of biodiversity initiatives, including support to more than 624 projects in over 122 countries during the last 20 years. It is actively supporting national actions to safeguard biodiversity and improve natural resource management. Many of these projects have supported globally important protected areas, but efforts have also been made to mainstream biodiversity conservation in the production landscape. As well as national efforts, the Bank has supported numerous partnerships with international NGOs to promote global and regional biodiversity initiatives.

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he sustainable use of natural resources is essential for poverty reduction and economic growth. But—as is forcefully pointed out in many articles in this year’s Environment Matters—development that also results in biodiversity loss undermines long-term economic growth and is particularly counterproductive in the poorest communities in developing countries. Absent further investments in biodiversity conservation and management, these communities will increasingly be affected by the impacts of biodiversity loss, further compounded by climate change.

The value of biodiversity resources is indisputable. Biodiversity is critical for maintaining ecosystems and the services they provide and is a vital source of innovation in fields such as medicine. Yet in many cases these values are unrecognized. For example, one and a half acres of rain forest are lost every second. Solely as a result of rain forest losses, we are losing 137 plant, animal, and insect species every day; that equates to 50,000 species a year. Among other things, those losses will have significant implications for human health, since about 25 percent of modern pharmaceuticals are derived from rain forest ingredients—yet less than 1 percent of tropical trees and plants have been tested by scientists. In light of these trends, one the most important challenges to all who are charged with supporting sustainable development will be to reverse the current degradation of biodiversity resources and the loss of these ecosystem services.

The World Bank Group has a major role to play through lending and grant support to developing countries, as well as through a range of partnerships intended to support action at the local, national, regional, and global levels. In the past several years, the WBG provided biodiversity conservation support to most of our developing country partners and through 60 multicountry efforts. We manage a $6.5 billion portfolio of biodiversity conservation projects and programs. This portfolio is supported by about $2 billion in loans and over $1.4 billion in Global Environment Facility resources; the balance is from other sources of cofinancing, including substantial contributions from developing countries’ own resources.

The portfolio includes local activities such as the production of local-language field guides and protecting relatively small but very critical habitats with communities and indigenous peoples. It includes programs to establish and manage national protected areas, as well as national environment and protected areas trust funds. The Bank also supports regional and global initiatives to increase awareness and the capacity of stakeholders to join forces in conserving natural resources. As noted in Nikita
Lopoukhine’s article, effectively managing protected areas or community-based conservation areas is essential.

The Bank, including the International Finance Corporation, also can point to significant achievements in each region in supporting the protection of critical habitats. Experiences working with international and local nongovernmental conservation organizations—through vehicles such as the Critical Ecosystem Partnership Fund—have also been highly rewarding. These efforts have succeeded in strengthening local capacity, in building bridges between these organizations and local and national governments, and in protecting threatened ecosystems. New initiatives such as the Global Tiger Initiative and Save Our Species program are breaking ground in how and whom we work with on biodiversity conservation.

The WBG also recognizes that the process of development, and therefore development projects financed by the WBG, can have severe impacts on natural resources and biodiversity. The WBG’s environmental safeguard policy framework is intended to minimize adverse impacts and mitigate unavoidable impacts and where possible to improve environmental quality. Of critical importance to achieving the objectives of our safeguard policies is effective policy and planning and strong governance to see that plans are effectively implemented. Our support to governments and stakeholders in setting an appropriate policy framework, planning environmentally sustainable development, and strengthening the ability to ensure such development will continue to be a cornerstone of the WBG’s support for protecting ecosystems and biodiversity.

Nevertheless, the global community clearly is not succeeding in its mission to conserve our natural resource base. Several international, regional, and national studies have shown that many critical natural assets are being lost or degraded to the point of not only losing their developmental support functions but rather, when combined with the impacts of climate change, hindering poverty reduction and economic growth. The very ecosystems that protect cities and agricultural areas from flooding, conserve soils, sustain water yields, reduce vulnerability of communities to coastal storms, and produce food and shelter are already degraded or are threatened in many developing countries that are the most vulnerable and least resilient.

Several contributors to this issue provide some important guidance on issues in which the Bank needs to strengthen its focus. For example, the WBG has worked closely over the last few years with indigenous leaders to strengthen our understanding of the special needs, concerns, and contributions of indigenous communities. Victoria Tauli-Corpuz points out that much of the world’s remaining natural areas are still inhabited by indigenous peoples, who place a high priority on protecting and sustainably using their biodiversity resources. As the global community increases its attention to protecting our remaining ecosystems—and particularly as the global community makes decisions relating to the use of forests and other natural areas as part of a global climate pact—we need to find ways to more effectively learn from and work with indigenous communities, while respecting and supporting their rights.

Similarly, we need to better understand how the WBG, through its country-based operations and global partnerships, might strengthen awareness and action to reduce the threats to the health of numerous ecosystems caused by invasive alien species. Dr. Dennis Rangi reports that invasives cause an estimated $1.4 trillion per year in damages, as well as increasing the global threat to biodiversity. Climate change is almost certainly going to exacerbate the loss of ecosystem services caused by invasive species, leading to even more severe economic and social costs, particularly affecting already vulnerable communities.

We also need to better understand our role as a multilateral development bank in addressing the global threat of reduced marine productivity. As noted by Dan Laffoley, the WBG could increase its support to developing country partners to improve the management of existing marine protected areas. We know that many of our partner countries will be severely impacted by the reduced productivity of marine and coastal ecosystems due to a combination of factors, from local pollution to climate change. Looking forward, it will be increasingly important to support national and global efforts to reduce the threats to these ecosystems.

Finally, it is clear that the global focus on climate change may actually provide opportunities to improve biodiversity conservation. The WBG’s support for biodiversity conservation and natural resource management is already contributing to effective mitigation and adaptation strategies. We need to quickly demonstrate the potential for integrating ecosystem-based adaptation into broader adaptation strategies and to scale up efforts to protect forests, wetlands, and grasslands and improve agricultural practices as part of national efforts to reduce greenhouse gas emissions. The cobenefits of such efforts in terms of improved ecosystem service delivery and biodiversity conservation are only now beginning to be understood. While doing so, the WBG—working with a range of partners—will need to dramatically strengthen the ability to measure the value of these ecosystems and their support to sustainable development. It is now vitally important to measure them as assets, so that national decision makers can balance short-term gains from unsustainable exploitation against long-term benefits from continued delivery of ecosystem services.
Biodiversity erosion is a serious concern for us—indigenous peoples—because the loss of flora, fauna, and microorganisms and the destruction of ecosystems are not just physical losses. This also means the loss of indigenous knowledge systems, cultures, languages, and our identities. Our very survival as peoples and cultures rests on how well we have conserved and sustainably used the biodiversity and ecosystems in our territories.

A significant number of the world’s remaining indigenous peoples still live in their ancestral territories in spite of the tragic histories of colonization and displacement. Those of us who still do live there put a high priority on protecting and using sustainably the biodiversity in our lands and waters.

Most of our struggles are to protect and save our lands, territories, and resources and assert the right to use and control our indigenous knowledge systems and customary laws, which govern our relationship with nature and with the rest of humanity. Our contributions seek to ensure the protection and conservation of biodiversity, as well as to strengthen the links between biodiversity and the development of our culture and identity. So, as we celebrate the International Year of Biodiversity, we need to be reminded that indigenous peoples still inhabit territories that contain some of the richest biodiversity on this planet, as well as the knowledge systems and cultures that come along with its conservation and use.

Clearly, this is the proof of the long-term viability of our traditional values and practices of stewardship, reciprocity, and integration with nature. It also confirms a highly advanced knowledge of how to be in the world; the rules, limits, and practices of sustainability. Studies (Maffi 2002) have shown that “small-scale societies with a history of continued and unchallenged occupation of given territories will over time tend to develop and maintain detailed and accurate knowledge about their ecological niches, as well as sustainable ways of extracting, managing natural resources. Their ways of speaking, oral traditions, and verbal art forms will transmit this knowledge.”

**Biodiversity and Cultural and Linguistic Diversity**

The links between biodiversity and cultural and linguistic diversity are not lost in the biodiversity and culture debates. It should not be difficult to understand why the vitality of indigenous languages is directly proportional to the vitality of biological diversity. The disappearance of species of plants, animals, or insects and the destruction of an ecosystem means the disappearance of related languages and knowledge. These knowledge services provided by biodiversity are still very much unappreciated and undervalued. Parts of the living library of life sciences are encoded in the language and minds of indigenous peoples, who are still dependent on biodiversity for their continuing existence.
“Linguistic ecologies and biological ecologies are mutually related through human knowledge, use and management of the environment and through the languages used to convey this knowledge and praxis...” (Maffi 2002).

The multiple crises of biodiversity loss, ecosystem destruction, and overall resource depletion, as well as climate change and the global economic crisis, tell us that we cannot continue with business as usual. This is the time to shift our thinking and ways toward a holistic development path that is influenced by the ecosystems-based approach and human-rights-based approach. There are many efforts toward developing measures of progress beyond the gross domestic product. The Human Development Index, Happy Planet Index, and Gross National Happiness are just a few examples. The aim of these efforts is to factor in the wear and tear of natural capital and social costs into national systems of accounts. The shift toward a different paradigm requires us to develop ways of measuring progress, well-being, and sustainability. This is where the development of indicators comes in.

Indigenous peoples, together with the Permanent Forum, have started work toward the development of indicators of indigenous peoples’ sustainability and well-being. It is a collaboration between the IIFB (International Indigenous Forum on Biodiversity) Working Group on Indicators, Indigenous Peoples’ International Center for Policy Research and Education, and the UN Permanent Forum on Indigenous Issues. As biodiversity loss means the loss of not only natural capital but social capital, indicators reflecting this loss have to be developed. The Convention on Biological Diversity (CBD) has ventured into developing indicators.

One proxy indicator to measure biodiversity loss is the status and trends of linguistic diversity and number of speakers of indigenous languages. For the 2011–20 targets, the IIFB is proposing two more proxy indicators for consideration. One is the status and trends in the practice of traditional occupations; the second is the status and trends in land-use patterns and land security in indigenous territories. These efforts are not just meant to add indicators, but also to reflect the inextricable link between biodiversity and indigenous peoples’ well-being and sustainability.

There is a proposal to establish an Intergovernmental Science-Policy Platform for Biodiversity and Ecosystem Services. This is a body like the IPCC of the Climate Change Convention. This entity should ensure that indigenous knowledge holders and experts are included as experts. Interdisciplinary and intercultural approaches in research increase the chances of producing more holistic knowledge that accommodates other world views. Doing our own research, which is guided by our own epistemologies and our own ways of knowing and understanding, will produce knowledge that can help save the world’s remaining biodiversity and the cultural diversity that comes with it. We argue that the reciprocal interactions between the social, cultural, and ecological spheres should be examined and addressed because it is the balanced interaction between these that brings about our well-being.

The whole issue of access and benefit-sharing is another major concern of indigenous peoples. Indigenous peoples are actively engaging in the negotiations for an international legal regime on ABS (access and benefit-sharing) at the CBD. Our efforts focus on various issues. One is ensuring that our free, prior, and informed consent is obtained for anyone conducting research and seeking access to and use of biogenetic resources from our territories and using our indigenous knowledge. We also would like to ensure that an ABS international regime will recognize and reinforce the protection of indigenous peoples’ knowledge systems, as well as the use of customary systems of protection of genetic resources and associated knowledge.

Conclusion

The celebration of the International Year of Biodiversity provides indigenous peoples many opportunities to articulate their perspectives on biocultural diversity and the linkages between biodiversity and their own development. Our efforts to date have succeeded in creating changes in approaches as well as thinking, but much more work needs to be done. It is our hope that states, intergovernmental systems, NGOs, academia, and the private sector will increase their efforts in understanding our concerns and using the ecosystem- and human-rights-based approach in meeting the objectives of the Convention on Biological Diversity.

Bibliography


Protected areas are now recognized as the cornerstones of biodiversity conservation. The modern era of protected areas began during the latter part of the 19th century, when the iconic Yellowstone National Park in the United States and Banff National Park in Canada were created. The initial founding criteria were not at all kind to the people living within these areas. The model was to expel local communities, eliminate predators, and place restrictions on activities within these areas. In time, the overriding purpose of these and subsequent protected areas focused more on the conservation of nature.

Starting in the latter part of the 20th century, new forms of management and different approaches to governance of these areas emerged. Conserving the diversity of nature continued to be a primary consideration, but alongside that concern there was a clear accommodation for people within these areas. Today, the responsibilities for decisions governing these areas are increasingly being shared. In many parts of the world, protected areas are home to indigenous and traditional peoples who depend on the areas’ health and viability for their very survival, and who in turn through their continued practices have assured the ongoing protection of native plants and animals.

Science tells us that protected areas are good for protecting nature. Yet, it is not science alone that drives the establishment of protected areas. Emotions are part of the equation: people feel strongly about the beauty of a landscape or the possible loss of charismatic species such as the grizzly bear or the white rhino.

Now people are embracing protected areas as a tool to ensure that both their homeland and nature-dependent lifestyle are protected for future generations. Native land claims in Australia, Canada, and South Africa are examples of local community values turning to protected areas as a solution.

According to the UNEP World Conservation Monitoring Centre, 150,000 protected areas cover over 13.9 percent of the Earth's land surface. The percentage is even higher if one includes privately protected areas or community-based conservation areas, which are presently not enumerated in the UNEP global database. In her opening address at the World Parks Congress in 2003, Queen Noor of Jordan stated that this growth is “one of the most significant collective land use decisions in history.” Marine protected areas are lagging behind terrestrial protected areas, with less than 1 percent of coverage.

Why has this growth in protected areas occurred? A definitive driver is the recognition by the signatory parties of the Convention on Biological Diversity that protected areas are critical to conserving in situ biodiversity, native plants, and animals.

Protected areas provide for life's essentials. They protect the natural resources that are critical to many people on Earth. Within these areas, genetic diversity is permitted to evolve in response to natural selection pressures. These genetic resources are a source of many new products. Biodiversity also serves to protect major ecosystem services essential to us all. Water, food, clothes, shelter,
transport, and medicines are thus available within and beyond the borders of protected areas. Without a doubt, these values have driven the creation of protected areas, but there is more to protected areas than just conserving biodiversity.

Protected areas are important to the people living within and around them. They provide jobs through tourism and direct employment. However, the ecosystem services derived from these areas are an even more important consideration. Clean water is an example of such a service. Of the 105 major world cities, 33 depend on adjoining protected areas for their source of water. The economics make sense. For example, in 1997 New York City acquired and invested in protecting the watershed that provides the city’s source of water. The city anticipated saving $4–6 billion over 10 years by taking these protective measures rather than the alternative of building new reservoirs and water purification facilities.

A growing body of evidence proves the importance of nature to human health, both physical and mental. Intact ecosystems in protected areas and the opportunities for visitors to experience nature add materially to the well-being of people. Healthy people contribute to strong economic outputs. Illness causing absenteeism has a devastating economic toll. Australia reports 6 million working days lost annually to illness. Protected areas can provide an antidote. Studies in the United States found that active users of protected areas were healthier than non-users on a number of counts, including blood pressure, body mass index, and levels of depression.

Nature's contribution to addressing human health problems does not stop with the above. Indeed, half of the synthetic drugs used today originate from nature. Unfortunately, this immeasurable service is at risk, given that up to 70 percent of the world’s plants are recognized to be in jeopardy. On the other hand, protected areas contain 80 percent of the IUCN Red List species, so they provide a level of insurance that there may yet be future pharmaceutical discoveries. In addition to medicinal plants, protected areas around the world harbor wild relatives of important crops, assuring DNA sources to combat possible diseases and pests affecting the world’s food supply.

The insurance role of protected areas is further exemplified in the face of natural disasters. Intact ecosystems have repeatedly proved to be a good investment, and never more so than during the 2004 Asian tsunami. Intact coastal mangroves within protected areas saved lives and livelihoods. Floods, landslides, and storm surges are all mitigated by intact ecosystems; wetlands absorb rising water levels; intact forests on slopes hold soils from sliding; coral reefs buffer storms; and vegetated shorelines absorb wave pounding. With the predicted enhanced frequency and intensity of disasters to be unleashed by climate change, we will need protected areas more than ever. Furthermore, maintaining intact ecosystems in protected areas prevents further emissions of harmful carbon into the atmosphere.

The case for protected areas is stronger than ever before. Their value cannot be underestimated.

How Well Do Protected Areas Conserve Forests?

Protected areas (PAs) cover a quarter of the tropical forest estate, an area the size of Argentina and Chile combined. Many PAs were set up in part to reduce deforestation, so they provide potential lessons for implementing REDD (reducing emissions from deforestation and degradation).

The World Bank’s Independent Evaluation Group evaluated the impact of protected areas using satellite data on forest fires—as an indicator of deforestation—and a “case-control” statistical comparison of protected versus unprotected forests. The study found that strict protected areas—where forests are devoted solely to conservation—are indeed effective in reducing deforestation. Perhaps more surprisingly, they found that mixed-use protected areas—where local people can carry on some forms of sustainable forest and land use—are even more effective than strict protected areas. Most effective of all were indigenous areas.

The findings are important because they show that there is successful experience, on the ground, with decelerating deforestation. And they show that it is possible to combine productive forest use with forest conservation. This may suggest ways to implement REDD in a manner that protects both forest biodiversity and local livelihoods.

As this is the International Year of Biodiversity, it is time to take action to better protect the “blue heart” of the planet—the 70 percent of the world that is covered by ocean.

Over the past three decades tremendous progress has been made in establishing about 13.9 percent of the world’s terrestrial surface as protected areas. These areas are the cornerstone of biodiversity conservation and fundamentally important for human health and livelihoods. Yet, despite these good efforts, less than 1 percent of the marine environment has been protected. Without having sufficient areas set aside for the conservation of marine biodiversity—the variety of life in the seas—little hope remains of ensuring that the ocean has the breathing space for recovery and replenishment from the sustained depletion of its natural resources.

As a new decade begins, why should the world care about this lack of protection for the ocean, and why should more be done alongside all our other problems and priorities?

The most compelling argument for protecting the ocean is that it ultimately provides for our well-being. It absorbs about a quarter of the carbon dioxide sent out from land, produces some two-thirds of the oxygen we breathe, and shapes our climate. It holds most of the water and silently processes our waste. It is the blue heart of the planet. Keeping the ocean in good shape is not just sensible and wise, but also essential.

Over many decades, human actions have taken a severe toll on marine life. Simply too much has been taken from the sea for it to be able to maintain a healthy state. Most of the largest predatory species of fish have now been removed. Sharks, turtles, and other large ocean-dwelling species—once incredibly abundant—have suffered catastrophic declines. Seamounts—underwater mountains—and deep-water seabed features such as coral reefs, which have endured over the centuries and perhaps even for up to 8,000 years in some cases, have been swept away in the geological equivalent of a blink of an eye. The ceaseless quest for fish moves farther away from the shore into ever deeper waters, leading to the collapse of fish stocks, and it will not be long before the consequences of such actions come back to haunt us. Unless we rapidly change our ways, we face the very real prospect of running out of fish to feed a growing world population, dealing with the economic collapse of coastal communities, and facing social unrest when protein sources and incomes dry up.

As awareness grows of ocean’s role in climate change, we begin to see it not just as the pretty blue marble seen from space but as a
fundamental lifeline to each and every one of us. The ocean has buffered the world from the severe impacts of climate change by absorbing vast amounts of carbon dioxide. Paradoxically, it is the ocean’s ability to absorb carbon dioxide that is now beginning to threaten the ocean itself. As the ocean absorbs greater amounts of carbon dioxide at increasing rates, the result is a shift to more acidic conditions—a process known as ocean acidification. Put simply, carbon dioxide from the air reacts with the surface waters to form carbonic acid. This spells bad news for coral reefs, essentially progressively depriving coral polyps of the very chemicals they need to form the reef structure. No reefs means no food for millions of people who live in the tropics, no tourist industry, and the undermining of the poverty reduction efforts that the World Bank has promoted over decades. Perhaps even more worrying are the negative impacts of increasing acidification on plankton, the very basis of the marine food chain, potentially placing at risk many of the marine ecosystems we now know. To put this into context, acidification is happening at a pace not seen for at least 55 million years.

Recent science indicates very clearly that about half the biological carbon stocks on Earth are stored in marine species like plankton, mangroves, and salt marshes. By improving the management of coasts and fisheries, and by protecting mangroves, seagrass meadows, and salt marshes from other negative human impacts, there is an immense potential to sequester carbon. We need to recognize the essential role the ocean plays in mitigating climate change, and take far more ambitious actions to safeguard these habitats and their ecosystem services.

There is still considerable scope for hope and optimism that we can help the ocean, and in so doing help ourselves. The opportunity must be seized to build support for the ocean. A vital step is to engage the general public and help them to discover the wonders of the ocean and understand the essential role it plays in conserving biodiversity and in maintaining our own well-being. The International Union for Conservation of Nature (IUCN) has already made a start with Google Earth to bring a three-dimensional ocean to everyone’s desktop. A potential audience of over half a billion people can now re-engage with the ocean at their leisure, explore marine life, and see for themselves just how little of the “blue” is actually protected. They can now directly interact with any of the 4,500 or so marine protected areas and upload their own pictures to show why such places are so important. The IUCN is now busy planning new ways to reach this global audience, such as using the Internet to show political leaders and others what else should be protected.

The IUCN has spearheaded a process to bring the ocean into the climate change debate. Together with UNEP, Natural England, and the Lighthouse Foundation, we recently published scientific data showing how effective many coastal habitats—such as salt marshes, seagrass meadows, and kelp forests—are in their role as natural carbon sinks. This work forms an important component of the “Natural Solutions” work championed by the IUCN and its World Commission on Protected Areas, with support from the World Bank and others. It demonstrates how the protection of natural systems can be an effective and cost-efficient means of mitigation and adaptation.

Work on the role of the ocean as a carbon sink is expanding, bringing new evidence and perspectives to bear on conventional views of life in the ocean. Hopefully, this will spur on politicians to take immediate and firm action to protect the ocean outside of the national jurisdictions—the High Seas that cover an amazing 50 percent of the Earth’s surface.

Finally, the quality of the management of existing marine protected areas needs to be improved. The World Bank and its partners have particular roles to play to help make this happen. We urgently need to ensure that our efforts and investments to produce best-practice guidance get used by those who need it, but this needs investment to translate and distribute guidelines and improve capacity building. Making this happen would empower many people worldwide, and for very modest cost. Marine protected areas with full protection show the greatest proven benefits for marine biodiversity, yet few areas have such full protection. This approach needs to be consistently championed and used much more extensively. Most important, the World Bank and the United Nations Development Programme must now play a pivotal role in promoting the role of coasts as carbon sinks and finding ways that this can be done so as to improve the livelihoods of the billions of people who depend on the ocean.

Let us not dither but resolve to act with renewed pace and ambition. Let us help the oceans to help ourselves.
Invasive alien species are now recognized as a great threat to biodiversity. They also constitute a threat to the environmental and economic well-being of our planet, costing an estimated $1.4 trillion per year, or nearly 5 percent of global GDP (Pimentel and others 2001).

Invasive species are not a new phenomenon. Farmers have been fighting weeds since the beginning of agriculture, and throughout history epidemics of human diseases—such as malaria, yellow fever, and bubonic plague—have been recorded. Yet in the 50 years since Elton first coined the term, the issue has assumed large proportions. Invasive species are plants, animals, or microorganisms whose accidental or intentional introduction into a new ecosystem threaten biodiversity, food security, human health, trade, transport, or economic development. What is of most concern is the rate at which invasive species are being introduced, coupled with increases in their distribution as a result of globalization, in particular increasing tourism, travel, transport, and trade. Emerging conflicts with commercial interests promoting the utilization of potentially invasive species, such as those used in biofuel production, are further confounding efforts to combat the problem. Moreover, the threat of climate change will favor species that are adaptable or opportunistic, a characteristic of many invaders. Climate change will inevitably exacerbate this problem, with consequences for biodiversity and human livelihoods.

Invasive species occur in all taxa and affect virtually all ecosystem types. They were identified by the Millennium Ecosystem Assessment as one of the main drivers of biodiversity loss and changes in ecosystem services. Invasive species are responsible for 33 percent of threatened birds (but up to 67 percent on islands), 26 percent of threatened amphibians, and 16 percent of threatened mammals. Their status as the second biggest threat to biodiversity—and in many ecosystems, such as small-island developing states, the biggest single threat to biodiversity—has been well documented and is well deserved.

The links between invasive species and poverty, specifically food security, continue to be poorly understood and frequently underestimated. In most countries, invasive species are viewed exclusively as a biodiversity issue and thereby confined to the mandate of the environment sector—traditionally not a priority for developing country governments. As a consequence, the threat posed by invasive species to food security and poverty alleviation has not been given adequate recognition by policy makers.

In developing countries—where agriculture accounts for a higher proportion of GDP, many ecosystems are fragile, and infrastructure is often weak—the negative impacts of invasive species on food security and economic development could cost as much as 20 percent of GDP. Food security is highly dependent on the adequate production of staple foods, yet this is precisely where the impacts of invasives species are most acute. For example, the larger grain borer costs Tanzania $91 million in lost maize production, while soybean rust costs Brazil $1 billion annually. More than half the staple crops planted in developing countries are rou-
tinely destroyed by invasive species, pre- and post-harvest. Data for just eight staple food crops indicate that these yield losses cost $12.8 billion per year. If maize stemborers could be controlled in the maize-producing countries of eastern and southern Africa, enough maize would be saved to feed another 27 million people. If we are to address Millennium Development Goal 1—to halve hunger and poverty by 2015—then we must recognize the threat of invasive species.

Trade is a conduit for introducing invasive species. As the levels of import and export trade increase, so does the risk. For example, shipping is a major pathway for the unintentional introduction of aquatic invaders, carried in ballast water and/or as fouling organisms on the hulls of vessels. There are 6 million containers on the High Seas currently, and it is estimated that the global shipping industry will more than double by 2020. Other pathways of importance include civil aviation, aquaculture, and the pet trade.

Even international assistance programs are not immune to the impacts of invasive species. In 2001, as millions of people in Africa were facing starvation due to droughts and floods, the food aid shipments also acted as pathways for invasive species. For example, Parthenium seeds entered Africa as “hitchhikers” and subsequently invaded surrounding ecosystems, causing irreversible damage. Parthenium competes with native and useful introduced plants; causes allergenic reactions and skin irritation; contaminates seed, grain, and hay; and is toxic to animals. To achieve poverty alleviation, we must begin by removing invasive species as one of the main barriers.

Other species are introduced legally but without an understanding of their potential risk. An example is the agroforestry species Prosopis juliflora, which was introduced into Africa in the 1960s and 1970s as a “miracle tree,” used primarily for firewood. In many parts of Africa, the tree has since become invasive, threatening biodiversity and food security. Commercial farms currently spend considerable sums of money trying to control Prosopis, uprooting them with bulldozers and burning Prosopis trees found on farmland, roadsides, and irrigation and drainage canals. In severe cases, farmers in Ethiopia have been forced to abandon their farms and livelihoods as a direct result of P. juliflora.

To a great degree, we have the knowledge and the technology to prevent, control, or manage most invasive species, thereby avoiding adverse consequences. What appears to be lacking is an awareness of the multisectoral nature of the threat, an international framework for addressing invasive species, and the political wherewithal to take the immediate action necessary to remove this particular barrier to food security and poverty alleviation.

The Global Invasive Species Programme (GISP) was established following the recommendations of the first international meeting on invasive species held in Trondheim, Norway, in 1996. GISP is an international, not-for-profit partnership dedicated to tackling the global threats of invasive species through policy development, awareness-raising, and information exchange. GISP’s mission is to conserve biodiversity and sustain human livelihoods by minimizing the spread and impact of invasive species. GISP’s goal is that by 2020, a majority of countries will have the necessary policies in place to implement their biosecurity strategies and action plans. GISP’s Secretariat—located in Nairobi, Kenya, with offices in Washington, D.C.—is responsible for coordinating GISP’s activities globally and facilitating implementation of the global strategy on invasive species. For further information, please visit the GISP website, www.gisp.org.

Reference


GISP is an international association of four founding partners, namely CABI, the International Union for Conservation of Nature, The Nature Conservancy, and the South African National Biodiversity Institute.

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The World Bank Group (WBG) is one of the major funders of biodiversity and sustainable natural resources management projects. Between 1988 and 2009, the WBG approved 624 projects in more than 122 countries and in 60 multicountry efforts. These projects were funded through almost $2 billion in loans and over $1.4 billion in Global Environment Facility (GEF) resources. In addition, they leveraged more than $2.9 billion in cofinancing, resulting in a total investment portfolio exceeding $6.5 billion (see Figure, at right).

Bank projects directly support biodiversity conservation and sustainable use in a range of natural habitats—from coral reefs to some of the world’s highest mountains, from tropical evergreen and monsoon forests to savanna grasslands and unique drylands, from marine ecosystems to freshwater rivers and lakes. About 7.4 percent of investments have supported marine and coastal ecosystems (as opposed to terrestrial ecosystems). Many are in centers of recognized global importance for biodiversity: mega-diversity hotspots, remaining wilderness areas, the Global 200 Ecoregions, and endemic and Important Bird Areas. A substantial amount of that investment has been dedicated to protected areas, but there is an increasing focus on improving natural resource management and mainstreaming biodiversity into forestry, coastal zone management, and agriculture. Many of these habitats provide critical ecosystem services and can be an important buffer to climate change, providing low-cost options for adaptation and mitigation, especially in countries and regions where communities are most vulnerable to the impacts of climate change.

Patterns of funding for biodiversity have changed over time. In the early years of the period (1989–92), IBRD funded a few large projects—for example, Brazil’s Rondonia Natural Resource Management, Mato Grosso Natural Resource Management, and National Environmental projects, whose cumulative biodiversity investment totaled $200 million. The emphasis has since shifted to lending for a larger number of smaller-sized projects or components within larger projects, with incremental costs often funded by GEF (see Figure, top of next page). Almost half of all Bank biodiversity projects have benefited from Bank lending, demonstrating the commitment of client countries to borrow for biodiversity.

### Regional Differences

The major share (39 percent) of all funding for biodiversity projects went to Latin America and the Caribbean (LAC) ($2.42 billion), with 6 percent to South Asia, 29 percent to Africa, 12 percent to East Asia and the Pacific, and nearly 6 percent to Eastern Europe and Central Asia. Less than 3 percent of total biodiversity funding went to the Middle East and North Africa. A further 5 percent has gone to global initiatives, such as the Critical Ecosystem Partnership Fund, coral reef research, and projects funded under the Bank-Netherlands Partnership Program.
Among the regions, LAC still has the largest share of IBRD funding allocated for biodiversity, with $688.7 million (68 percent). The relatively poorer Sub-Saharan African countries have received the largest share of IDA funding, accounting for 54 percent ($502.1 million) of total IDA biodiversity funds. GEF funding for biodiversity mirrors regular lending. Together the Africa and LAC regions jointly absorb over 60 percent of all biodiversity investments made through GEF, with LAC receiving the highest GEF funding overall, a reflection of the high biodiversity value of the region’s ecosystems and the country capacity to prepare and implement projects.

Protected areas are the cornerstones of most national biodiversity conservation strategies. More than half of GEF investments—in a wide range of countries—have gone toward protected area projects, including support for activities in park buffer zones. In addition to strengthening management of existing protected areas, the Bank has supported the design, establishment, and operation of new conservation areas (Georgia, Indonesia, Lesotho, Micronesia, Panama) and protected area systems (Argentina, Brazil, Congo, Laos, Meso-American Corridor, Philippines, South Africa). To ensure sustainability of financing, the Bank has supported the establishment of numerous conservation trust funds to support park operations and provide livelihood opportunities for the communities in and around those conservation areas.

The 2010 biodiversity target of the Convention on Biological Diversity is to significantly reduce the current rate of biodiversity loss. To date, one positive trend is that protected area coverage—one of the response indicators toward the 2010 target—has doubled over the past 20 years; terrestrial protected areas now cover over 13.9 percent of the Earth’s land surface. The Bank’s biodiversity funding has made a substantial contribution toward this improved global indicator.

### Mainstreaming Biodiversity in Production Landscape and Sectors

The Bank is increasingly seeking opportunities to link biodiversity activities to sectoral development programs, climate change, and rural development—as well as agriculture, forestry, watershed management, land management, coastal zone management, and fisheries—especially where there are opportunities to integrate GEF-funded activities within Bank sector lending. Pilot projects—such as a pilot project focusing on silvopastoral and cattle ranching in Mesoamerica—are now being scaled up through Bank lending. To a lesser degree, biodiversity-related activities have also been incorporated in investment programs for tourism, transport, the private sector (business and private reserves), land tenure, disaster management, energy, climate, hydropower, and the oil industry. Many biodiversity projects have promoted more sustainable livelihoods and poverty alleviation, seeking to reconcile the legitimate needs of both biodiversity and local and indigenous communities.

The scale and variety of Bank financing instruments provide multiple opportunities to integrate biodiversity concerns into development assistance and to address the root causes of biodiversity loss and climate change. The Bank’s leadership and coordinating role within the donor community, which is complemented by access to trust funds and lending resources, can help to introduce biodiversity within national agendas as a critical part of sustainable development and facilitate dialogue between client countries and other stakeholders on matters such as loss of ecosystem resilience, forest law enforcement and governance, wildlife trade, and overharvesting of natural resources. The new multidonor climate investment funds provide exciting new opportunities to further benefit biodiversity while addressing the climate change agenda. Development of the new Environment Strategy in 2010 provides additional opportunities to reassess the added value of Bank engagement in biodiversity and ecosystem conservation and to explore new tools and financing mechanisms to more fully integrate biodiversity conservation in WBG operations.
The whole world is talking about climate change, promising billions of dollars for mitigation and adaptation programs but rarely considering some of the more cost-effective, proven, and sustainable solutions, such as protecting natural ecosystems. Global warming and changes in climate have already had observed impacts on natural ecosystems and species. Natural systems such as wetlands, mangroves, coral reefs, cloud forests, Arctic, and high-latitude ecosystems are especially vulnerable to climate-induced disturbances. On the other hand, forests, grasslands, freshwater, and marine and other natural ecosystems provide a range of services often not recognized in national economic accounts but vital to human welfare: regulating water flows and water quality, flood control, pollination, decontamination, carbon sequestration, soil conservation, and nutrient and hydrological cycling. Enhanced protection and management of these habitats can mitigate the impacts of climate change and help vulnerable communities to adapt.

Terrestrial and oceanic ecosystems play a significant role in the global carbon cycle. Natural ecosystems, especially forests and wetlands, serve as major carbon stores and sinks, mitigating and reducing greenhouse gas (GHG) emissions from energy-related or land-use changes. Forests cover about 30 percent of total land area, but they store about 50 percent of the Earth’s terrestrial carbon (1,150 GtC) in plant biomass, litter and debris, or the soil. Globally, about 20 percent of total GHG emissions are caused by deforestation and land-use changes, but in tropical regions emissions attributable to land clearance are much higher, up to 40 percent of national totals. Reduction

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**Natural Ecosystems**

Convenient and Cost-Effective Solutions to Climate Change

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**HOW PROTECTED AREAS CAN HELP ADDRESS CLIMATE CHANGE**

**MITIGATION**

*Store:* Prevent the loss of carbon that is already present in vegetation and soils

*Capture:* Sequester further carbon dioxide from the atmosphere in natural ecosystems

**ADAPTATION**

*Protect:* Maintain ecosystem integrity, buffer local climate, and reduce risks and impacts from extreme events such as storms, droughts, and sea level rise

*Provide:* Maintain essential ecosystem services that help people cope with changes in water supplies, fisheries, disease, and agricultural productivity caused by climate change

Protected area systems are already established as efficient, successful, and cost-effective tools for ecosystem management, with associated laws and policies, management and governance institutions, knowledge, staff, and capacity. They often protect the last remaining large areas of natural habitats in many areas. Increasing connectivity at the landscape level and improving management can enhance the resilience of ecosystems to climate change and safeguard vital ecosystem services.

Source: Dudley and others 2010.
Feature Articles

of emissions from deforestation and forest degradation is the forest mitigation option with the largest potential for maintaining carbon stocks in standing forests; rare and threatened species would also benefit.

Grasslands occur on every continent except Antarctica and constitute about 34 percent of the global terrestrial carbon stock. Overgrazing, conversion to cropland, desertification, fire, fragmentation, and introduction of non-native species affect their carbon storage capacity and may in some cases even lead to grasslands becoming a net source of CO₂. Wetlands—including swamp forests, peatlands, mires, and marshes—are also important carbon sinks and stores; clearance and drainage can lead to peat collapse and further carbon emissions. Coastal and marine habitats such as mangroves and seagrass beds store even more carbon. Enhanced protection and improved management of natural ecosystems can thus contribute to reductions in GHG emissions, carbon sequestration, and biodiversity benefits. Many protected areas, for instance, overlie areas of high carbon stocks, globally protecting some 15 percent of the terrestrial carbon stock.

Three of the world’s greatest challenges over the coming decades will be biodiversity loss, climate change, and water shortages. Biodiversity loss will lead to the erosion of ecosystem services and will increase vulnerability. Climate change will lead to water scarcity, increased risk of crop failure, pest infestation, and overstocking and permanent degradation of grazing lands and livestock deaths. Water shortages affect agricultural productivity, food security, and human health. Impacts from these challenges are already imposing severe economic and social costs, and they are likely to get more severe as climate change continues, particularly affecting already vulnerable communities.

Adaptation is becoming an increasingly important part of the development agenda. Protecting forests, wetlands, coastal habitats, and other natural ecosystems can provide social, economic, and environmental benefits, both directly through more sustainable management of biological resources and indirectly through protection of ecosystem services. Natural ecosystems maintain the full range of goods and ecosystem services, including water, timber, and fisheries, on which human livelihoods depend. These services are especially important to the most vulnerable sectors of society. Protected areas, and the natural habitats within them, can protect watersheds and regulate water flow and water quality; prevent soil erosion; influence rainfall regimes and local climate; conserve renewable harvestable resources and genetic reservoirs; and protect breeding stocks, natural pollinators, and seed dispersers, which maintain ecosystem health. An increasing number of Bank projects are making explicit linkages between conservation and sustainable use of natural ecosystems, carbon sequestration and watershed values associated with erosion control, clean water supplies, and flood control. Better management of key habitats and natural resources benefits poor, marginalized, and indigenous communities by protecting ecosystem services and access to resources during difficult times, including drought and disaster.

In response to climate change, many countries are likely to invest in even more infrastructure for coastal defenses and flood control to reduce the vulnerability of human settlements to climate change. Increased water shortages will increase demand for new irrigation facilities and new reservoirs. Natural ecosystems can often complement, or substitute for, more expensive infrastructure investments to protect coastal and riverine settlements. Floodplain forests and coastal mangroves provide storm protection, coastal defenses, and water recharge and act as safety barriers against natural hazards such as floods, hurricanes, and tsunamis, while wetlands filter pollutants and serve as water recharge areas and nurseries for local fisheries. Traditional engineered solutions often work against nature, particularly when they...
aim to constrain regular ecological cycles, such as annual river flooding and coastal erosion, and could further threaten ecosystem services if creation of dams, sea walls, and flood canals leads to habitat loss. Instead, in Ecuador and Argentina, flood control projects utilize the natural storage and recharge properties of riparian forests and wetlands by integrating them into “living with floods” strategies—simple and effective solutions that protect both communities and natural capital.

Climate change is likely to aid the spread of invasive alien species (IAS), further threatening agricultural productivity and food security through the spread of weeds, pests, and diseases of crops and livestock. The introduction of new and adaptable exotic species for agriculture, biofuels, mariculture, aquaculture, and reforestation presents a particular challenge. Ironically, the very characteristics that make a species attractive for introduction—fast-growing, adaptable, high reproductive output, tolerant of disturbance and a range of environmental conditions—are the same properties that increase the likelihood of the species becoming invasive. Such events are costly; invasives accidentally introduced through development assistance programs include itch grass, a major weed in cereals in South and Central America, and a range of nematode pests. The economic impacts of IAS can be expensive, costing an estimated $140 billion annually in the United States alone.

Climate change can also be expected to have serious consequences on water resources. Melting glaciers, higher intensity and more variable rainfall events, and increasing temperatures will contribute to increased inland flooding, water scarcity, and decreasing water quality. Overall, the greatest human requirement for freshwater resources is for crop irrigation, particularly for farming in arid regions and in the great paddy fields of Asia. In South Asia, hundreds of millions of people depend on perennial rivers such as the Indus, Ganges, and Brahmaputra—all fed by the unique water reservoir formed by the 16,000 Himalayan glaciers. Current trends in glacial melt suggest that the low flows will be substantially reduced. Even under the most conservative climate projections, net cereal production in South Asian countries is likely to decline by 4 to 10 percent by the end of this century.

Municipal water accounts for less than a tenth of human water use, but clean drinking water is a critical need. Today, half of the world’s people live in towns and cities, and one-third of urban inhabitants live without clean drinking water. These billion havens are unevenly distributed across the globe: 700 million city dwellers in Asia, 150 million in Africa, and 120 million in Latin America and the Caribbean. Governments and city councils are increasingly interested in opportunities for offsetting or reducing the costs of maintaining urban water supplies—and water quality—through management of natural ecosystems, particularly forests and wetlands. Most protected areas are established to conserve biodiversity, but

**The Role of Protected Areas in Carbon Storage and Capture**

- **Madagascar:** Around 6 million hectares of new protected areas are being created, responsible for 4 million tons of avoided CO2, a year.
- **Tanzania:** The Eastern Arc Mountains store over 151 million tons of carbon, 60 percent of which is in existing forest reserves.
- **Russian Federation:** The protection of 1.63 million hectares of virgin taiga forests and peat soils in the Komi Republic is protecting their store of over 71.5 million tons of carbon.
- **Bolivia, Mexico, and Venezuela:** Protected areas contain 25 million hectares of forest, storing over 4 billion tons of carbon, with an estimated value of $39–87 billion.
- **Brazil:** Protected areas and indigenous lands in the Brazilian Amazon are likely to prevent an estimated 670,000 km² of deforestation by 2050, representing 8 billion tons of avoided carbon emissions.

Source: Dudley and others 2010.
many could be justified on the basis of the other ecosystem services they provide. From China to Ecuador and Mexico to Kenya, protected areas in forest watersheds safeguard drinking supplies for some of the world’s major cities. The Gunung Gede-Pangrango National Park in Indonesia, for instance, safeguards the drinking water supplies of Jakarta, Bogor, and Sukabumi and generates water with an estimated value of $1.5 billion annually for agriculture and domestic use.

Bank projects and conservation programs designed to protect natural habitats and ecosystem services are already contributing to effective mitigation and adaptation strategies. Pilot projects that integrate natural habitats and “green” infrastructure into watershed management, flood control, and coastal defense demonstrate the cost-effectiveness of such ecosystem-based approaches. Climate change highlights the need to replicate and scale up such interventions.

Promoting further integration of ecosystem-based approaches into climate change responses and national adaptation strategies will require access to much greater sources of funding, including capitalizing on opportunities to protect natural ecosystems as part of major energy and infrastructure projects. The Bank is also facilitating the development of market-based financing mechanisms and piloting new avenues to deepen the reach of the carbon market. New initiatives and investment funds such as the Forest Carbon Partnership Facility, Forest Investment Program, and the Pilot Program for Climate Resilience provide exciting new opportunities to better protect natural capital, benefit communities, and utilize cost-effective green technology to address the challenges of climate change.

For more information


This article was prepared by Kathleen MacKinnon of the Environment Department. ENV website: www.worldbank.org/environment.
Wind power is widely regarded as a key part of an environmentally sustainable, low-carbon energy future because it is fully renewable and involves near-zero emissions of greenhouse gases (GHGs). Over the past 20 years, wind power has become the world’s fastest-growing source of electricity. However, as with all large-scale sources of power generation, wind energy poses its own particular set of environmental challenges. For example, the inevitable visual impacts of large turbines across the landscape are widely recognized and sometimes controversial. Less widely recognized, but potentially significant, are the adverse impacts that wind power facilities (turbines, new transmission lines, and access roads) can have on biodiversity.

Biodiversity Impacts

Even though wind power development overall might benefit biodiversity by reducing GHG emissions (thus potentially mitigating global climate change), land-based wind power facilities located in sensitive areas often harm birds, bats, and/or natural habitats.

Birds are killed by collisions with wind turbines as well as with the barely visible guy wires around meteorological towers. Although modern large turbine blades appear to be moving rather slowly when viewed from a distance, the blade tip speed is actually very fast (up to 270 km/hour), so the birds are struck by surprise. For certain species groups, such as large birds of prey, wind turbine mortality could become significant from a conservation standpoint. For example, the 2002–05 installation of 68 wind turbines on the Smola archipelago, Norway (previously designated as an Important Bird Area), caused the breeding population of white-tailed eagles (Haliaeetus albicilla) to collapse, declining from about 19 eagle pairs to only one. For some scarce, open-country species such as North American prairie grouse, the main conservation threat posed by wind projects is not collisions but rather displacement from their habitat, because the birds instinctively stay far away from wind turbines, transmission towers, and any other tall structures.

Bats tend to be killed by wind turbines at significantly higher rates than birds. The higher mortality for bats is because (a) bats appear to be attracted to rotating wind turbines, rather than simply encountering them by chance and (b) bats can be killed just by closely approaching an operating turbine without even touching it, due to lung damage from rapid decompression. Because bats have low reproductive rates, populations are potentially vulnerable to the added mortality from wind turbines.

Natural habitats can be lost or fragmented when they are cleared to establish wind power facilities, sometimes with significant risks to biodiversity. For example, wooded mountain ridge-tops (particularly in the tropics) often harbor unique plant and animal species, due in part to their wind-swept microclimate. Long rows of turbines with interconnecting roads along such ridge-tops can disproportionately affect scarce, highly localized species. Constructing access roads to previously remote wind farm sites can also lead to the loss or degradation of natural habitats, either (a) directly, through road construction and resulting erosion or (b) indirectly, through increased land clearing,
Reducing Biodiversity Risks

Various options exist to minimize the adverse biodiversity impacts from wind power. Among the most important of these are project site selection, post-construction monitoring, and (under special circumstances) operational curtailment.

As with other infrastructure development, project site selection is generally the most important tool available for making wind power safer for biodiversity. Where multiple, feasible choices exist for wind power expansion, locating projects away from the most sensitive sites need not reduce overall power generation. From a biodiversity standpoint, the higher-risk sites for locating wind farms tend to be existing or proposed protected areas, critical natural habitats (including Important Bird Areas), wildlife migration corridors, forests and woodlands, wetlands, shorelines, small islands, native grasslands or shrub-steppes, and sites near caves. Conversely, lower-risk sites tend to have low bird and bat numbers (year-round) and do not harbor species or ecosystems of conservation concern; they include many cultivated lands, non-native pastures, and deserts (away from coastlines and oases). Once the general site for a new wind farm has been selected, adjusting the location of turbine rows—or even individual turbines—can sometimes minimize biodiversity impacts without significantly compromising power generation or other objectives.

Post-construction monitoring of bird and bat mortality is an essential part of proper environmental management for any wind power project. Monitoring is indispensable for (a) knowing whether or not a significant bird or bat mortality problem exists at any given wind farm, (b) predicting the impacts of scaling up development within a particular wind resource area, (c) supporting adaptive management of wind farm operation to reduce bird or bat mortality, and (d) advancing scientific knowledge. Such monitoring, which involves searching for bird and bat carcasses around turbines, towers, and transmission lines, should be carried out during the first two or so years of wind farm operation and continued if significant mortality is found.

Operational curtailment refers to selected, short-term periods when turbine rotor blades are intentionally kept from rotating. For bats, the most cost-effective type of operational curtailment appears to be a modest increase in cut-in speed, the lowest wind speed at which the rotor blades spin and generate electricity for the grid. Recent, cutting-edge research at wind farms in Canada, Germany, and the United States shows that increasing the cut-in speed from the usual 3.5–4.0 meters/second to about 6 m/s reduces bat mortality by 50–75 percent, while reducing power generation by only about 1 percent. Bats fly around mostly at low wind speeds and mainly at night (and, at higher latitudes, during only part of the year).

For migratory birds, the most useful form of operational curtailment may be short-term shutdowns, in which the rotor blades do not turn during peak migration events. These shutdowns can be cost-effective in preventing large-scale mortality of migratory birds, when species pass through the wind farm area for only a few days or weeks per year. Shutdowns can be scheduled in advance on a precautionary basis to coincide with expected dates of peak bird passage. They can also be on-demand in real time, if radar and/or human spotters show sizable flocks headed toward the wind farm. This approach has been effectively demonstrated at the World Bank–supported Wind Umbrella (La Venta II) Project in southern Mexico.

Forthcoming Report—Greening the Wind

A recent World Bank study examined the environmental and social implications of rapidly scaling up wind power development. The study’s technical report, Greening the Wind: Environmental and Social Considerations for Wind Power Development, is scheduled for publication later in 2010. This report (a) identifies good practices for managing the biodiversity and other environmental and social issues associated with wind power development and (b) offers practical advice on how best to address these issues in project planning, construction, and operation. The World Bank Group will continue to collaborate with our clients and development partners in supporting wind power in ways that effectively address environmental and social concerns, thereby optimizing the sustainable development benefits of this renewable energy technology.

This article was prepared by George Ledec (gledec@worldbank.org) of the Africa Region Environment and Natural Resource Management Unit.
Tigers are icons of global biodiversity. As apex predators, they are indicators of the health of the ecosystems they inhabit. Their plight epitomizes a profound biodiversity crisis across Asia. Habitat destruction, poaching, and illegal trade have led this species to a range collapse, despite decades of conservation efforts, with only 3,200 animals remaining in the wild, down from about 100,000 a hundred years ago. Climate change impacts, deforestation, habitat degradation, urbanization, and infrastructure development also present formidable challenges for tiger-range countries (TRCs). Without urgent action, wild tigers could disappear during the next decade.

Launched in June 2008 by World Bank President Robert Zoellick—together with the Smithsonian Institution, Global Environment Facility, and International Tiger Coalition—the Global Tiger Initiative (GTI) is an alliance of the 13 TRCs—Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Russia, Thailand, and Vietnam—and their global partners toward the ambitious goal of reversing the decline of wild tigers and doubling their numbers—to at least 7,000—by 2022.

Most solutions to the tiger crisis are well known and have proved effective at local scales. They require a matrix of actions in wildlife law enforcement and governance, smart green infrastructure, landscape and park management, community incentives, demand management, and innovative sustainable financing. The challenge is to generate the political will to scale up these actions. The Bank and its GTI partners are working to create some political space for decision makers to launch the necessary programs and ensure their effective implementation, backed by the coherent support of the international community. Such actions would have a “multiplier” effect for tiger landscapes, as well as supporting broader biodiversity values.

GTI activities are timed to “ride the wave” of global public interest related to 2010 as the Year of the Tiger and the International Year of Biodiversity. According to Bank President Zoellick, “2010 is the most important year ever for the tiger—it MUST be the year we take decisive steps to save this majestic species.”

TRCs have exercised strong leadership in developing the Global Tiger Stabilization and Recovery Program. Nepal and Thailand hosted milestone GTI events, bringing together all interested countries and international partners at a Global Tiger Workshop in Kathmandu in October 2009, as well as the Asia Ministerial Conference on Tiger Conservation in Hua Hin, Thailand, in January 2010. In September 2010, Russia will host the “Tiger Summit” in Vladivostok, where the global program will be endorsed by heads of government and global partners.

For the World Bank, GTI represents a signature instrument to move from the “do no harm” approach to the “do measurable good” approach by placing climate change, biodiversity, and ecosystems within the mainstream of the development paradigm. According to James Adams, Vice President for East Asia and Pacific Region: “How well the GTI is internalized into the World Bank’s everyday business in Asia—its work on infrastructure, its investments, its role in urbanization, and its own ecological footprint—will be the real test of our seriousness.”

This article was prepared by Andrey V. Kushlin (akushlin@worldbank.org) of the World Bank. GTI website: www.globaltigerinitiative.org.
With biodiversity loss increasing at an unprecedented rate, the GEF, World Bank (WB), and the International Union for Conservation of Nature (IUCN) plan to establish the Save Our Species (SOS) program to focus fund-raising efforts on a scale necessary to adequately address the biodiversity extinction crisis.

It is estimated that 15 to 37 percent of all species are committed to extinction by 2050 unless widespread and effective conservation actions are undertaken soon and maintained. Losses of that magnitude have massive implications. Species are the building blocks of biodiversity and ecosystems and provide us with essential services: not only food, fuel, clothes, and medicine, but also purification of water and air, prevention of soil erosion, regulation of climate, and pollination of crops. They also provide a vital resource for economic activities—notably tourism, fisheries, and forestry—as well as having significant cultural, aesthetic, and spiritual values.

A key strategy for the SOS project is to leverage new funds from private companies that use animals and plants in their logos. With the Bank, GEF, and IUCN providing the seed capital for this initiative, SOS will request support from international corporations, foundations, individuals, and governments. It will provide the private sector and other donors with a mechanism to contribute to efficient, credible, and coordinated species conservation action around the world through competitive grants to civil society partners.

SOS is intended to support immediate action on species conservation priorities derived from the IUCN Red List and the Species Survival Commission’s Species Profiles and Action Plans. Expected global benefits include averting extinction of multiple threatened species, as well as the increased participation and capacity of national and local civil society groups to manage and deliver conservation initiatives in a strategic and effective manner linked to development, landscape planning, and natural resource management. These interventions are expected to lead to the generation and adoption of lessons for improved conservation outcomes, relevant both to SOS and the broader Bank and GEF biodiversity portfolios, as well as to other small- and medium-size grant programs. By saving species, we save biodiversity and the ecosystems that provide the natural resources we need to survive.

The Save Our Species project will be launched in May 2010 as part of the celebration of the International Year of Biodiversity. The Fonds Français pour l’Environnement Mondial has also generously agreed to partner with the program. The World Bank through the Development Grant Facility and GEF has contributed substantial funds to establish the program ($5 million and $4.9 million respectively). Save Our Species will be managed through a secretariat housed within the IUCN for the allocation of funds. Grants will be awarded on a competitive basis and according to strategic directions identified in consultation with IUCN’s Species Program and Species Survival Commission.

**This article was prepared by Claudia Sobrevila (csobrevila@worldbank.org). SOS website: www.sospecies.org.**
Founded in 2000, the Critical Ecosystem Partnership Fund (CEPF) is a unique partnership, enabling civil society to participate in—and benefit from—conserving some of the world’s most critical ecosystems. CEPF provides grants for nongovernmental and private sector organizations to help protect biodiversity hotspots, the Earth’s most biologically rich yet threatened areas. These 34 hotspots cover only 2.3 percent of the planet’s land surface, yet have each lost more than 70 percent of their original natural vegetation. Their protection is critical for both biodiversity conservation and the needs of millions of people who live at the rural frontier. The fund’s support equips civil society groups to conserve their environment and influence decisions that affect lives, livelihoods, and, ultimately, the global environment. Grant recipients range from small farming cooperatives, indigenous groups, and community associations to private sector partners and international organizations. Grants are guided by regional investment strategies developed with stakeholders. This approach creates working alliances among diverse groups, combining unique capacities and eliminating duplication of efforts.

Since its first grant, awarded in 2001, CEPF has supported civil society organizations to protect biodiversity in 18 hotspots across 51 countries. Grants support a range of activities from species inventory to community management of sacred forests and from creation of comprehensive forest, rangeland, and wetland management plans to new communal and national protected areas in Africa and Latin America. To date, CEPF grant recipients have helped protect more than 10 million hectares and have improved management of double that amount in rich ecosystems that are life-lines for communities and nations alike. Within the next year, activities will expand to three additional hotspots for which ecosystem profiles are being prepared: the Caribbean Islands, the Mediterranean Basin, and the Maputaland-Pondoland-Albany hotspot in southern Africa.

With the support of the World Bank and the other CEPF partners—l’Agence Française de Développement, Conservation International, the Global Environment Facility, the government of Japan, and the John D. and Catherine T. MacArthur Foundation—CEPF’s global portfolio has included more than $120 million in investments to support innovative initiatives by more than 1,500 nongovernmental and private sector organizations. This support has leveraged a further $220 million to support conservation.

With CEPF support, NGO and community initiatives have resulted in real gains for species, spaces, and communities. Examples of achievements by CEPF grantees in the field this year are described here.

**Support to new protected areas in Africa.**
In the vast arid plains and coast of the Sperrgebiet region of Namibia and the lush forests of the Uluguru Mountains of Tanzania, CEPF grantees are helping to protect ecosystems that are crucial to people and biodiversity. The declaration of Sperrgebiet National Park in Namibia boosted the extent of protected habitat in the Succulent Karoo, one of just two desert biodiversity hotspots. The 2.6-million-hectare park includes land...
Biodiversity Hotspots

To date, CEPF grants have supported civil society in 18 of the 34 biodiversity hotspots. Ecosystem profiles are being developed in three more hotspots (in italics) to begin investments.

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<th>Region</th>
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<td>Africa and Madagascar</td>
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<td>Coastal Forests of Eastern Africa</td>
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<td>Eastern Afromontane</td>
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<td>Madagascar and Indian Ocean Islands</td>
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that has remained virtually untouched for more than 100 years and is a refuge for nearly 25 percent of Namibia’s plant species. The large swath of natural habitat provides a buffer to climate change. CEPF supported the Namibia Nature Foundation in development of management and tourism plans for the region. In Tanzania, the 24,000-hectare Uluguru Nature Reserve was established with support from CEPF and a UNDP/GEF project. Conserving these mountain forests protects the headwaters feeding the Ruvu River, the major water supply and hydroelectric power source for millions of Tanzanians.

A carbon offset payment scheme in the Chiapas region of Mexico that benefits farmers who use conservation coffee practices and reforestation. The AMBIO Cooperative and NGO Aires de Cambio, with support from CEPF, brought farmers in 20 villages into the program. They are planting trees on their plantations and as living fences to control livestock movement. Participating growers are also interplanting their coffee with trees that provide edible legumes, which help to fertilize the soil and provide partial shade for the coffee plants and habitat for birds and other species. Companies and other entities looking to offset their own carbon emissions purchase carbon credits generated by the project, providing payments to the growers.

Training for new livelihoods that benefit Indian communities and tigers. Villagers on the fringe of the Manas Tiger Reserve in northeastern India are learning new skills, boosting their incomes and changing their relationship with their lush but overtaxed ecosystem. To help these communities reduce dependency on the forest, CEPF supported the Dolphin Foundation to develop sustainable livelihoods by providing instruction in silk farming, apiculture, handloom weaving, and marketing. More than 200 residents in 12 indigenous villages are now generating income from their chosen new vocations. The villagers now associate the project’s benefits with the existence of the park and are stepping forward to support its protection.

Engaging people in sustaining their natural wealth in Colombia and Mexico. Aided by CEPF, a community council in the Málaga Bay area of southwest Colombia successfully advocated for the government’s creation of two reserves: La Plata Integrated Management System and the Regional Natural Park of Sierpe. These reserves protect coastal mangrove forest and the resources and biodiversity the forest hosts. In the state of Veracruz in Mexico, CEPF supported Mexican nonprofit Pronatura in its work with communities to establish local management of communal lands. Three villages have been awarded 50-year management of reserves where they live, and they have pledged to preserve trees, curtail poaching and logging, and otherwise protect the reserves.

Improving forest and rangeland management in Armenia. In Armenia, villagers, nonprofit organizations, academic institutions, and the national government have teamed up to restore native tree cover and help residents manage their lands sustainably. Supported by CEPF and WWF–Armenia, the Armenian Tree Project (ATP) and Yale’s Global Institute of Sustainable Forestry conducted the most in-depth forest evaluation in northern Armenia since the nation’s independence in 1991. ATP staff, Armenian forestry students, and government employees learned data collection techniques, sampling design, and inventory analysis and created a forest and rangeland management plan, as well as a sustainable forestry manual. Tens of thousands of native trees have been planted in demonstration plots in two neighboring communities. There is also a new community orchard where young people get environmental education and villagers receive range management training. The accomplishments of this partnership have brought sustainable forestry concepts to the forefront of environmental policy discussions in Armenia.

Everyone depends on Earth’s ecosystems and their life-sustaining services, such as clean air, fresh water, and healthy soils. In the world’s biodiversity hotspots, CEPF is helping millions of impoverished people who depend on critical ecosystems for survival to achieve important conservation outcomes through a stronger voice, influence, and action by civil societies, ensuring benefits for both conservation and communities.
WHAT’S FOR DINNER?
- At least 30,000 of the world’s plants are edible.
- We eat some 7,000 of them, but only 150 are commonly consumed.
- Twenty edible plants make up 90 percent of the world’s food, with three grains—wheat, rice, and maize—accounting for 50 percent of the world’s food energy intake.

THE DEEP BLUE SEA
- The oceans cover more than 70 percent of the Earth and contain 99 percent of the planet’s living space. Humans have explored less than 10 percent of that space.
- Ninety percent of the ocean’s volume constitutes the dark, cold environment we call deep ocean water.
- Average depth of the ocean: 3,795 meters. Average height of the land: 840 meters.
- An estimated 50–80 percent of all life on Earth is found in the ocean. There are currently more than 170,000 valid marine species, according to the World Register of Marine Species. According to the Census of Marine Life, there could be more than 1 million marine species.
- Sharks attack some 50–75 people each year worldwide, usually with 8–12 fatalities (IASF); whereas, some 20–100 million sharks are killed every year as a result of fishing activities.

ARE WE ALONE?
- Over the past 250 years, scientists have identified and named some 1.78 million species of animals, plants, and microorganisms. Today about 15,000 new species are discovered every year.
- Earth’s total number of species is unknown. Estimates place the number at 5–30 million.
IT’S THE END OF THE WORLD AS WE KNOW IT

♦ One and a half acres of rain forest are lost every second. Deforestation is resulting in the loss of 137 plant, animal, and insect species every day. As the species disappear, so do possible remedies for numerous diseases. To date, about 25 percent of Western drugs are derived from rain forest plant species, yet less than 5 percent of rain forest plants have been studied.

♦ The rate of extinction is accelerating. Thirty-eight bird and mammal species became extinct between 1600 and 1810, compared to 112 species between 1810 and 1995 (McDaniel and Gowdy 2000). Of the 129 recorded bird extinctions, 103 have become extinct since 1800 (Birdlife International 2000).

SIZE MATTERS!

♦ The Amazon rain forest covers 566–670 million hectares. If Amazonia were a country, it would be the ninth largest in the world. One hectare may contain over 750 types of trees and 1,500 species of higher plants.

♦ Twelve countries—Australia, Brazil, China, Colombia, Costa Rica, Democratic Republic of Congo, Ecuador, India, Indonesia, Madagascar, Mexico, and Peru—are home to 70 percent of the world’s species, many of which are endemic.

♦ Earth’s largest animal ever (even bigger than the greatest known dinosaurs) is the endangered blue whale. It can measure up to 30 meters long and weigh as much as 180 tons; its heart is the size of a Volkswagen Beetle.

♦ At 15.25 meters long, the snakelike oarfish is the longest bony fish in the world. With a dorsal red fin running its length, a horselike face, and blue gills, the oarfish accounts for many sea-serpent sightings.

FROM THE EQUATOR TO THE POLES, BIODIVERSITY RULES!

♦ Ecuador’s Yasuni National Park may contain the highest terrestrial biodiversity in the world. For example, one hectare of forest may contain some 100,000 species of insects. And contrary to previous thought, the polar regions can be rich in biodiversity as well. The South Orkney Islands and their surrounding waters have more biodiversity than the Galapagos Islands!

WATCH WHERE YOU STEP...

♦ Forest soils are one of the most diverse ecosystems on Earth. Depending on the forest type, a square meter of soil could contain more than 1,000 invertebrates and countless micro-arthropods. An old-growth forest supports more than 56 times as many insects and bugs belowground as it does aboveground.

...AND WHAT YOU DRINK!

♦ Billions upon billions of microscopic creatures live in the ocean. A mouthful of seawater may contain tens of thousands of zooplankton, hundreds of thousands of phytoplankton, and millions of bacterial cells.

LOOKING AT FROGS, LOOKING AT YOU

♦ Frogs have amazing eyes. Frogs can see to the front, sideways, and up at the same time and their eyes remain open when they sleep. The eyes even help a frog swallow its food; each blink pushes the eye down, pressing onto the roof of mouth and creating a bulge. This bulge pushes food inside the frog’s mouth down the frog’s throat.
Managing Conflicts Between People and Wildlife in Botswana and Namibia

Conflicts between people and wildlife are a widespread problem in rural Africa, especially when the animals attack or kill people or damage crops or livestock. Such conflicts are increasing, in part because of the loss of critical wildlife habitat and the closer proximity of wildlife and people. If left unmanaged, human-wildlife conflicts (HWC) could become one of the main threats to the survival of some iconic wildlife species, including elephants and large carnivores such as lions. Such conflicts can undermine local support for conservation.

This brief review focuses on proactive prevention strategies to reduce conflict areas outside of formally protected areas in Botswana and Namibia, where elephants and large predator species come into contact with rural subsistence agriculturalists.

Botswana

Although the lion population in Botswana remains healthy, conflicts are increasing between humans and large cats in the northern and central districts, and there is growing concern about the number of lions being killed. Comprehensive strategies are needed to address this problem.

Another major concern in northern Botswana is human-elephant conflict. During the period from 1994 to 2004, the elephant population in Botswana nearly doubled, making it probably the largest elephant population in Sub-Saharan Africa. Only 20 to 30 percent of Botswana's elephants reside in the protected area network. As a result, conflicts between people and elephants outside formally protected areas are increasing, especially along elephant migration corridors.

Conflicts between people and wildlife are also having significant impacts on subsistence farming and livelihoods. In a unique effort to reduce the conflict and promote conservation, compensa-
tion programs for wildlife damage have been implemented. These programs provide direct compensation to farmers for crop and livestock losses caused by wildlife. While the program has helped affected farmers, it has also created disincentives to protect crops and manage livestock in a more sustainable manner. The total annual costs (compensation and recurrent) in Botswana are currently estimated at $6.8 million.

The government recognizes that these and other complementary subsidies facilitate the expansion of subsistence agriculture and habitat conversion and result in practices that are unsustainable. Accordingly, the Department of Wildlife and Parks—with two local NGOs and support from the Bank and GEF—has prepared a project that will contribute to Botswana’s long-term goal of enhancing coexistence between rural communities and key wildlife species through proactive conflict prevention and development of local employment through wildlife-based tourism.

The project will target 13 villages. These villages are along three important biodiversity regions in northern Botswana—the Okavango Delta panhandle, the Chobe-Linyanti wetlands, and the Makgadikgadi wetlands.

Project interventions will actively encourage 1,500 households to adopt elephant restraining techniques—such as chili pepper fences—to discourage elephants from invading farmers’ fields. Hot chili varieties can be locally grown. Chili paste and grease are mixed together and applied to the perimeter fence using mutton cloth. If elephants make contact with the string, the hot chili causes irritation to the animal. As crop-raiding elephants become accustomed to these control methods, farmers must be trained to apply other deterrent methods. The project will therefore pilot additional approaches, such as using early maturing seeds, solar-powered restraining fences, and beehives mounted strategically around crop fields (beehive fences). Community members will be trained in management-oriented monitoring systems to track and analyze HWC data and inform management decisions.

Namibia

Most of the rural population in Namibia lives on communal land formally owned by the government. Conservancies are established under the Nature Conservation Amendment Act and constitute a structure through which rural communities can maintain users rights for the ownership and use of game. At present, there are more than 50

Since the mid-1990s wildlife conservation projects in the mountainous regions of Uganda have been vital factors in protecting the mountain gorilla and its habitat, creating thousands of new conservation jobs and a thriving new tourism industry.

Prior to that time poaching was rampant and institutional capacity was weak. Beginning in 1995 with the Bwindi Impenetrable National Park and Mgahinga National Park Conservation project, and continuing in 1999 with the $35 million Protected Areas Management and Sustainable Use (PAMSU) project, the Bank and GEF provided the financial foundation for a long-term program of sustainable biodiversity conservation. The Bwindi Trust is now considered a model of innovative conservation finance and management; its original endowment of $4 million has generated income that assisted communities with alternative livelihoods and underwritten core operating expenses of gorilla parks.

Thanks in large part to the Bwindi and PAMSU projects, poaching has been all but eliminated in Bwindi. Gorilla populations, tourist visitation, and revenues have all climbed steadily. Across Uganda, the 1,300-member staff of the Uganda Wildlife Authority (UWA) are well trained and equipped for the first time in living memory. PAMSU has delineated park boundaries in all 23 of Uganda’s protected areas, has provided critical infrastructure such as roads and staff housing, and has been instrumental in helping communities form co-management partnerships with UWA that promote conservation and provide alternative livelihoods and social services such as education and health clinics.

The PAMSU project will close in June 2010 and leave a legacy of successful partnerships among World Bank, GEF, and Ugandan stakeholders. A new project in the Democratic Republic of Congo (DRC) has just begun to support management in the Mikeno sector of the Virunga National Park, an important habitat for mountain gorillas. Since some of the gorilla groups cross back and forth from DRC to Uganda and Rwanda, the Mikeno activities will complement and supplement transnational efforts to protect this charismatic species.
registered conservancies in Namibia. Their formation has become a social development movement, as well as an accepted and holistic approach to conservation. Together with the USAID LIFE program, the Bank and GEF have provided support to conservancies for participatory land-use planning, development, and extension of community wildlife management and monitoring. This support has facilitated the strategic introduction of wildlife in conservancies with low game densities and has diversified income generation opportunities to increase non-financial benefits and new income to households.

Several measures to reduce conflict between wildlife and people have been tried in the conservancies, including the protection of water installations and the provision of alternative water points for elephants away from settlements. A self-insurance scheme, the Human Animal Conflict Self Insurance Scheme, allows conservancies to compensate individuals who have lost livestock to predators, but under conditions aimed at improving livestock management and preventing further incidents. Currently, conservancies cover 50 percent of the costs from their own funds; the aim is that conservancies eventually will fully fund the scheme.

Data produced by the insurance scheme can be used to improve livestock management. Communities also have their own monitoring system that gathers data on instances of wildlife conflict, wildlife mortality, levels of rainfall, and meeting frequency and attendance. Gathering this information gives local people valuable skills and allows them to better understand the linkages between their actions, resources, and benefits.

The Community-Based Natural Resource Management program in Namibia has already demonstrated the effectiveness of devolving management authority over wildlife to landholders as a conservation mechanism; the model could be replicated by neighboring countries such as Botswana. Local and regional forums to improve community coordination and improved management of conflicts between people and wildlife will further enhance conservation efforts.

Madagascar — Supporting a Protected Areas Network in a Time of Political Turmoil

Recognizing its unique biodiversity resources (see Box, at right), in 2003 Madagascar pledged to triple its protected areas coverage to 6 million hectares, or approximately 10 percent of the country’s surface area.

In a relatively short time, the nation’s pledge is bearing fruit. Madagascar’s protected areas network currently includes 2.6 million hectares of national parks managed by Madagascar National Parks (MNP, formerly ANGAP). In addition, 3.2 million hectares of new protected areas are being developed by international NGOs—including WWF, Conservation International (CI), and the Wildlife Conservation Society—on behalf of the Ministry of Environment and Forests. Moreover, the annual deforestation rate in Madagascar has fallen from 2 percent to only 0.5 percent.

The nation’s protected areas network contains very high levels of species endemism in all groups from mammals (lemurs) to butterflies. It is considered the single highest priority area on Earth for conserving primate diversity, with all primate species unique to the island. Protected areas also are the backbone of the tourism industry (worth $400 million per year) and provide environmental services such as carbon sequestration and water flow regulation.

Funding from the International Development Association (IDA) and GEF to the Third Environmental Program (EP3) supports 60 percent of MNP parks (28 parks covering 1.6 million hectares) and 15 percent of new protected areas (one corridor covering 0.5 million hectares). Overall, EP3 finances the management and development of 2 million hectares of protected areas, a third of the emerging network, at a cost of about $4 million per year.

Going forward, Madagascar faces two distinct challenges: reducing its dependence on donor assistance and recovering from a period of political turmoil, which threatens protected areas and biodiversity conservation.
Development assistance—from donors such as IDA, GEF, and the European Commission—currently accounts for about 90 percent of MNP’s budget. New protected areas development is also financed by multiple donors, such as the Critical Ecosystem Partnership Fund, the Global Conservation Fund, and private foundations such as the Moore and MacArthur foundations.

In the future, it is hoped that an increasing percentage of operational costs will be covered by a conservation fund, carbon finance (avoided deforestation), and park entrance fees and other fiscal revenues from tourism. The Madagascar Foundation for Protected Area and Biodiversity—an endowment fund supported by France, Germany, IDA through EP3, WWF, and CI—is expected to increase its capital fund to $50 million by 2012.

Madagascar plunged into political turmoil at the beginning of 2009 after an unconstitutional change of government. As a result, the Bank and other donors suspended funds to Madagascar.

The collapse of law and order resulted in increased threats to the national parks and other protected areas, with growing illegal logging and poaching. There were concerns that weakened protection of the parks could cause irreparable losses for the global environment and biodiversity, and perhaps even lead to local extinction of some species. The Bank has since decided to resume partial disbursement of project funds to ensure adequate protection of protected areas and support to local communities.

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Biodiversity Conservation in Production Landscapes in Africa

In South Africa, the Cape Floristic Region—world famous for its astonishing diversity of plant and animal life and one of the most important biodiversity hotspots in the world—is under increasing pressure from human development, in part because about 80 percent of the land with important biodiversity resources is under production and is privately or communally owned. In an effort to save these resources, the Cape Action Plan for People and Environment (C.A.P.E.) partners—government and civil society—have introduced new models for biodiversity conservation in the agricultural landscape. The biodiversity-friendly production concept involves creative partnerships between agricultural producers, industry associations, retailers, communities, and conservationists, working together to conserve valuable biodiversity, such as sustainably harvested/cultivated rooibos tea and potatoes, badger-friendly honey, and biodiversity-friendly wine. The South African companies and producers involved in these initiatives have helped to establish new models for biodiversity conservation. At the same time, they are helping to guarantee the sustainability of their businesses through certification and marketing of their products in niche markets.

The Ghana Northern Savanna Biodiversity GEF Project and the Burkina Faso Partnership for Ecosystem Management GEF Project have pioneered biodiversity conservation in production landscapes, creating two biological corridors between the countries to allow free movement of wildlife, transboundary spatial planning, community empowerment, agrobiodiversity, and more. The projects focused on activities in production landscapes that could keep the corridors intact and on livelihood strategies for nearby communities, such as agroforestry, beekeeping, shea-butter production, ecotourism, medicinal plants cultivation, and the reintroduction of indigenous crops that are more drought-resistant and nutritional. These activities resulted in very good impacts on conservation of biodiversity in production landscape, wildlife corridors creation, and livelihood enhancement.
The biodiversity of East Asia and the Pacific is in considerable danger. The region’s peat swamps and other wetlands are being drained or are drying up due to large-scale irrigation schemes and oil palm plantations. The grand forests of the Far East continue to be lost to illegal logging, agricultural encroachment, and forest fires. River fish—already threatened by invasive species—are being poisoned, bombed, and netted in such large numbers that the riparian people who used to depend on these resources now go without. Coral reefs in the Coral Triangle—the epicenter of global marine biodiversity—are under threat from overfishing, blast fishing, cyanide fishing, and climate change.

The World Bank is working with governments, civil society, and nongovernmental organizations to respond to these problems in a variety of ways, focusing on biodiversity conservation in the context of watershed management, strengthened efforts to control illegal wildlife trade, and the expansion and improved management of protected areas (PAs). The Bank has also carried out an active program of research on biodiversity conservation in Mongolia.

Watershed Management

The largest biodiversity project in the region is related to a public-private sector offset from the Nam Theun 2 hydropower project in Lao PDR, which is providing $31.5 million over 30 years for the reservoir’s watershed management and livelihood improvements for the communities within the watershed. The protected area covers 4,500 km². The financing is intended to protect biologically rich forests to offset the inundation of forest area, which is about one-ninth of the protected area. The World Bank and other international finance institutions helped establish the Watershed Management Protection Authority (WMPA) through a Prime Minister’s decree. The WMPA is responsible for management and monitoring of the watershed forests. When the reservoir started filling and accessibility to the watershed from the populated southern shores increased, the project faced its most challenging phase. Greater accessibility has led to increased poaching, illegal logging, and encroachment. In addition, there have been a number of unanticipated threats to the
Illegal Wildlife Trade

The enormous scale of the wildlife trade, much of it illegal, has robbed almost all the region’s forests of their vertebrate seed dispersers, pollinators, and the prey for whatever large predators that have thus far avoided the snares and hunters. The wildlife in many of East Asia’s forests is naturally rare, but nowadays it is even more unusual to see animals except in a handful of managed protected areas, such as Hustai in Mongolia and Nantu in Indonesia. Many forests are now “empty” and any mammal or reptile sighting is notable.

At the last World Conservation Congress, the Bank’s EAP Region launched—together with TRAFFIC—a report entitled What’s Driving the Wildlife Trade? The report focuses on wildlife trade in general and on tigers, agarwood, and various species of tortoises and freshwater turtles in particular. The study aims at assessing the effectiveness of measures used to halt illegal and/or unsustainable trade, generates recommendations for governments and others to follow to reduce such trade, and is believed to be the first of its kind.

The report concludes that (a) wealth appears to be a stronger driver of illegal and/or unsustainable wildlife trade than poverty, (b) interventions need to take into account the broader conditions and trends that drive illegal and/or unsustainable wildlife trade, (c) laws and regulations need to be effectively implemented and enforced, (d) non-regulatory approaches to controlling illegal and unsustainable trade are underused, (e) awareness efforts need to be targeted to specific audiences and their effectiveness evaluated, and (f) mutually reinforcing interventions are required to address illegal and/or unsustainable wildlife trade. These conclusions are not necessarily applicable to every product or every national circumstance, but they serve as a starting point for further investigation and refinement. Moving forward from the Driving report, a major campaign was launched against the illegal wildlife trade as part of the Southeast Asian Games in Vientiane in December 2009. This campaign was initiated by the Lao government and is being supported by the World Bank, NGOs, and the private sector.

Protected Areas

Also in Lao PDR, new IDA resources were approved in 2009 for a trust fund within the Lao Environment and Social Project. Projects being funded under the Biodiversity Window include the drafting of a new regulation for national protected areas, which is scheduled to become a Prime Ministerial decree. The new project will raise the authority of protected area managers, fund protected area management planning in three provinces, and train PA staff in best practice approaches.

GEF medium-size projects (MSPs), using grants up to $1 million, have been a major element of the region’s biodiversity portfolio over the last decade. Burung Indonesia—the BirdLife International affiliate in Indonesia—is implementing an MSP in and around the Aketajawe-Lolobata National Park on Halmahera in eastern Indonesia. The PA management is forming partnerships with communities, logging companies, government, and nickel mines. Another MSP supported protected areas in central Laos. This project successfully used a systematic landscape approach to assess key biodiversity areas where wildlife monitoring, law enforcement, and community support should be focused. A follow-up project focusing on the important Nam Et–Phou Louey protected area is in the pipeline.

In Indonesia, forest and biodiversity loss are global concerns. An innovative project under preparation is seeking to take advantage of a new policy environment. Outside the 30-million-hectare national park system, an additional 20 million hectares of logged-over production forests are no longer under concession license either because the logging companies lost their licenses for underperforming or because the quantity of timber left is no longer attractive for commercial operators. These areas are now targets for illegal logging and conversion. In response, the Ministry of Forestry has launched a policy to allow companies to develop non-timber and environmental service-based businesses within former logging concessions.

Another policy allows licenses for ecological restoration to be granted for logged-over concessions. This “restoration” policy encourages the full integration of biodiversity conservation objectives into the management of a production forest. This project is being executed by both Burung Indonesia and the Ministry of Forestry. Burung Indonesia holds the first ecological restoration concession in Indonesia, Harapan Forest, which lies on the border between Jambi and South Sumatra.
Harapan has 900,000 hectares of good forest cover and will be managed for biodiversity and ecosystem services. The new project will build on the Harapan experience to expand lessons into new concessions in eastern Indonesia. It complements other Bank efforts to build up the legal, institutional, and technical base needed for Indonesia to take advantage of new financial incentives and carbon incentives associated with reducing deforestation and degradation under the climate change agenda.

In Aceh, at the northern tip of Sumatra, funds from the World Bank–managed Multi-Donor Trust Fund are supporting Fauna and Flora International and the Leuser International Foundation to execute a $17.5 million project to help mitigate the negative impacts of post-tsunami reconstruction interventions on the forests of Aceh, mainstreaming environmental concerns into planning processes, and building sustainable capacity and institutions for forest protection. The project is thus helping to ensure that ecosystem services provided by the biodiversity-rich forests are maintained, supporting Aceh’s future social and economic development. Forest management and protection are vital to support and sustain Aceh’s reconstruction and recovery process. The project will ensure that conservation and environmental concerns are integrated into Aceh’s reconstruction and development planning process and that management structures and governance systems are maintained to assure delivery of the project objectives.

Marine protected areas are also being established. With help from the GEF, the World Bank Group, the Asian Development Bank, and a host of bilateral donors and NGOs, the countries of the Coral Triangle region are committed to reversing harmful marine harvesting practices. COREMAP and the Coral Triangle Initiative, which includes a Pacific component involving Pacific small-island developing states, are channeling significant resources to establish effective networks of marine protected areas, manage valuable tuna stocks more sustainably, and engage communities in better management of their coastal resources.

**Mongolia**

Over the last few years, the Bank has carried out a wide range of relatively small but mutually supportive and strategic activities focusing on biodiversity in Mongolia. This work has been financed from a variety of sources, notably the government of the Netherlands. A report on illegal wildlife trade—*The Silent Steppe*—has spawned a series of additional initiatives ranging from undercover surveys of wildlife markets and hospitals to ride-along surveys by a law enforcement task force, public awareness of the trade, training in crime-detection software, and a review of the necessary amendments to the Law on Hunting.

Mongolia recently became the first developing country to assess the national threat status of all its vertebrate species. This information feeds into an online geographic species search tool, which the government is planning to require all consultants to use when undertaking environmental assessments. A basic taxonomic review of fish species resulted in the fully illustrated *Fishes of Mongolia*. Such studies are an essential part of the picture if environmental assessments are to be professional and accurate. We have also supported the government’s online, searchable database of environmental impact assessments, which should radically change the extent to which the public can engage in environmental management of development projects.

In connection with improving our understanding of the impacts of a nationwide rural development program, the Bank supported a satellite-tracking study of seven wild asses. This study found that wild asses have enormous range (nearly 50,000 hectares), which has important implications for the major infrastructure developments being undertaken in the southern Gobi region where they live.
IMMORTALIZED BY A BUG

The World Bank’s safeguard policies are designed to minimize or mitigate the environmental and social impacts of its projects. During the preparation of the Yichang-Badong Highway Project in China, the project team learned that the route would traverse an area of karst caves. These caves are often completely isolated ecosystems where one can find unique species, particularly invertebrates.

The project was carried out with the Hubei Provincial Communications Department (HPCD), which was committed to minimizing its environmental impact. HPCD agreed to have a local university undertake a baseline survey to catalog the cave biodiversity. The survey focused on caves within one kilometer of the centerline of the road. This helped to define specific project mitigation measures—such as putting in fencing to prevent workers accessing the caves or changing the runoff from the road so that the caves would not be flooded.

While carrying out the survey, the team discovered what was thought to be a new species of beetle. The process for identifying a species is quite precise. The samples were sent off to Guangzhou and from there to specialists in France for classification. As it turned out, the trechine carabid beetle from Duandongzi Cave, Yichang, is both a new genus and new species. It is named Superbotrechus bennetti after Chris Bennett, the project’s task team leader in the Bank.

As part of a Bank-supported study of Important Bird Areas (IBAs) in Mongolia (Mongolia IBA Directory), a survey of the threatened saker falcon and houbara bustard found that these birds live in an IBA outside the protected area system. This finding led to a national assessment of the impacts of infrastructure, mining, and tourism activities and plans on critical natural habitats. The Bank also has supported protected areas by engaging IUCN to work with a government working group on suggestions for amendments to the Protected Areas Law and it funded an award scheme for the underappreciated forest rangers. Through its Small Grant Program, the Bank also supports a large number of projects by local NGOs and others—operated through the Open Society Forum— with the close engagement of the Ministry of Nature, Environment, and Tourism, our main partner. One of the most recent products is an economic valuation of the upper Tuul River, which supplies all the water to the nation’s capital and lies in the protected areas of Khan Khentii and Gorkhi-Terelj. Our next books will be field guides to Mongolia’s birds and mammals written by the staff of the National University of Mongolia.

Over the last decade we have reached out to and supported all manner of large and small civil society groups across Mongolia, including Buddhist groups. In 2009 much of that experience was brought together in a handbook, Mongolian Buddhists Protecting Nature, which is as much for development workers to learn about the potential of working with Mongolian faith communities as for the Buddhist followers to confirm the relevance of their faith to environmental management. A practical application of this concept was incorporated into an IFC-GEF project in northwest Mongolia that focused on low-impact, catch-and-release fishing of the world’s largest salmon, the taimen. The project, and a parallel Development Market-place project, supported the Taimen Conservation Fund to establish a partnership between the local communities—including the “ranger monks” from a renovated Buddhist temple—government institutions and bodies, and tourist companies to collaboratively and proactively establish a natural resource management regime. The underlying rationale of the project was to treat wildlife as a locally managed concessionable natural resource rather than as a simple public good, thereby enabling the local communities to maximize the economic returns from its use. The financial sustainability and biodiversity conservation vehicle for the project is the high-end fly-fishing.

BLOGGING ON BIODIVERSITY IN EAST ASIA AND PACIFIC

The EAP Region’s blog (http://blogs.worldbank.org/eastasiapacific) has more information on some of the stories featured in this article and other biodiversity-related issues in East Asia and Pacific:


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The protection of nature in Europe and Central Asia (ECA) is an important part of the development agenda. The region accounts for 23 percent of the world’s forest area, 13 percent of its arable land, and 12 percent of its annual renewable freshwater resources. It also includes the world’s largest contiguous steppe and intact forest ecosystems; five seas (Aral, Baltic, Black, Caspian, and Lake Baikal), with a combined area of 1.3 million km²; and 21 major mountain chains.

Twenty-seven ecosystems in Europe and Central Asia are recognized internationally as part of the World Wide Fund for Nature’s top 200 sites of global importance. Many of the world’s cultivated food crops originated in ECA, and the region harbors the wild relatives of these species that feed the world, including wheat, barley, chickpeas, lentils, apples, cherries, apricots, walnuts, pistachios, and pomegranates, as well as many vegetables, medicinal herbs, and flowers. Most ECA countries have ratified the Convention on Biological Diversity and many have benefited from GEF programs to support nature protection.

Over the past decade, ECA’s Central European and Baltic countries have elevated nature protection in their national agendas. This trend has been driven by several factors, including integration with the European Union’s (EU) international system of protected areas, the Natura 2000 network. The role of ecotourism within national tourism strategies, for example, has grown significantly across the region over the past decade. In addition, more frequent flood events with attendant economic losses have prompted a closer look at past engineering practices, which did not integrate the protection of natural systems as flood buffer zones or erosion control measures. Increasingly globalized and interlinked markets for agricultural and natural-resource-based products are driving suppliers in ECA countries to step up to the challenge of more sustainable production.

At the same time, the region supports 7 percent of the world’s population—450 million people, including 36 percent who live in rural areas. Many of the region’s most biologically rich areas—particularly in Central Asia, the Caucasus Mountains, and parts of southeastern Europe—include pockets of some of the region’s...
most pervasive poverty, necessitating dual development strategies to simultaneously help improve rural livelihoods and conserve biodiversity.

The region has made a sustained effort to increase coverage of territorial areas under protection and strengthen national laws; in most cases, however, this has occurred without the requisite increases in national budgets or substantial funds for capacity building. The expansion of protected areas requires more extensive stakeholder engagement through widened opportunities for community participation in nature conservation, as well as strengthened institutions to help promote intersectoral solutions and broker inevitable conflicts. More significant national efforts are needed on research, biological inventory and data collection, and modernization of data systems and tools to employ cutting-edge computer-based, satellite, and remote-sensing technologies to better track and understand threats when they occur.

World Bank projects are supporting ECA countries to help meet these challenges, introducing participatory park management planning models, supporting institutional reforms, and promoting integration of nature protection into other economic sectors. World Bank–financed projects have strengthened protected areas management in many countries, including Albania, Armenia, Bosnia and Herzegovina, Croatia, Georgia, Kazakhstan, Kyrgyz Republic, Romania, Serbia, Tajikistan, Turkey, and Uzbekistan.

In the broader landscape, a number of large infrastructure projects—roads, dams, transmission lines, wastewater treatment plants—and agriculture, tourism, and forest-related projects are taking into account biodiversity conservation needs. Several good practice examples include proactive mitigation measures, such as dedicated biological monitoring programs and “green bridges” across highway corridors to promote large-mammal wildlife habitat connectivity.

The ECA region is characterized by many transboundary watersheds, which require international cooperation across states both within and neighboring the EU. The Bank has supported investments in watershed management planning and training to promote good practices, including better integration of biodiversity objectives in decision-making processes. Multicountry programs, such as the Black Sea/Danube Investment Facility, demonstrate improved wetland management and rehabilitation, biodiversity conservation through vegetation buffers along waterways, integration of habitat-friendly agricultural practices, and reduction of nitrogen fertilizers in agricultural landscapes.

Global and regional market forces are stimulating change across the entire region. Sustainable forest management practices, for example, are being driven by market preferences for certified wood products. Several countries—including Armenia, Bosnia and Herzegovina, Croatia, Kazakhstan, Romania, and Russia—are promoting forest certification with the help of World Bank projects. These countries have seen tremendous growth in forest area coverage by certification through the Forestry Stewardship Council, which promotes higher biodiversity benefits within productive landscapes.

Some of the first impacts of climate change are being felt in the most biologically sensitive parts of the region—such as high mountain glaciers and forested wetlands—and tend to coincide with an increased risk of disasters linked with poorly regulated land-use management practices. Diagnostic studies in the region have highlighted more sensitive areas, and the Bank is starting to work with governments to identify the support needed for mitigation and adaptation. Nature protection and biodiversity programs that work to ensure robust and resilient ecosystems are a necessary (and perhaps least costly) part of the solution to a more stable future development path.
Opportunities for Accession Countries to the European Union

Three important opportunities for EU accession countries include the Water Framework Directive (WFD), ecological service payments in agricultural landscapes, and the expansion of the Natura 2000 protected areas network.

**Water Framework Directive.** The Water Framework Directive, updated in 2006, is a comprehensive policy that is changing perspectives and approaches to water management throughout the EU member, accession, and candidate countries, focusing on water as a natural resource to be protected and managed rather than as a commodity. National or international river basin districts (RBDs) are defined as the basic units for water resource management, with the requirement to prepare and implement river basin management plans to achieve “good status” for all water bodies within each RBD. Good status encompasses both chemical status and ecological status, including factors such as species composition. This places biodiversity at the heart of water management.

The WFD creates a strong need for effective cooperation between authorities and specialists in water management and ecological protection, two groups that usually have been quite separate and sometimes even antagonistic. Some countries have responded by broadening the mandate and expertise of existing departments, while others have replaced them with new cross-sectoral water agencies. The WFD thus represents a fundamentally new perspective and approach to water management as an integral element of environmentally sustainable development.

**Ecological service payments.** EU member states have jointly supported a system of ecological service payments in agricultural landscapes since 1992. Approximately 25 percent of agricultural lands in the European Union are covered by agri-environment management agreements. Payments from public money are used to encourage farmers and other landowners to produce environmental products and services through maintaining, enhancing, or restoring traditional landscapes and through preserving valuable wildlife habitat and other areas rich in natural, cultural, and historical features.

Potential EU member states are encouraged to start building capacity to participate in these programs. The World Bank is currently the only international financial institution in the ECA region with active programs of support to help introduce and pilot such programs into lending operations.

**Protected areas.** The EU Natura 2000 network extends the protected areas concept to the international level, establishing an EU-wide system of nature protection areas aimed at ensuring the long-term survival of Europe’s most valuable and threatened species and habitat types. The network currently includes over 26,000 sites covering
CROATIA KARST ECOSYSTEM CONSERVATION PROJECT INCLUDED IMPORTANT SUPPORT FOR RURAL LIVELIHOODS

On mountain meadows unspoiled by pollution and human intervention in Velebit, in Croatia’s karst region, Bariša Vila tends to his 50 beehives. Vila collects the honey and drives back to his small honey bottling plant in Senj, where he produces ecologically clean, high-quality organic sage, forest, and meadow honey, wax candles, and honey brandy.

Vila’s family business has been financed by a €22,000 grant he received under the Conservation and Rural Revitalization Grants (CRRG) program. The program is financed by a GEF grant of $5.07 million to the government of Croatia for the Karst Ecosystem Conservation (KEC) project, centered on the Plitvice Lakes National Park. The area is characterized by high unemployment, lack of infrastructure for the protection of the environment, and an urgent need to encourage private sector development in an otherwise economically depressed region. In addition, the National Environment Action Plan identified karst ecosystems as the top priority for biodiversity conservation. The project strengthened institutional and technical capacity, integrated biodiversity conservation into physical planning and sectoral objectives, strengthened the management of protected areas, and promoted entrepreneurial and tourism activities to support sustainable use of natural resources.

On the other side of the mountains, in the Lika region, Mladen Matak checks on his herd of goats. He expanded his herd from 16 animals to about 140, thanks to the €14,000 grant he received in 2003 under the CRRG program for the reintroduction of goat breeding and maintenance of protected mountain meadows. “We benefited from the grant tremendously. I would never be able to afford to buy so many goats by myself. I have three children to educate and now, from the income the herd generates, I am able to extend my house,” Matak says. Meanwhile, Sime Gazic, an advocate of ecotourism development, welcomes tours with visitors from across the country in his reconstructed 300-year-old family household in Ljubotic, another tiny village situated on the slopes of Velebit Mountain.

These examples illustrate how the preservation and protection of the natural environment can be successfully integrated with farming and tourism activities to support the sustainable use of natural resources by working with local communities. The government of Croatia is now preparing for a follow-up World Bank loan to extend the work of the KEC project to new challenges of integration with the EU Natura 2000 network.

about 850,000 km²—20 percent of the total EU territory. Member countries commit to manage these areas to maintain their biodiversity and ecological values. The Natura network will expand further as additional countries join the EU. Croatia has already designated nearly one-third of its land area within its National Ecological Network, much of which is likely to become part of the Natura 2000 network. Designation of Natura 2000 sites requires both detailed baseline information and consensus building among a range of stakeholders and interests.
The World Bank's investment portfolio in the Latin America and Caribbean Region (LAC) clearly shows the importance the institution places on conserving biodiversity. From the Chaco in Argentina to the deserts of Mexico, from the Brazilian Mata Atlântica to the Amazon tropical forests, from the Caribbean islands to the melting glaciers of the Andes, Bank projects are addressing the continued pressure biodiversity is facing.

Throughout LAC the Bank has been piloting projects to improve land management and biodiversity conservation. Improved valuation of biodiversity and the services it provides to society is one tool gaining traction with conservation experts as a means of emphasizing the importance of biodiversity to decision makers. Several projects are piloting payments for ecosystem services to demonstrate how biodiversity conservation can be fully integrated into the rural landscape. One regional pilot project in Colombia, Costa Rica, and Nicaragua was so successful in increasing both agricultural productivity and biodiversity richness on farms that it has now been transformed into a nationwide effort to mainstream sustainable cattle ranching in Colombia.

Others are working with indigenous communities, building on traditional knowledge to improve natural land and water management and strengthen the capacity of indigenous communities to protect and manage their natural and cultural resources. In Brazil the Bank is supporting various land management projects that aim to mainstream biodiversity conservation into rural development activities, with a special focus on small- and medium-size land holdings. Project-supported activities include (a) soil conservation and erosion control, which benefit soil and aquatic biodiversity; (b) reforestation and rehabilitation of riparian forests; (c) identification and implementation of biodiversity corridors; (d) reduced reliance on inorganic fertilizers and pesticides through the use of green manure and adoption of integrated pest management techniques; and (e) environmental education for farmers, rural extension agents, and rural families. Sustained collaboration between the Bank and the state of São Paulo over the last 10 years has resulted in the
adoption of policies for the payment of environmental services for the rehabilitation and restoration of native riparian forests.

The effects of climate change are expected to have significant impacts in Latin America and the Caribbean. The World Bank is working within a number of climate-sensitive hotspots in the region, aiming to safeguard and protect biodiversity and related ecosystem services. Climate change is expected to increase the bleaching of coral reefs, leading to the potential collapse of the coral biome in the Caribbean Basin. Coral reefs are home to more than 25 percent of all marine species and are also vital for fisheries, tourism, coastal protection, and livelihoods. The Bank is supporting appropriate protection and management of coral reefs to maintain resilience to climate change. Elsewhere in the region the Bank is working with clients to address climate impacts on mountain ecosystems in the Andes, forest dieback in the Amazon Basin, and wetlands and associated coastal systems in the Gulf of Mexico.

**Brazil — Payments for Environmental Services**

The World Bank has been a leader in implementing innovative payments for environmental services projects throughout Latin America. The recently inaugurated Florestas para Vida (Biodiversity and Watershed Conservation and Restoration) Project in Brazil is a good example of how lessons learned during the last decade are now incorporated into project design. The project will support the adoption of environmentally friendly land-use practices in two key watersheds in the Atlantic Forest in the state of Espírito Santo. These two watersheds provide approximately 90 percent of the Greater Vitória Metropolitan Area’s (GVMA) water supply, while also generating hydroelectricity. The GVMA is an area of great importance to the state’s economy; it houses close to half the population of 3.1 million and generates 62 percent of state GDP. Upstream of the GVMA, land-use patterns have resulted in severe erosion, substantially increasing silt loads and reducing the quality and timing of water supplies. The project will strengthen institutions responsible for planning and implementing natural resource management strategies in the watersheds, including the technical agencies responsible for monitoring conditions. It will develop governance mechanisms that bring stakeholders together in participatory ways to agree on appropriate responses. Improved land and forest management will reduce threats to globally important biodiversity—for example, the endangered muriqui monkey.

**Colombia — Mainstreaming Biodiversity in Cattle Ranching**

The Integrated Silvopastoral Approaches to Ecosystem Management in Colombia, Costa Rica, and Nicaragua demonstrated that silvopastoral practices can play an important role in rural development while providing global environmental benefits. It illustrated how tree species that are drought-tolerant and retain their foliage in the dry season provide high-quality fodder. This helps provide more stable milk and beef production, maintain livestock condition (through reduced heat stress from increased shade), reduce methane emissions, and secure farmers’ assets through increased farm productivity. Improved silvopastoral systems (SPSs) were also associated with a significant reduction in the use of fire as a pasture management tool, as well as with significant carbon sequestration in the soil and in the standing tree biomass.

This success prompted the Colombian Cattle Ranching Federation to scale up the initiative in Colombia. A full-scale project will promote the adoption of environment-friendly SPSs in Colombian cattle farms nationwide, improving natural resource management, enhancing the provision of environmental services (biodiversity, carbon, and water), and raising livestock productivity in participating farms. Four criteria are employed to assess the positive environmental impacts of a cattle-ranching production system: (1) an increase in vegetative cover, including trees; (2) a decrease in use of agrochemicals of fossil origin (pesticides and fertilizers); (3) decreased soil erosion; and (4) improved quality of the landscape. Greater tree cover on farms will increase habitat connectivity and link conservation of protected areas (PAs) and their buffer zones, improving biodiversity conservation as well as fostering more sustainable production systems.

**Ecuador — Ancient Biodiversity Knowledge Informing Agricultural Development**

Recognizing that lack of knowledge is a key challenge to the adoption of sustainable conservation practices, the Rescuing Ancient Knowledge on Sustainable Use of Biodiversity Project aims to increase knowledge about traditional and modern systems of technologies for sustainable use of the biodiversity of southwestern Ecuador. The systems targeted are pre-Columbian detention ponds, also known as *albarradas*. According to archaeological findings, these ponds have been in existence for over 3,800 years. These horseshoe-shaped earth embankments retain runoff water, which infiltrates the underlying permeable sandstone deposits of the Tablazo formation, enriching the aquifer and replenishing groundwater wells. The *albarradas* create their own microclimate, maintaining plant species that have disappeared or are endangered in the surrounding Tumbésico dry forest. Taxonomic studies have identified 595 species; seeds of endangered and endemic species are retained in the project herbarium. These findings are providing a historical perspective and insights for environmental management and agricultural development programs.
Mexico —  
Linking Religious and Cultural Values to Biodiversity Conservation

Religious practices in many parts of the world are linked to the use of wild species for ceremonial purposes. In the southern Mexican state of Chiapas, various species of bromeliads, palms, orchids, and cycads are collected for use by traditional indigenous religious groups. The Sacred Orchids project has developed strategies for managing and conserving the populations and habitats of wild orchids. A local conservation NGO, Pronatura Sur, is mobilizing religious congregations and traditional community organizations in favor of biodiversity conservation through the management of community protected areas, extractive reserves, and nurseries for habitat restoration and orchid propagation. There is potential for scaling up this approach to the national level, working with the Alliance of Religions and Conservation.

Central America —  
Indigenous Knowledge Conserving Biodiversity

A regional initiative in Central America—the Integrated Ecosystem Management in Indigenous Communities Project—aims to increase conservation effectiveness by strengthening the capacity of indigenous communities to protect and manage their natural and cultural resources. The project will create a network of indigenous communities engaged in biodiversity conservation and sustainable and culturally appropriate land use and support subprojects for sustainable production, promotion, and marketing of traditional products, environmental services, and eco/ethnotourism. Each participating indigenous group has developed cultural land-use plans. These plans strengthen and incorporate traditional knowledge and customary law, thereby promoting community participation and common visions in land planning and reducing conflict between land uses.

Brazil —  
Conserving the Rain Forest

After almost two decades, the Pilot Program for Conservation of Brazilian Rain Forests is coming to an end. Subprograms in the Amazon and Atlantic Forest fostered innovation, social participation, and partnerships to test sustainable natural resource management alternatives, linking conservation action to local livelihoods. Among its many accomplishments, the program provided support to producers’ associations to adopt new production models; demarcated over 43 million hectares of indigenous land; defined ecological corridors; and established a sustainable timber management model, extractive reserves, and 1 million hectares of new protected areas in the Atlantic Forest.

The Amazon Region Protected Areas (ARPA) program is considered a critical part of the Brazilian effort to combat deforestation and to conserve biological diversity. It is the world’s largest tropical forest conservation program, funded with financial resources from the GEF, World Bank, WWF–Brasil, Kreditanstalt für Wiederaufbau, and the German Agency for Technical Cooperation.

ARPA tackled some of the most formidable concerns in ecosystem protection today, including enforcement of environmental laws in remote areas, improving livelihoods for rural people, and valuing and funding conservation activities against a wider backdrop of ongoing resource exploitation. The first phase of ARPA built the capacity of key partner organizations and increased the number and area of protected areas in the Amazon. The ARPA program has effectively created one-third of all new protected areas worldwide since 2003, namely 13 “strict protection” PAs totaling 13.2 million hectares and 30 “sustainable use” PAs totaling 10.8 million hectares.

The Amazon Basin is recognized as a global carbon sink. The ARPA Program has contributed to biodiversity by forming a mosaic of protected areas under different management systems, thereby reducing deforestation and contributing to climate change mitigation. A recent study “showed that by 2050, expansion of protected areas during 2003–07 reduced 272,000 km² (27.2 million hectares) in deforestation, thereby avoiding 3.3±1.1 gigatons of carbon (GtC) emissions, of which 0.4 GtC was attributable to 13 protected areas established with ARPA’s support. Including an additional 127,000 km² (12.7 million hectares) of new ARPA protected areas, the program contributed 4.7 GtC to climate change mitigation by 2050.”

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areas throughout 2008, the ARPA program would reduce a total of 1.4 GtC (or 5.1 Gt CO₂) in emissions by 2050."

Related research looks at “unintended” carbon emissions from the Amazon due to climate change affecting the ecology. Models indicate reduced rainfall, increased dry periods, and “savannahization” of certain areas of the Amazon. In these models the preservation of large blocks of forest is considered an important part of maintaining rainfall patterns and the water cycle. ARPA investments in creating large PAs are seen as critical in limiting “unintended” carbon emissions and maintaining high levels of ecosystem functionality.

Andes —
Climate Change and Biodiversity Conservation

The páramos in Colombia provide water to major urban centers, including Bogota, and are central to the hydrological stability of basins that generate the country’s power. Moreover, the páramo ecosystem contains a unique assemblage of fauna and flora endemic to the region and of significant global value. Climate change and anticipated temperature increases will impact the páramo hydrology, threatening both its economic services and the biology of the region.

Project activities with local communities aim to reduce anthropogenic impacts and invest to strengthen the resilience of the region to future unavoidable changes. These measures include the restoration of soil cover with native vegetation and the protection of water sources, as well as the expansion of protected areas.

A second project in the watershed of San Nicolas, Colombia, will pioneer carbon sequestration through afforestation and reforestation of about 1,400 hectares of abandoned pasturage. Measures are being put in place on about 5,000 hectares of remaining forest stands in the valley of San Nicolas to avoid deforestation and encourage natural forest regeneration. Project activities will create a carbon asset while improving the income of small landowners from the sale of timber and non-timber products. Training and capacity building will promote sustainable forest management and biodiversity protection for small-scale farmers. The BioCarbon Fund will purchase the carbon sequestered through the tree-planting activity, as well as the carbon preserved through the avoided deforestation and forest degradation component.

The Caribbean —
Protecting Coastal Zones and Biodiversity

In Dominica, the Adaptation Measures in Coastal Zones Project is helping protect the national parks that contribute to the island’s economy through international tourism. They also harbor important biodiversity, including the emblematic Amazona imperialis, considered the world’s most critically endangered parrot. In addition to park management and tourism plans, the project is reducing threats by encouraging appropriate development and sustainable agriculture for the surrounding communities.
Situated at the geographical crossroads of three continents, the Middle East and North Africa (MENA) region is one of the most diverse areas on Earth. The region is characterized by extreme differences in elevation, ranging from the Dead Sea area, which is below sea level, to high mountains rising to over 3,000 meters. These geographic and climatic differences are reflected in a great diversity of terrestrial, coastal, and marine environments; a high level of endemism; and the importance of natural resources to the region’s continued social and economic development. The greatest biodiversity is concentrated in specific ecosystems, like freshwater wetlands, coastal habitats, mountains and woodlands, mangroves, seagrass beds, salt marshes, and mudflats. Many of these areas are small in size but are of tremendous importance to biological productivity and ecological integrity.

The Challenge

For thousands of years, the people of the MENA region were able to live with their environment in a sustainable fashion. Considerable wisdom built up over many centuries regarding the use of natural resources and survived until recent decades. For example, practices such as sound water management and the efficient use of agricultural terraces in mountainous area, as well as rotational grazing of domestic stock on desert rangelands, have been in place for hundreds of years. Farmers used many indigenous and environmentally friendly techniques for the production of food varieties for subsistence and trade. Fishing communities on the coast have continued to benefit from the rich diversity of marine life, utilizing these resources while respecting their biological cycles. Local populations thus had the knowledge, traditions, and potential for maintaining prosperity while respecting the environment and continuing to use natural resources in a sustainable fashion.

However, a number of social and economic transformations have undermined these traditional practices in the region. Many factors—a rapidly growing population, changing consumption patterns, urbanization, an expanding transportation network, and changed water and land-use management systems—have made the task
of managing the environment increasingly complex. The more intensive use of natural resources has led to considerable degradation of the region's woodlands, rangelands, wetlands, soils, and fisheries. Biodiversity and unique habitats are being lost at an alarming pace. These trends directly affect the quality and quantity of ecosystem services, such as carbon sequestration, watershed protection and erosion control, maintenance of soil fertility, recycling of nutrients, and pollination of crops and trees.

Climate change is further accelerating the situation. The region is one of the most vulnerable to temperature increase, reduced precipitation and storm surges, and sea level rise. The cost of environmental degradation in the MENA countries varies from an estimated 2.1 percent of GDP in Tunisia to as high as 7.1 percent in Iran. These costs spill into areas of public health, household budgets, the competitiveness of the economy, and intergenerational equity, since the rate of degradation suggests that many natural resources will not be available in the future. These new challenges require innovative thinking and urgent action.

**Biodiversity Conservation and Local Communities**

The depletion or degradation of natural resources has important implications for the livelihoods of a sizable majority of the population, undermining the sustainability of the region's economy and posing a real threat to poverty reduction. Biological resource management and people's livelihoods are complex and interconnected. While everyone is affected by ecosystem degradation, the poor are disproportionately affected. They are dependent on local ecological resources and climate-sensitive economic activities—such as subsistence agriculture, fisheries, and forestry—and are directly affected by the ways in which environmental resources are exploited.

**Response to Conserving Biodiversity**

Over the last decade, an increasing number of World Bank projects in the region have made explicit linkages between the sustainable use of ecosystems, biodiversity conservation, and community involvement. The effective involvement of local communities is critical to the success of such projects. Important examples include projects on the conservation of medicinal and herbal plants in Jordan, a protected areas management project in Tunisia, an integrated ecosystem management (IEM) project in Jordan's Rift Valley, and a climate change adaptation project in Yemen.

*The conservation of medicinal and herbal plants in Jordan.* This World Bank/GEF project supports the conservation, management, cultivation, and sustainable utilization of medicinal and herbal plants in Jordan while ensuring effective *in situ* protection of threatened habitats and ecosystems. This was the first comprehensive approach in Jordan to conserve and sustainably use medicinal and herbal plants. In the Mujib Reserve, the Cooperative of Sheep Grazers is working closely with the reserve staff to integrate new grazing management techniques within the zoning plan of the reserve. Areas have been assigned for grazing and non-grazing. Water wells were built and forage crops planted to guide the movements of animals. This close cooperation has been so successful that herders are now also patrolling the reserve, reporting illegal hunting or collection activities. Herders benefit from the medicinal and herbal plants grown in the reserve for their own consumption and animal health. Areas previously heavily grazed are now conserved, which also reduces land degradation.

**Protected areas management in Tunisia.**

This project assisted the government in its endeavors to manage and protect selected national parks for the purpose of conserving biodiversity, while also contributing to the welfare of local populations. It was the first to implement community participation for successful protected areas management, including the formulation of park management plans. As part of the community development plans, several small projects—including livestock production, camel breeding, beekeeping, and handicrafts promotion—were initiated to help the communities living on the fringes of the parks diversify their livelihood options. Women were often directly involved in many of these income-generating activities. The local communities have become social champions for the parks. Park management is coupled with local partnerships and extensive awareness-raising programs, which has enhanced collaboration for nature conservation. These efforts have reduced illegal activities, such as logging and hunting in the fragile national parks. Significant work has been carried out for the regeneration of key vegetative species and the reintroduction of rare animals. The project was instrumental in having the Lake Ichkeul National Park taken off the UNESCO List of World Heritage Sites in
Danger. The substantial growth of populations of addax (*Addax nasomaculatus*) and of scimitar oryx (*Oryx dammah*) in Bouhedma National Park has allowed for transportation and reintroduction of addax to Jebil National Park and oryx to Dghoumes National Park in Tozeur.

*Integrated ecosystem management in the Jordan Rift Valley, Jordan.* This project will mainstream integrated ecosystem management practices in pilot areas in the Jordan Rift Valley. The Great Rift Valley is a globally important ecological corridor, and the Jordanian section is a major flyway between Africa and northern Europe used by millions of migrating birds each year. Apart from its significance for birds, the Jordan Rift Valley also holds many important ecosystems, including the Dead Sea, the Gulf of Aqaba, and the Jordan and Yarmouk river systems, as well as numerous specialized or unique habitats of regional importance, like the *Quercus aegilops* oak forests of Yarmouk. The valley’s critical geographical location and agricultural productivity threaten its unique ecological and cultural values. Habitat degradation and species loss in the valley are serious and accelerating, largely as a result of increasing development pressure, inappropriate agricultural practices, and population growth.

Previously, the local community was little involved in wildlife conservation. Thus it was crucial to seek ways to secure the valley’s economic and ecological integrity for the benefit of its people. By emphasizing the linkage between local participation and local benefits, the project is addressing threats through an IEM and local development program. The project’s success closely relates to its strategic community-based approach to management of special conservation areas (SCAs). SCAs are a new concept in Jordan, involving communities directly in conservation planning and management. Seven SCAs are recognized in the Rift Valley Management Plan. In 2009, a network of nine protected areas was approved by the Jordanian cabinet.

*Adaptation to climate change, Yemen.* The WB/GEF project on Agrobiodiversity and Climate Adaptation in the rain-fed highlands of Yemen will enhance coping strategies for adaptation to climate change through the conservation and utilization of biodiversity important to agriculture. Historically, agricultural terrace systems were developed in response to rainfall patterns and provided optimal soil and water management in mountainous terrain for crop cultivation. Over many generations, the communities retained important agrobiodiversity and traditional knowledge for the utilization of their natural resources. Yemen is considered an important primary and secondary center of diversity for cereals, so these crops are important genetic resources. Many wild relative species of wheat, sorghum, millet, and lentil are still found here. However, during the last decades social and economic factors—exacerbated by the effects of climate change—have resulted in changing farming and grazing practices. Desertification of land is gaining momentum, and water erosion is becoming a major problem leading to the gradual collapse of the vital terrace systems and affecting the area’s delicate agrobiodiversity.

To address these problems the project will protect this invaluable agrobiodiversity both on the farms and in gene banks to provide an important genetic base for crop improvement programs. In addition, local knowledge on the adaptive characteristics of local
landraces will be documented. Based on the development of predictive climatic models, a range of coping mechanisms will be developed and piloted to reduce the vulnerability of farmers to future climatic conditions. The project will improve the capacity of key line agencies and local stakeholders to collect and analyze data, improve climate predictions, and develop systems of information and information flow for enhanced adoption of coping mechanisms in the agricultural sector. Further, it will develop knowledge management systems that will preserve and mobilize local knowledge in conjunction with research-based knowledge that is fully accessible by local people.

Conclusion

The conventional systems of natural resource management widely used throughout the region have in the past been government-driven and have tended to be protective and regulatory in nature. This approach failed to utilize and strengthen the linkages between local benefits and biodiversity conservation gains, and in most cases sustainability was difficult to achieve. Major new characteristics of the World Bank MENA Region biodiversity portfolio include:

- Supporting an integrated approach that strengthens sustainable use and income generation for the local populations so that communities have a stake in the long-term success of the project. All of the projects, in various ways, combine reduction of biodiversity loss and poverty alleviation by providing opportunities for significantly improved livelihoods and other tangible local socioeconomic benefits.
- Safeguarding biodiversity resources by emphasizing the participation of a diverse range of stakeholders to ensure that all interests are accommodated and to secure long-term environmental benefits.
- Making biodiversity conservation an important component in national climate change adaptation strategies and measures in the region. This new focus is based on the increasing recognition that ecosystem protection and more sustainable management of biological resources are among the most efficient and cost-effective ways to address challenges caused by climate change. Countries in the region also are seeing chances to embark on opportunities provided by the carbon markets.
South Asia is a region of significant importance for its rich biological diversity, marine and coastal resources, and fisheries. India alone represents one of the 12 megadiversity countries of the world, which collectively account for 60 percent of the world’s plant and animal species. Yet this region is one of the most populous in the world, and a large part of its population is dependent on natural resources for their livelihoods and survival. This provides immense challenges in the management of the region’s natural resources. The South Asia Region of the Bank has been in the forefront of trying to reconcile the legitimate needs of poor communities and the management of its natural resources.

For example, the Bhutan Sustainable Land Management Project seeks to strengthen institutional and community capacity to anticipate and manage land degradation in Bhutan. By demonstrating successful sustainable land management practices in pilot areas, the project is providing lessons and experiences for policy guidance and learning to enable the mainstreaming of such approaches countrywide. The sustainable land management approach is guided by bottom-up planning at the village level with local farmers and other stakeholders, including resource mapping of village lands as a basis for planning on-the-ground investments in consultation with local farmers.

Resource mapping involves the spatial delineation of land-use categories, land degradation areas, hydrology and irrigation characteristics, non-wood forest production areas, firewood and timber collection areas, common grazing areas, and private and community forest areas. This is supported by information on soil fertility and biodiversity and by indigenous knowledge on soil fertility management that then guide local farmers on how best to use their lands more sustainably. Investments are then made for conversion of shifting cultivation lands to wetland cultivation, construction of bench terraces and hedgerows, organic vegetable cultivation, development of orchards, irrigation canal renovation, community forestry, protection of water sources, and other sustainable land management activities. As a result, there has been a marked conversion from
shifting cultivation to more sustainable uses, improved management of common grazing areas, extension of community forestry areas, and a general improvement in the management of irrigation, forestry, biodiversity, and agricultural resources in the villages.

An innovative Dynamic Information Framework (DrukDIF) is supporting the development of cross-sector (agriculture, biodiversity, forestry, hydrology/hydropower, infrastructure, and water) decision making for natural resource management and adaptation to climate change. This geospatial data framework will accurately capture and link (a) terrain characteristics that precisely delineate field to watershed to landscape characteristics; (b) precise locations of settlements and other boundaries and infrastructure (roads, power lines, communication towers); (c) current and historical land cover and land use; (d) a complete drainage network; (e) wetlands and riparian zones; (f) meteorological data; and (g) wildlife, forestry, and conservation areas. Once in place, the geospatial data in DrukDIF will be “brought to life” via coupling to a distributed hydrological model that responds to changes in any of the land cover, land use, and climate variables. This allows local hosts to generate scenarios for how changes in land use/land cover—for example, deforestation, new plantations, extensive fires, or pest outbreaks, or new infrastructure such as roads or a dam—impact surface flows of water and sediments. These scenarios are a valuable tool to allow policy makers to assess trade-offs between different land-use options. Once established, DrukDIF can serve as a permanent baseline for the landscape and can continue to accumulate additional data for existing variables as well as aggregate additional data layers. The system uses climate variables—for example, temperature, precipitation, estimated evapotranspiration, and solar radiation—that are critical to primary production linked to land cover/land use. It thus enables local stakeholders to deal with uncertainties inherent in global and regional climate models by using the trend information to assess potential impacts on land cover, land use, and hydrological flows.

Improving Regional Collaboration for Protection of Marine and Coastal Resources

The World Bank is one of the agencies that is partnering with the Food and Agriculture Organization of the United Nations in the implementation of the Bay of Bengal Large Marine Ecosystem (BOBLME) Project. Over the next five years, the eight littoral countries surrounding the Bay—Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka, and Thailand—will attempt to lay the foundation for a coordinated effort to improve the lives of the coastal populations through improved regional manage-
ment of the Bay of Bengal and its fisheries resources. These eight countries are some of the most populous in the world. Most of the 400 million people living adjacent to the Bay of Bengal are poor and rely heavily on its marine resources, which are being affected by overfishing, removal or degradation of important marine and coastal habitats, and land-based pollution from sediment, chemicals, and sewage. Collaboration under the umbrella of BOBLME will result in completion of a transboundary diagnostic analysis of environmental issues impacting the Bay and an agreed strategic action plan to sustain the marine and coastal resources. Other expected outcomes of the project are establishment of a permanent institutional arrangement for regional management and a sustainable financing arrangement for the BOBLME program. Regional fishery assessments and management of key shared resources—shark, Indian mackerel, and tuna—would provide a good basis for cooperation among the eight countries to manage key fish stocks.

In the Periyar Tiger Reserve in Kerala, the constitution of village committees—based on their occupational patterns, geographic settings, and dependency levels—helped to better focus and target project livelihood interventions. User group committees, drawn from members dependent on natural resources, were helped to reduce their dependencies on the reserve and to find alternative livelihoods. Neighborhood committees were helped with micro-credit schemes to improve the agricultural productivity of their lands and enhance their incomes through farm and non-farm enterprises. Members of a third “professional” group—including tribals, former poachers, and hunters—with excellent knowledge of the protected area were trained as trekking guides, adventure guides for river rafting, and other ecotourism-related tasks. These livelihood “professional activities” yielded handsome returns, improving community employment in protection and patrolling of the protected area.

Another remarkable story comes from the Pench National Park in Madhya Pradesh, which took the Mowgli hero of Rudyard Kipling’s famous *Jungle Book* as its mascot to attract tourists to the park. Promotion as “Mowgli land” resulted in a fourfold increase of park visitors from 2000 to 2002.

Field experiences from ecodevelopment demonstrate that the promotion of new income generation based on non-park-dependent activities is critical to marrying conservation and equity imperatives. These can act as powerful incentives for winning the support and cooperation of the poorest households for conservation. The Kalakad

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**Improving Community Participation for Protection of Biodiversity through Ecodevelopment**

From 1998 to 2004, the Ecodevelopment Project in India provided a new opportunity to conserve biodiversity by addressing both the impact of local people on protected areas and the impact of protected areas on local people. Despite an ambitious agenda and slow start-up, as well as criticism from some sectors of civil society, the project had some significant achievements. It challenged some long-term assumptions and provided some excellent learning to guide future participatory conservation programs in India and elsewhere in Asia. The project focused on
Mundanthurai Tiger Reserve in southern India illustrates how targeted income generation and micro-credit facilities can reduce pressure on biologically important parks. By design, the program targeted women and the poor who were most dependent on forest resources. Success has been instrumental in bringing thousands of families above the poverty line and in genuinely empowering women and their families, as well as assuring financial sustainability of the ecodevelopment program around the reserve. The project originally placed Rs 39.4 million in the collective accounts of the 70 ecodevelopment committees; these committees have now built these revolving funds to Rs 109.4 million—nearly a threefold increase.

Strong community institutions at the ground level are essential, as demonstrated in the Machiara National Park in Azad Jammu and Kashmir, a site financed under the Protected Areas Management Project. Park communities were severely affected by the earthquake of 2005, which resulted in the loss of most community infrastructure and housing. The strong community institutions created through the project served at the village level to coordinate the relief, recovery, and rehabilitation efforts in these remote areas of the park. So effective were these institutions that they were able to channel over $7 million in donor and other assistance to the surrounding park communities for essential activities, including drinking water and irrigation systems rehabilitation, health and education, and alternative energy and micro-enterprise schemes. As a result, the park communities are indebted to the park authorities and have themselves embraced conservation as an important part of their lives.

**Integrating Biodiversity Conservation Approaches in Road Development**

In India, the Bank is trying to balance the need for improved infrastructure, in particular road development, with protecting the rich flora and fauna in these areas. In the Orissa State Roads Project, there are large tracts of forests and protected areas adjacent to the road network. Biodiversity assessment studies have been carried out as part of the overall environmental assessment effort. These studies have included the upstream identification of likely impacts on natural habitats—such as intertidal areas, wildlife habitats, and areas of rich biodiversity—and enabled the institution of avoidance and mitigation measures for protection of habitats and species. Corridor-specific environmental and biodiversity management plans have been integrated into the final engineering designs and bidding documents to ensure implementation during the construction phase. Concurrent independent reviews are planned to evaluate and monitor compliance with these plans. The Orissa project provides the first such opportunity in India for undertaking a comprehensive and systematic effort to assess and address biodiversity issues as part of a road development project. The biodiversity study has created considerable interest among other development partners.

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The loss of tropical forests represents a large source of greenhouse gas emissions—from 15 to 20 percent of worldwide emissions—and is a leading cause of global climate change. Thus the reduction of emissions from deforestation and forest degradation, forest conservation, the sustainable management of forests, and the enhancement of forest carbon stocks—an agenda known as “REDD plus”—has become a major component of international climate change negotiations.

At the recent session of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen in December 2009, countries negotiated several texts on REDD plus, including the provision for the immediate establishment of a mechanism that would include REDD plus. Furthermore, six countries together pledged over $3 billion for REDD plus during the period 2010–12.

REDD plus and Biodiversity — Synergies or Trade-offs?

Some say that REDD plus represents the best, maybe the last, chance of preserving tropical forests. If planned and implemented properly, REDD plus can produce benefits beyond climate change mitigation, including benefits for biological diversity and indigenous communities. Typically, what is good for the climate is good for biodiversity: if forests are preserved and their carbon stocks remain sequestered in the biomass and soils, biodiversity values also will be preserved.

The international biodiversity community is analyzing the synergies—as well as potential trade-offs—between biodiversity and REDD plus. Trade-offs may occur if REDD plus programs focus on carbon-rich areas that are not necessarily the most biodiverse, and in fact leave the most biodiverse areas exposed to pressures. Mapping—such as the United Nations Environment Programme’s Carbon and Biodiversity Demonstration Atlas (see www.unep.org/pdf/carbon_biodiversity.pdf)—may help locate REDD plus programs in regions of high biodiversity. Efforts are already under way to monitor the biodiversity impacts of REDD plus programs, like the development of social and environmental REDD plus standards (see www.climate-standards.org).

The UNFCCC texts—such as the draft text produced by the Ad Hoc Working Group on Long-Term Cooperative Action (see unfccc.int/resource/docs/2009/awgka8/eng/107a06.pdf) in Copenhagen—recognize the need for seeking synergy or minimizing trade-offs between REDD plus and biodiversity. It also affirms several principles, such as consistency with national sustainable development needs and goals, facilitation of sustainable development, and the promotion of the sustainable development of forests. In addition, it emphasizes the need for safeguards designed to foster biological diversity in undertaking REDD plus activities.

Demonstration Activities on REDD plus and Their Contributions to Biodiversity

The Bali Action Plan adopted by the Parties in December 2007 called for demonstration activities on REDD (still primarily focusing on the reduction of deforestation and forest degradation).

Well before this, numerous projects and programs fostered climate change mitigation and biodiversity, albeit without explicitly making the connection between them. Forest and biodiversity projects financed by the World Bank and others have undoubtedly contributed to reducing the loss of forests and thus greenhouse gas emissions, though...
Carbon Finance

no quantitative estimate of emissions reduced in this way can be provided.

At the World Bank, the explicit linkage between forest protection, biodiversity, and climate change mitigation started in 2004 with the BioCarbon Fund (see www.biocarbonfund.org). This fund extends carbon payments to forest restoration and protection projects in more than a dozen countries and has spearheaded land use, land-use change, and forestry (LULUCF) activities through the design of baseline and monitoring methodologies and the engineering of purchase and sales contracts of emission reductions from LULUCF projects.

The BioCarbon Fund recognizes projects that have special value for land restoration and biodiversity protection. Indeed, the fund offers a premium built into the price of emission reductions to projects with high biodiversity benefits. The BioCarbon Fund’s portfolio contains three REDD projects in Colombia, Honduras, and Madagascar. The project in Madagascar—managed by the Ministry of Environment, with technical support from the World Bank, Conservation International, and a local NGO—helps protect a globally significant forest ecosystem. It aims to reduce deforestation of primary Malagasy forests and to reforest around 3,000 hectares. It would link three forest fragments, including a special lemur reserve, that are at the core of the remaining fragments of the richly biodiverse Malagasy rain forest.

Projects like these generated precious experience and informed the creation of the Forest Carbon Partnership Facility (FCPF), a World Bank–led global partnership on REDD plus infrastructure. It is coupled with the FCPF Carbon Fund, which will provide performance-based payments to a number of the REDD plus–ready countries for verified emissions reduced in a regime entering into force in 2013. The FCPF is expected to achieve benefits beyond climate change mitigation, including biodiversity promotion. Under the FCPF Readiness Fund, the FCPF has proposed a framework for designing a measurement, reporting, and verification system that monitors the biodiversity impacts of REDD plus separately from the climate impacts.

To help finance the generation of emission reductions, the Forest Investment Program (FIP)—managed jointly by multilateral development banks, including the World Bank—will finance investments that initiate transformations in the forestry sector, including investments in the public sector, the private sector, and indigenous communities (see www.climateinvestmentfunds.org/cif/keydocuments/FIP). FIP will build on the work funded by the FCPF Readiness Fund, UN-REDD Programme, and other initiatives and may help countries achieve the emission reductions necessary to access carbon finance under the FCPF Carbon Fund.

FIP will also help countries adapt to the impacts of climate change on forests and will contribute to multiple benefits including, in particular, biodiversity conservation.

The question of whether biodiversity-rich REDD plus programs are treated preferentially under the FCPF Carbon Fund or other REDD payment schemes remains open. The issue is whether tomorrow’s carbon buyers should be expected to pay a premium for carbon with biodiversity, or whether the community interested in biodiversity should mobilize the additional finances that may be needed to ensure that climate change mitigation through REDD plus also produces positive outcomes for biodiversity.

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Agriculture is a key driver of habitat conversion and biodiversity loss. Surging global prices for food and energy are driving the expansion of agricultural commodities across many emerging markets, increasing the demand for even more land. A number of countries with unique biodiversity are also global leaders in agricultural production. Brazil has doubled its area under soy cultivation in less than 10 years, making it the current global leader in soy production. Indonesia and Malaysia expect to double their acreage of oil palms in the next five years; the area under cocoa cultivation advances by 7 percent annually in Ghana and Côte d’Ivoire alone; and sugarcane production is escalating throughout the tropics. However, the environmental and social issues that accompany this growth rate pose significant threats to continued economic development.

These issues illustrate the necessity for the sustainable use of natural resources in agricultural commodity production. However, there are several market barriers to accomplishing this:

- Small producers—and even large ones—are often unaware of their environmental and social performance, associated risks, and the costs and benefits of better management practices (BMPs).
- Commodity value chains do not account for the true environmental and social costs of current practices or the positive values attributed to more sustainable and safer food or biofuel production, and thus do not invest in the maintenance of the natural asset base.
- Financial markets do not fully recognize the value of risk reduction, thus do not positively discriminate for lending that encourages better agricultural practices.
- Inadequate regulations or enforcement capacity reinforce pricing and market distortions and encourage inappropriate and inefficient practices.

The convergence of concerns over climate change and biodiversity loss, coupled with improving labor practices and food safety interests, has created new and powerful coalitions for transformational change. Increasingly, market-based multistakeholder processes are redefining the nature of agricultural commodity production, processing, and trading through the establishment of new global standards. These voluntary, industry-led standards address environmental and social problems by providing a framework of codified metrics and indicators for practices and technology in entire supply chains. Company operations can then be audited and verified against these standards.

The International Finance Corporation (IFC) helps in the development of these standards through its participation in initiatives known as commodity roundtables. IFC has been one of the pioneering supporters of the concept, and then a member of these roundtables since 2001, joining WWF and a handful of other banks and companies. It has provided institutional and technical support to the Round Table on Responsible Soy, the Roundtable on Sustainable Palm Oil (RSPO), the Better Sugarcane Initiative, and the Better Cotton Initiative. With the support of GEF and several other donors, IFC fosters the transformation of commodity markets by reducing market barriers that discourage the adoption of better management practices throughout the supply chain. Private companies that meet these roundtable standards through their use of BMPs can expect to accrue a number of benefits: (a) more secure supply chains; (b) better access to markets; (c) increased efficiency, yields, and quality; (d) reduction of risks and costs; (e) positive reputation; and (f) increased access to finance.

Agriculture

IFC’s Biodiversity and Agricultural Commodities Program (BACP) aims to preserve global species and ecosystem diversity within
agricultural production landscapes in the tropics by leveraging market forces. BACP works in partnership with commodity roundtables, NGOs, and those actors in the public and private sectors in the commodity markets of palm oil, soy, cocoa, and sugar-cane that are committed to adopting more sustainable practices. BACP provides grants to projects that address at least one of the following four components:

1. **Policy.** Modifying regulatory environments to encourage the adoption of biodiversity-friendly practices.
2. **Better management practices.** Improving production practices of targeted commodities to increase preservation of global biodiversity.
3. **Markets.** Increasing demand for products with positive biodiversity impacts by supporting market-visible certification systems.
4. **Financing.** Promote the development of financial products and services that reward the adoption of biodiversity-friendly practices.

Funding priorities are specified in the market transformation strategy documents produced for each target commodity, which are available at www.bacp.net.

While better management practices can reduce overall production costs in the long run, compliance with standards introduces new transaction costs into the production system. The BACP Grants Facility helps reduce these new costs by funding projects that test and refine standards and BMPs, monitor their business case, and improve information sharing.

Oil palm RSPO is the most developed of the commodity roundtables. As of November 2009, RSPO had certified 1,495,902 tons of palm oil and 326,418 tons of palm kernel oil, representing roughly 3.8 percent and 6.4 percent of global production, respectively. RSPO’s 382 ordinary and 100 affiliate members together represent close to 50 percent of globally traded production.

BACP is currently implementing four grants that promote biodiversity conservation within the palm oil sector. A grant to RSPO supports the work of the Biodiversity Technical Committee and its coordinator to better define RSPO’s biodiversity-related principles and criteria (P&C) and guide members in their application. Among other roles, this committee helps disseminate high-conservation-value assessment methods.

A project with the Zoological Society of London (ZSL) is aimed at increasing the effectiveness and applicability of RSPO’s P&C by creating BMP guidelines and biodiversity toolkits. ZSL will increase producers’ ability to improve production practices, measure biodiversity in and around plantations, and identify high-conservation-value areas. Information and tools generated under the project will be disseminated through RSPO and at workshops in Sumatra and Kalimantan.

The PanEco Foundation is conducting a pilot study in Sumatra to cultivate RSPO-certified palm oil on ecologically degraded and/or fallow land. PanEco hopes to demonstrate the social, environmental, and economic benefits of redirecting oil palm expansion away from the last remaining high-biodiversity coastal peat swamp rain forests of Aceh to these degraded areas.

BACP’s project with Fauna and Flora International (FFI) supports work with local stakeholders to assess, map, and manage high-conservation-value forests, as well as identify degraded areas fit for oil palm cultivation, in three critical districts in Indonesia. With assistance and training from FFI, local authorities will be able to incorporate these landscape assessments into district spatial
plans to make informed decisions in the zoning and concession process.

BioTrade

Natural products are gaining considerable ground in the food and cosmetics sectors, as consumers opt for natural ingredients and wholesome lifestyles. The management of these natural resources is one of the primary challenges for the sustainability of the sector. Ethical BioTrade was developed as a set of business practices that enable the ethical sourcing of biological products. These practices follow the principles and criteria developed by the Union for Ethical BioTrade, thus ensuring the sustainable use of natural ingredients obtained from native biodiversity (see Box, at right). The Ethical BioTrade standards are based on work by the United Nations Conference on Trade and Development through its BioTrade Initiative.

The Ethical BioTrade standards advance the conservation of biodiversity, while ensuring that all contributors along the supply chain—including small-scale producers—are paid fair prices and receive an equitable share in the benefits from the sale of the final products. Ethical BioTrade also recognizes countries’ sovereign rights over biodiversity and respects the rights of local and indigenous communities over their traditional knowledge.

Members of the Union for Ethical BioTrade establish company-wide management systems to gradually implement Ethical BioTrade standards for all products that use native species, thus fostering long-term relationships with their source countries, contributing to local development, ensuring that benefits reach all involved, and helping preserve local ecosystems. The commitment of companies is backed by a third-party verification system that assesses management systems and supply chain practices all the way to the source. The Union for Ethical BioTrade seeks to reduce the burden of external verification in different ways, such as cooperating with labeling schemes or verification systems like the Forest Stewardship Council and Rainforest Alliance. Finally, to further support the smaller players in the supply chain, community grants are available to cover costs related to the design and full implementation of Ethical BioTrade practices, supporting the deeper engagement of companies with local and indigenous communities.

Conclusion

From an IFC perspective, and that of many of its clients and partners, the development of these different voluntary standards regimes and the promotion and adoption of corresponding better practices along supply chains has become an imperative to conduct business in most markets. This ensures that biodiversity impacts can be addressed in a market-friendly fashion, and thus with a better chance of success. By doing this, these pioneering producers and industries are a step ahead of the general market, while ensuring that benefits accrue to those stakeholders who are most at risk.

For further information, please visit the following websites:

- www.bacp.net
- www.aliancadaterra.org.br
- www.zsl.org/conservation/regions/asia/indonesia/
- www.paneco.ch
- www.fauna-flora.org
- www.uebt.ch
- wwwrspo.org

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The World Bank’s Field Guides Program has now contributed to the production of 110 local-language field guides across Asia, Africa, Latin America, and the Caribbean. The field guides are supported through Bank projects, Bank-Netherlands Partnership Program, and grants from the MacArthur Foundation. They are tools in promoting environmental awareness and capacity building in developing countries. They provide accessible information in local languages for strengthening biodiversity training and park ranger capacity and for improving environmental assessments of development projects.

The program has supported guides on numerous plant and animal groups, such as the trees of Thailand and Sri Lanka; mountain flora of Java; amphibians of Borneo, Honduras, and Madagascar; reptiles of India and Southeast Asia; the seashore of East Africa; and the snails and crabs of Sri Lanka. A substantial number of guides focus on birds, including the birds of Iraq, which marked a sign of hope for that war-torn country.

Many of the field guide projects have been implemented through and co-funded by local and international NGOs, in collaboration with national scientific agencies and amateurr tourists. Calls for proposals in 2004 elicited more than 500 submissions from around the world. It is encouraging that some regular Bank projects are now also producing local-language guides, but much more needs to be done to build local capacity.

Field guides may encourage young scientists and local communities so that they can better promote and benefit from natural resources and biodiversity, as well as from alternative livelihoods based on sound biodiversity management. Some of the bird guides, for instance, have spawned local bird clubs that generate data on the occurrence and abundance of bird species. These data are linked to the global Important Bird Areas Program, which is used as part of the World Bank’s safeguard project reviews. In addition, some of the field guides are being utilized at the local level by village ecotourism guides, teachers, and young professionals to increase their own knowledge and strengthen the services and information they can provide to others.

Local-language field guides contribute to overall capacity for environmental management and impact assessment. Moreover, by providing access to information in local languages, they provide tools for environmental activists to monitor and improve government-landed development programs.

The World Bank is currently exploring with an international publisher the feasibility of creating an online compendium of the field guides.

T he Forest Investment Program (FIP) is now under way to support climate-friendly forest management in developing countries, with a robust infusion of $406 million in pledges from Japan, Netherlands, Norway, Switzerland, the United Kingdom, and the United States. With this funding base secured, at its March 2010 meetings the FIP governing Subcommittee endorsed the first five FIP pilots in Burkina Faso, Ghana, Indonesia, Lao PDR, and Peru, based on advice from an established Expert Group.

FIP provides a tool to help developing countries sustainably manage their forests to reduce greenhouse gas emissions caused by deforestation and forest degradation, or REDD plus. FIP is designed to invest in a small number of country-owned programs to build institutional capacity, forest governance, and information; to support forest mitigation efforts, including forest ecosystem services; and to support investments outside the forest sector to reduce pressure on forests. FIP is designed to leverage additional financial resources, including from the private sector.

FIP, a program of the Strategic Climate Fund under the $6 billion Climate Investment Funds (CIF), operates through a unique governing mechanism with equal representation by contributor and recipient countries and with observers from the broader stakeholder base.

To be effective, REDD plus must include forest communities, indigenous peoples, and other local communities. Their participation depends on strengthening their capacity and on supporting their tenure rights, forest stewardship roles, and traditional forest management systems. At its March 2010 meetings, the Subcommittee also approved a consultation process for designing a special grant mechanism for these communities.

FIP joins other institutions that support REDD plus activities, such as the World Bank’s Forest Carbon Partnership Facility and UN-REDD. FIP, as a CIF program, is implemented jointly by the African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank, and World Bank Group.

For more information, please visit: www.climateinvestmentfunds.org

NEW FOREST INVESTMENT PROGRAM ENTERS PILOT PHASE
First Five Country Pilots Selected

T he World Bank Group (WBG) is preparing a new Environment Strategy to be presented to the Board of Executive Directors by December 2010. The new strategy will propose an approach for achieving environmental sustainability at the WBG to ensure that its support to client countries leads to sustainable development outcomes. The Bank is updating the current strategy with IFC and MIGA as active partners. The consultation process is intended to be inclusive and transparent. The Bank will be seeking inputs from all WBG stakeholder groups, including governments, the private sector, civil society, and representatives of vulnerable communities. Check the “consultations calendar” at www.worldbank.org/environmentconsultations to read what people in more than 50 countries are saying and to see if there is a consultation coming up in your city. You can also review the background analytical work that will underpin the strategy. You can provide your feedback online—in English, Spanish, Arabic, Portuguese, pyc dictatorship, or French.

International Year of Biodiversity
KEY DATES

3-12 May 2010, Nairobi, Kenya FIP Celebrations at SBSTTA 14
13-28 May 2010, Nairobi, Kenya FIP Celebrations at WGM I
21-22 May 2010, New York, U.S.A. Celebration of the International Day for Biodiversity at the Permanent Forum for Indigenous Issues
22 May 2010, worldwide International Day for Biological Diversity
26-28 May 2010, Montevideo, Uruguay Fourth Assembly of the Global Environment Facility
5 June 2010, Nairobi, Kenya World Environment Day
9-11 June 2010, Montreal, Canada International Conference on Biological and Cultural Diversity
15-17 September 2010, Washington DC, U.S.A. World Bank Celebrating the Web of Life: Biodiversity Fair
4-6 October 2010, London, U.K. Census of Marine Life 10-Year Finale
11-13 October 2010, Nagoya, Japan FIP – Fifth Meeting of the Conference of the Parties to the CoP 10
27-29 October 2010, Nagoya, Japan FIP – Fifth Meeting of the Conference of the Parties to the CoP 10
1-19 December 2010, Kanazawa, Japan Closing of FIP – Contribution to the International Year ofForests