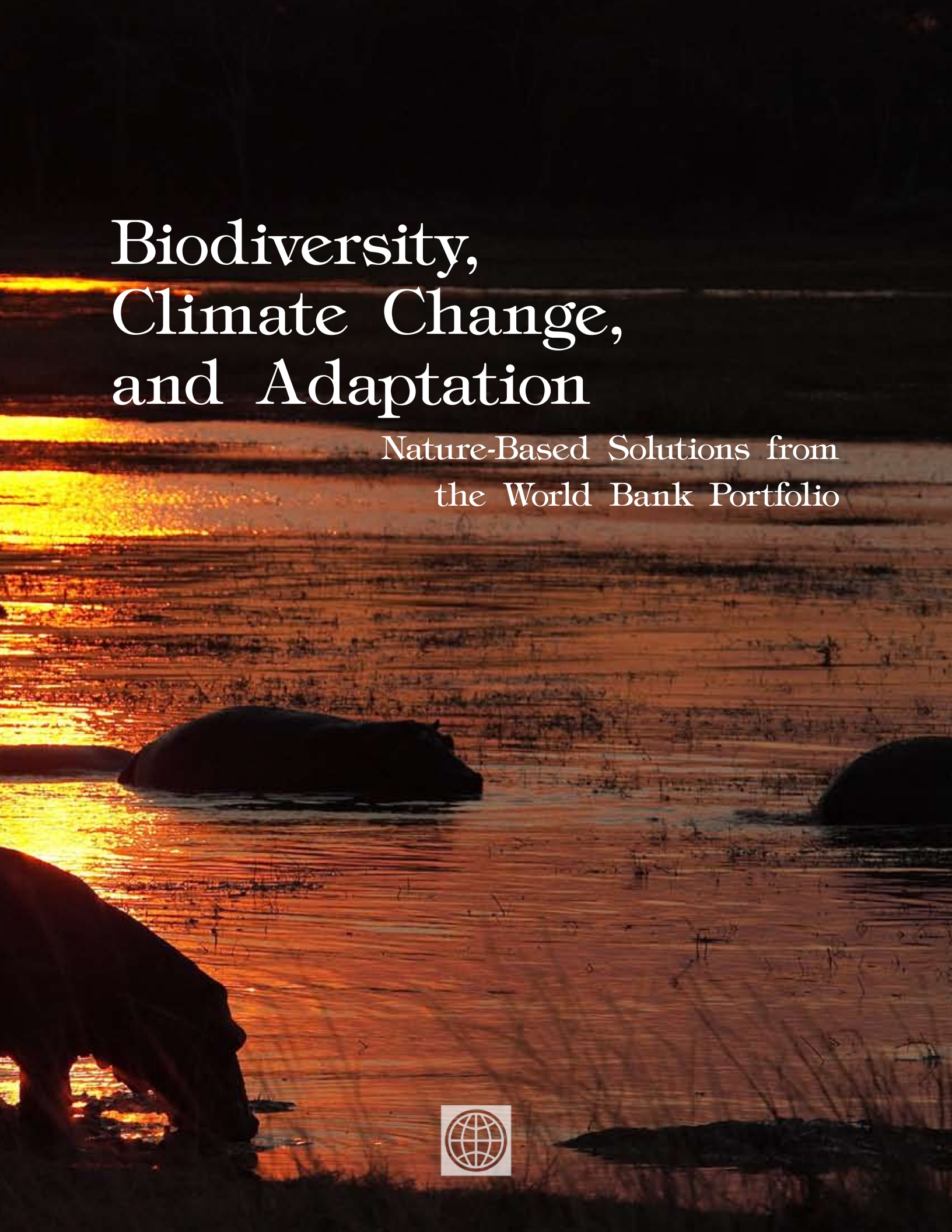
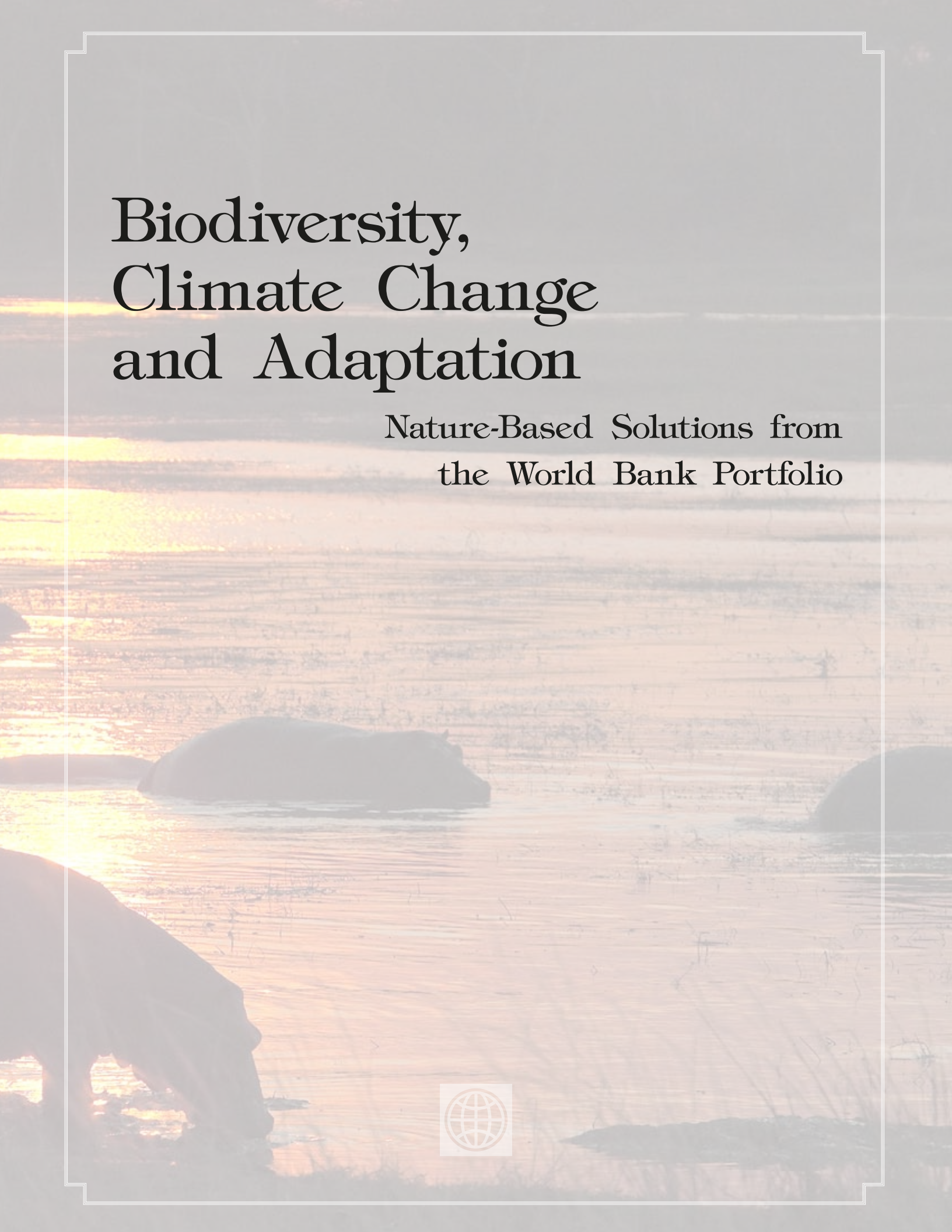


Biodiversity, Climate Change, and Adaptation

Nature-Based Solutions from the World Bank Portfolio



Biodiversity, Climate Change and Adaptation

Nature-Based Solutions from the World Bank Portfolio

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September 2008

This report was prepared by Kathy MacKinnon, Claudia Sobrevila and Valerie Hickey (Biodiversity Team, ENV) with substantial material on adaptation in LAC from Walter Vergara, and contributions from Marjory-Anne Bromhead, Christophe Crepin, Karsten Ferrugiel and Gayatri Kanungo (AFR); Emilia Battaglini, Maurizio Gudagni and Karin Shepardson (ECA); Joe Leitmann and Tony Whitten (EAP); Enos Esikuri, Marea Hatziolos, Astrid Hillers and Klas Sander (ENV); Gunars Platais, Adriana Moreira, Juan Pablo Ruiz, Walter Vergara and Jocelyne Albert (LAC); Kanta Kumari Rigaud (MENA) and Richard Damania and Malcolm Jansen (SAR). Marieke van der Zon, Grace Aguilar, Perpetual Boateng, Marielena Guttierez and Valerie Hickey updated the biodiversity database and Valerie Hickey undertook the data analysis. Jim Cantrell was responsible for the design and layout. Thanks are due to the GEF regional coordinators and to Steve Gorman and the GEF Anchor team for support and advice with regard to the GEF portfolios. This paper is part of an ongoing review of the biodiversity portfolio of the World Bank Group and a contribution to Bank work on climate change and adaptation. It is a work in progress and has not been formally cleared by Bank management. This publication, and other publications about the Bank's work on biodiversity, are available online at www.worldbank.org/biodiversity.

Design: Jim Cantrell (ENV)

Cover image: Hippos at sunset, Zambia: Kirk Hamilton. All images in text: Kirk Hamilton, Kathy MacKinnon, or Claudia Sobrevila (ENV)

Note: All dollars are U.S. dollars.

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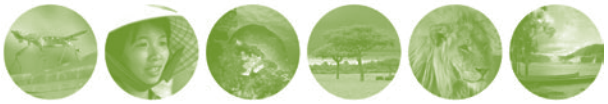

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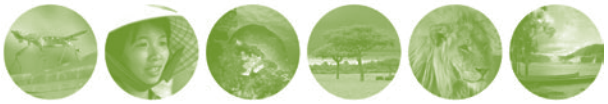
The Bank's Biodiversity Portfolio



Introduction

Climate change is a serious environmental challenge that could undermine the drive for sustainable development. Since the industrial revolution, the mean surface temperature of Earth has increased an average of 1° Celsius per century due to the accumulation of greenhouse gases in the atmosphere. Furthermore, most of this change has occurred in the past 30 to 40 years, and the rate of increase is accelerating, with significant impacts both at a global scale and at local and regional levels. While it remains important to reduce greenhouse gas emissions and reverse climate change in the long run, many of the impacts of climate change are already in evidence. As a result, governments, communities, and civil society are increasingly concerned with anticipating the future effects of climate change while searching for strategies to mitigate, and adapt to, its current effects.

The World Bank's mission is to alleviate poverty and support 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 vital to human welfare: regulating water flows, flood control, pollination, decontamination, carbon sequestration, biodiversity conservation, and nutrient and hydrological cycling. Sound ecosystem management provides countless streams of benefits to, and opportunities for, human societies, while also supporting the web of life. Biodiversity conservation contributes to environmental sustainability, a critical Millennium Development Goal (MDG) and a central pillar of World Bank assistance.

The *Millennium Ecosystem Assessment* showed that over the past 50 years human activities have changed ecosystems more rapidly and extensively than at any comparable period in our history. These changes have contributed to many net development gains but at growing environmental costs: biodiversity loss, land degradation, and reduced access to adequate water and natural resources for many of the world's poorest people. Biodiversity loss matters because species and habitats are the building blocks on which human livelihoods depend, the foundation for production forests, fisheries, and agricultural crops. Enhanced protection and management of biological resources

will also contribute to solutions as nations and communities strive to adapt to climate change.

Terrestrial and oceanic ecosystems play a significant role in the global carbon cycle. About 60 gigatons of carbon (GtC) annually are taken up and released by terrestrial ecosystems, and another 90 GtC are taken up and released by marine systems. These natural fluxes are large compared to the approximately 6.3 GtC currently being emitted from fossil fuels and industrial processes and about 1.6 GtC per year from deforestation, predominantly in the tropics. Terrestrial ecosystems appear to be storing 3 GtC per year and oceans another 1.7 GtC, with a resulting buildup of 3.2 Gt of atmospheric carbon each year. Appropriate management of terrestrial and aquatic habitats can, therefore, make a significant contribution to reducing greenhouse gases.

The World Bank Group (WBG) has a rich portfolio of biodiversity projects. Through lending and grant support to client countries, it is one of the largest international funding sources for biodiversity worldwide. This portfolio review and update shows that between July 1988 and June 2008, the World Bank approved 598 projects that wholly or partially supported biodiversity conservation and sustainable use. Of these, 277 projects have been completed. This biodiversity portfolio represents over $6 billion in biodiversity investments, including Bank contributions and leveraged co-financing. Although this investment is a very small part of the Bank's overall lending, this biodiversity funding has made a substantial contribution in helping client countries meet their obligations under the Convention on Biological Diversity (CBD), as well as implementing the convention's work programs and priorities. 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. Beyond these "traditional" biodiversity sectors, the Bank is also supporting innovative modalities for protection and improved management of natural habitats through Bank-funded energy and infrastructure projects and development policy lending (DPL). The Bank is also currently developing innovative new climate investment funds, including funds that will target natural ecosystems (see Box 1.1).

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 and from tropical evergreen and monsoon forests to savanna grasslands and unique drylands, limestone, marine and freshwater ecosystems. Many are in centers of recognized global importance for biodiversity: mega-diversity hotspots, remaining wilderness areas, the Global 200 Ecoregions described by Worldwide Fund for Nature (WWF), and Endemic and Important Bird Areas. Many projects are in countries and regions where communities are most vulnerable to the impacts of climate change. By promoting investments in these locations, the Bank is helping countries to meet the 2010 targets of the CBD and prepare for the impacts of climate change.

This portfolio review is a report for the World Conservation Congress in Barcelona in October 2008. It provides an update on previous reviews of the Bank's biodiversity portfolio, which focused on specific ecosystems (forests, mountains, marine ecosystems) and themes (protected areas) as well as previous overviews of the whole portfolio. It includes information on some of the most recent highlights of the portfolio, particularly those projects and programs that emphasize biodiversity-climate change linkages.

Methods

This paper is based on the most recent update of the World Bank biodiversity portfolio and summarizes the efforts of the World Bank Group (alternatively, WBG, the World Bank, or the Bank) over the past 20 years (1988–2008) to promote the conservation and sustainable

BOX 1.1

Innovative Funds that Leverage Biodiversity Investments for Carbon Outcomes

The BioCarbon Fund (BioCF), a public/private initiative administered by the World Bank, aims to deliver cost-effective emission reductions while promoting biodiversity conservation and poverty alleviation. This fund provides carbon finance for projects that sequester or conserve greenhouse gases in forest, agricultural, and other ecosystems. Through its focus on bio-carbon, or carbon "sinks," it delivers carbon finance to many developing countries that otherwise have few opportunities to participate in the Clean Development Mechanism (CDM), or to countries with economies in transition through joint implementation (JI). The BioCarbon Fund tests and demonstrates how land use, land-use change, and forestry (LULUCF) activities can generate high-quality emission reductions (ERs) with environmental and livelihood benefits that can be measured, monitored, and certified. The Fund started operations in May 2004 and has a total capital of $91.9 million.

Over 150 project proposals have been submitted for consideration by the BioCarbon Fund. The World Bank, in consultation with the BioCarbon Fund participants, has identified a group of around 20 leading project candidates, which would supply the greenhouse gas emission reductions to the Fund. Proposals were assessed against criteria, including the likelihood of the project raising the necessary start-up capital, the price requested per ton of carbon dioxide equivalent, the expected benefits for the local environment and communities, and the developer's track record. Geographical and technological diversity was also sought.

The Forest Carbon Partnership Facility (FCPF) will assist developing countries in their efforts to **r**educe **e**missions from **d**eforestation and **d**egradation (**REDD)** by giving added value to standing forests. The FCPF aims to reduce deforestation and forest degradation by compensating developing countries for greenhouse gas emission reductions through improved protection of forests as carbon stores. The partnership became functionally operational in June 2008.

The FCPF is designed to set the stage for a large-scale system of incentives for reducing emissions from deforestation and forest degradation, providing a source of financing for the sustainable use of forest resources and biodiversity conservation, and for the more than 1.2 billion people who depend on forests for their livelihoods. It will build the capacity of developing countries in tropical and subtropical regions to tap into any future system of positive incentives for REDD. In some of these countries, the FCPF will also help reduce the rate of deforestation by providing an incentive for each ton of carbon dioxide emissions reduced through specific emission reductions programs that target the drivers of deforestation and forest degradation.

Fourteen states have been selected as the first developing country members of an innovative partnership and international financing mechanism to combat tropical deforestation and climate change. The 14 developing countries include six in Africa (the Democratic Republic of Congo, Gabon, Ghana, Kenya, Liberia, and Madagascar); five in Latin America (Bolivia, Costa Rica, Guyana, Mexico, and Panama); and three in Asia (Nepal, Lao PDR, and Vietnam).

For more information on carbon funds administered by the World Bank, please visit http://www.carbonfinance.org

use of biodiversity. This period spans ratification and implementation of the Convention on Biological Diversity as well as two major Earth Summits in Rio de Janeiro and Johannesburg, and more than 15 years of experience with implementation activities of the Global Environment Facility (GEF). As a GEF implementing agency, the Bank has played a major role in supporting the objectives of the Biodiversity Focal Area program, especially in promoting the sustainability of protected area networks and in mainstreaming biodiversity in production landscapes.

This portfolio update incorporates both stand-alone biodiversity projects and biodiversity-related sectoral projects—for example, a hydropower project in Lao PDR,

an irrigation project in Iran, and a ship-generated waste management project in the Eastern Caribbean—that clearly describe and include biodiversity activities. It includes all such projects financed through the International Bank for Reconstruction and Development (IBRD), International Development Association (IDA), and GEF projects executed through the World Bank. The Bank's private sector partner, the International Finance Corporation (IFC), contributes to biodiversity conservation through private sector lending and GEF grants; only the latter are included in this analysis. In addition to projects and project components with specific and direct biodiversity objectives (the biodiversity portfolio), the Bank funds many other development projects that may also have positive, albeit indirect, impacts on biodiversity. For example, pollution abatement, sewage treatment, and cleaning up pollution discharges may enhance water quality in freshwater ecosystems and benefit freshwater biodiversity. This update, however, does not cover such indirect support.

A small but growing source of funding for protected areas and other biodiversity activities comes from special World Bank trust funds. The Bank contributes to biodiversity conservation through innovative programs funded by the Development Grant Facility (DGF) and the Bank-Netherlands Partnership Program (BNPP). The DGF, sourced from Bank income, provides support to global partnerships such as the World Bank/ Worldwide Fund for Nature (WWF) Alliance for Forest Conservation and Sustainable Use, the Critical Ecosystems Partnership Fund (CEPF), and the Global Invasive Species Programme (GISP). It has also contributed approximately $50 million annually to the Consultative Group for International Agriculture Research (CGIAR) networks for critical research to improve crops and increase agricultural productivity. The DGF also provided co-financing to projects such as the Millennium Assessment, Global Coral Reef Targeted Research Project, and the International Agriculture Assessment.

Since 1998, the Bank-Netherlands Partnership Program (BNPP) has contributed $50 million through its Environment Window to mainstream the environmental dimension of sustainable development into overall World Bank assistance by supporting the implementation of the Bank's corporate and regional environmental strategies. BNPP funding has supported upstream analytical work to strengthen poverty-biodiversity linkages and Bank lending; strengthened new partnerships such as Global Witness and the Alliance on forest governance; and supported capacity building through initiatives to address invasive alien species and local language field guides. Another Bank program, the Development Marketplace (DM), is providing seed funding for innovative development ideas. An increasing focus on environment in the Development Marketplace has afforded the opportunity to support new biodiversity initiatives and small grants in some of the poorer countries. Since the marketplace opened for business, it has supported 54 biodiversity projects. In 2008, the Development Marketplace focused on sustainable agriculture.

Annex 1 lists all Bank biodiversity projects included in the portfolio for the fiscal year in which they were approved by the Bank Board or, in the case of GEF medium-size projects (GEF MSPs), by the country management unit. The source of funding, whether WBG (loans, credits, or grants) or co-financing from non-Bank sources, is noted for each project. Where there is more than one source of WBG financing in a project, these components are assessed separately to avoid double counting. Co-financing amounts include contributions from borrower governments, local beneficiaries, nongovernmental organizations (NGOs), bilateral donors, regional development banks, and United Nations' agencies. As in previous reviews, biodiversity costs are determined by itemizing each activity component. For each project, figures have been estimated for total project cost, total biodiversity costs (WBG funds plus associated co-financing), and Bank biodiversity funding. Annex 1 provides a listing, by region, of all biodiversity projects with their funding and key activities.

Investment Trends

The biodiversity portfolio of the WBG has shown a steady growth over the past 20 years, especially since 1992 when GEF funding became available. Between July 1988 and June 2008, the Bank approved 598 projects that fully or partially supported biodiversity conservation and sustainable use. These biodiversity initiatives are taking place in 122 countries, and through 52 multi-country efforts. More than 130 of these projects were approved since the last World Conservation Congress in 2004. Many of these projects benefit from GEF funding.

Bank biodiversity projects directly support biodiversity conservation in a range of natural habitats, from temperate forests to freshwater rivers and lakes, from large marine ecosystems to high mountain habitats, and some of the most expansive tropical forest wildernesses. 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 actions. During the period between 1988 and 2008, the WBG committed almost $3.5 billion in loans and GEF resources and leveraged $2.7 billion in co-financing, resulting in a total investment portfolio exceeding $6 billion.

Table 1.1 shows the total World Bank commitments for biodiversity projects by year and funding source from 1988 to 2008. Cumulative WBG biodiversity funding for biodiversity projects during that period totaled $6,192 million. Figure 1.1 summarizes biodiversity investments from all funding sources.

Table 1.1 Total Biodiversity Investments by Year and Funding Source (million USD)

FY	GEF	IBRD	IDA	Trust Funds	Carbon Finance	Total WBG Investments	Co-Financing	Total Biodiversity Funding
1988	0.00	3.79	2.86	0.00	0.00	6.65	8.95	15.60
1989	0.00	3.16	3.93	0.00	0.00	7.09	5.21	12.30
1990	0.00	129.26	14.22	0.00	0.00	143.48	91.00	234.48
1991	0.00	97.17	35.48	0.00	0.00	132.65	129.94	262.59
1992	23.20	91.21	125.97	0.00	0.00	240.37	130.17	370.55
1993	29.79	17.13	28.37	0.00	0.00	75.29	43.68	118.97
1994	51.27	27.94	54.01	0.00	0.00	133.21	63.95	197.17
1995	44.06	55.81	34.80	36.66	0.00	171.33	176.06	347.40
1996	74.23	40.89	5.07	0.30	0.00	120.48	70.48	190.96
1997	95.90	39.29	103.78	2.00	0.00	240.97	158.46	399.43
1998	78.27	59.64	122.86	0.20	0.00	260.96	252.68	513.64
1999	45.12	15.87	40.15	3.23	0.00	104.36	101.97	206.34
2000	52.07	49.59	14.05	7.35	0.00	123.05	60.74	183.80
2001	166.75	49.54	29.41	27.90	0.00	273.59	268.68	542.27
2002	164.92	15.10	55.49	5.67	0.00	241.18	205.21	446.39
2003	81.31	33.33	62.29	0.00	0.00	176.92	110.68	287.60
2004	103.46	38.95	66.60	4.42	0.44	213.87	274.97	488.84
2005	118.63	88.64	73.20	14.46	0.00	294.93	154.38	449.31
2006	156.02	78.65	25.39	17.70	19.20	296.96	172.33	469.29
2007	70.61	35.54	27.52	3.02	1.04	137.73	55.78	193.51
2008	48.36	33.38	0.80	1.10	0.00	83.64	178.11	261.75
Totals	**$1,403.95**	**$1,003.86**	**$926.23**	**$124.00**	**$20.68**	**$3,478.72**	**$2,713.45**	**$6,192.18**

Figure 1.1 Annual Total Biodiversity Investments Including Co-financing (million USD)

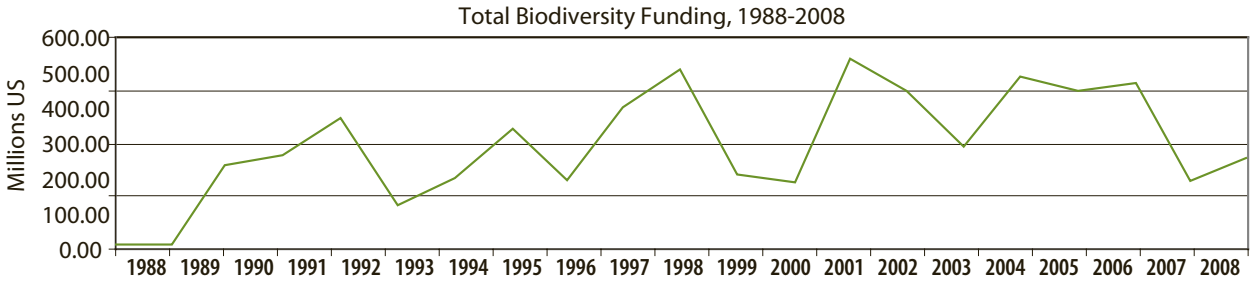


Figure 1.1 gives an indication of the normal fluctuation of the funding cycles. Apparent surges in funding between years are explained by bunching of a few large projects in some years or slippages of Board approval dates. Apparent decreases in overall funding levels in one year are usually compensated in the next. Longer preparation times due to the particular pace of country dialogue and the intricacies of biodiversity projects are also contributors to these fluctuations. Comparisons between years are thus difficult to interpret and necessitate a longer-term view of biodiversity portfolio trends. Preliminary qualitative assessments of the portfolio suggest that funding reflects, and responds to, the diverse strategic conservation priorities of Bank clients.

Partner governments have borrowed just over 31 percent (down from 39 percent in 2000) of this total through IBRD loans or IDA credits, representing a total of $1,930 million. Grants comprise 25 percent ($1,548 million) and were facilitated through Bank-executed GEF projects ($1,403 million), several trust funds ($124 million), and carbon financing ($20.7 million). The remaining 44 percent of total funding ($2,713 million) represents co-financing and parallel financing, approximately equivalent to an additional 78 cents for every dollar the World Bank invests in biodiversity (up from 70 cents per dollar invested by 2000). Figure 1.2 presents the total biodiversity investment by funding source. Figure 1.3 represents the total annual biodiversity investments by the Bank and the leveraged co-financing.

The total number of biodiversity projects or projects with biodiversity components funded by IBRD and IDA is 116 and 122 projects, respectively. Some $398 million of IDA funds (43 percent) and $276 million of IBRD funds (27.5 percent) are linked to GEF financing; this is a trend that has become more common over time. This indicates that a wide range of client countries, including the poorer IDA-eligible countries, are borrowing for biodiversity conservation and sustainable use. It is expected that in the coming years new carbon finance modalities will become a major source of conservation funding, especially in biodiversity-rich countries.

In the early stages of the review period (1989–92), IBRD funded a few large projects. This is well illustrated by the Latin America and Caribbean (LAC) region, and Brazil specifically, where funding in the early period focused on large environmental projects such as the 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, which indicates improved mainstreaming of biodiversity conservation into broader development lending.

Figure 1.2 Total Biodiversity Investments by Funding Source, 1988–2008

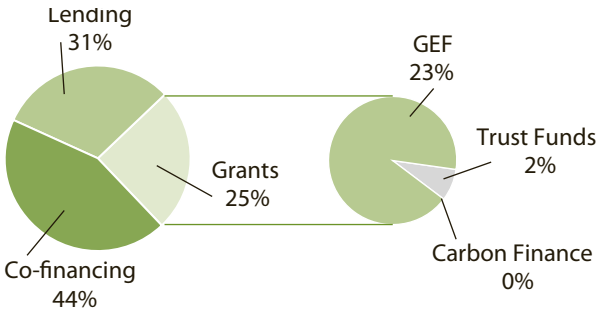
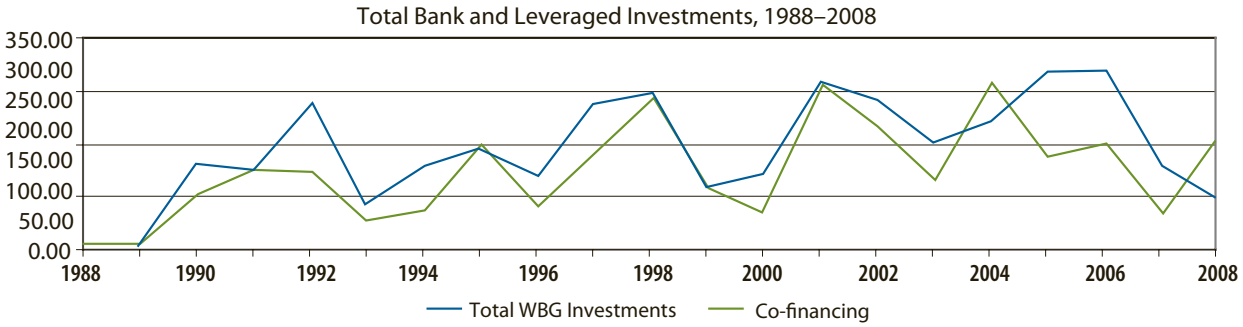


Figure 1.3 Annual Biodiversity Investments—Bank Investments and Co-financing (million USD)



The number of biodiversity projects as a whole has steadily increased over the review period, with an addition of 76 new projects over the two years between 2006 and 2008. While the number of projects has increased, the average investment per project has become smaller. Much of the increase is attributable to an increase in the number of GEF projects. More than 50 percent of the Bank's total biodiversity portfolio is made up of GEF projects or projects with GEF components blended with IBRD and IDA lending (see Figure 1.4).

The WBG is supporting conservation and sustainable use of biodiversity worldwide. Table 1.2 and Figure 1.5 show the cumulative biodiversity funding (over $6 billion) from all sources by region. The major share (39 percent) of all funding for biodiversity projects went to Latin America and the Caribbean (LAC) ($2,428 million), with 6 percent to South Asia (SAR), 29 percent to Africa (AFR), 12 percent to East Asia and the Pacific (EAP), and nearly 6 percent to Eastern Europe and Central Asia (ECA).

Table 1.2 Total Biodiversity Investments by Region

	Total Investments (million USD)	*Percentage*
AFR	$1,796.13	29.01
EAP	$775.65	12.53
ECA	$364.50	5.89
LAC	$2,428.40	39.22
MNA	$139.68	2.26
SAR	$378.33	6.11
Global	$309.50	5.00
Total	**$6,192.18**	

Less than 3 percent of total biodiversity funding went to the Middle East and North Africa (MNA). A further 5 percent represents biodiversity financing through global initiatives, such as the IFC Small and Medium Enterprise Fund, the Critical Ecosystems Partnership Fund, Coral Reef Targeted Research, and projects funded under the BNPP Forests and Biodiversity windows.

Table 1.3 shows IBRD and IDA funding by region, totaling $1,004 million and $926 million respectively.

Figure 1.4 Bank Biodiversity Investments by Funding Source

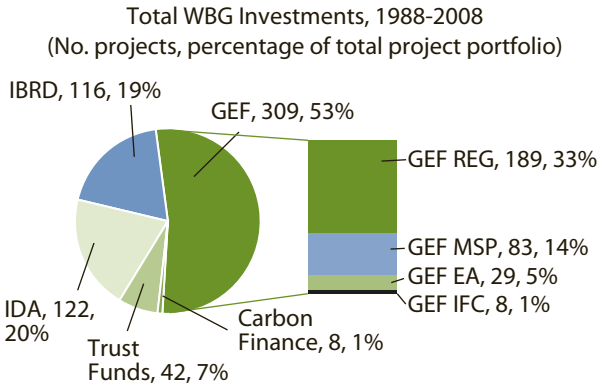


Figure 1.5 Total Biodiversity Investments by Region (million USD)

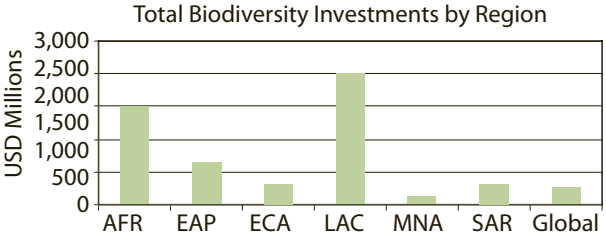


Table 1.3 Regional Breakdowns of Biodiversity Investments by Funder

	IBRD	IDA	Trust Funds	Carbon Finance	GEF	GEF REG	GEF MSP	GEF IFC	GEF EA	Total
AFR	16.728	502.1315	11.11	9.7	395.233	379.682	14.13	0.475	0.946	934.9025
EAP	213.786	123.3699	18.835	2	168.0914	137.98166	13.69775	15.19	1.222	526.0823
ECA	55.79179	29.5425	5.055	1.48	136.1177	127.68371	5.245	0	3.189	227.987
LAC	688.6756	63.21063	51.414	7.5	508.2319	472.73958	29.6308	5	0.8615	1319.032
MNA	25.47818	1.711008	0	0	59.01	55.88	2.24	0	0.89	86.19919
SAR	0.4	206.2597	0	0	66.52	66.32	0	0	0.2	273.1797
Global	3	0	37.59	0	70.75	56	0.75	14	0	111.34
Total	1003.86	926.2253	124.004	20.68	1403.954	1296.2869	65.69355	34.665	7.3085	3478.7228

Among the regions, LAC still has the largest share of IBRD biodiversity funding with $688.7 million (68 percent). Many of the LAC countries are among the mid- to higher-income developing countries and are not eligible for IDA credits. Conversely, the relatively poorer sub-Saharan African countries have received the largest share of IDA funding, corresponding to 54 percent (or $502.1) of total IDA biodiversity funds.

As an implementing agency for the GEF, the WBG channels GEF grants for enabling activities (EAs), medium-sized projects (MSPs), and regular GEF grants, both through the Bank and the IFC. The Bank's biodiversity investments through GEF grant windows have more than doubled over the last five years to $1,403 million in all regions. By FY08, the Bank had supported 29 biodiversity EAs (up from 19 in FY99) and 83 MSPs (up from 17 in FY99), spread across all Bank regions (see Table 1.3). In recent years, the Bank has provided less support for enabling activities such as Biodiversity Action Plans but has begun to help some countries to design and implement Biosafety projects. Pilot projects to address biosafety issues have been developed for India, Colombia, and West Africa.

GEF funding for biodiversity mirrors regular lending. Together the Africa and LAC regions jointly absorb over 60 percent of all biodiversity investments made through the three GEF windows. Latin America and the Caribbean is the region with the highest GEF funding overall, a reflection of the high biodiversity value of the region's ecosystems and country capacity to prepare and implement projects. In recent years, a greater focus on regional and national projects to address sustainable land management and land degradation has increased GEF funding to Africa, often with some associated biodiversity benefits.

More than half of these GEF investments have gone toward protected area projects, but the Bank is increasingly seeking to promote the GEF mandate on mainstreaming biodiversity in production landscapes, especially where there are opportunities to integrate GEF-funded activities within Bank sector lending. The Bank is also increasingly looking at best practice and lessons learned, both to improve the effectiveness of the GEF portfolio and overall Bank lending efforts.

The introduction of GEF MSPs in 1997 made mid-sized grants more readily available to NGOs and nongovernment stakeholders, which allowed a rapid expansion of the biodiversity portfolio. Latin America and the Caribbean (LAC) is the region with the highest GEF funding overall for biodiversity, a reflection of the species richness and high biodiversity value of the region's ecosystems. LAC is also the region with the most MSPs. The MSPs have proven to be useful and cost-effective instruments under the Biodiversity Focal Area to test new management models and demonstrate tangible biodiversity impacts at key sites, even though it may be difficult to scale up successful pilots into larger programs. MSP activities with an effective local

partner (for example, NGOs,) have proven especially useful for site-based conservation, even within countries riven by civil strife and weak governance. The MSP grants have also provided the opportunity for greater community involvement in biodiversity management. Unfortunately, the recent introduction and slow uptake of national allocations under the GEF Resource Allocation Framework (RAF) seems to have reduced GEF availability to many of the least developed countries and NGOs.

Overall, co-financing from client governments and other donors makes up 44 percent of the total biodiversity investment; this reflects strong commitment for biodiversity conservation at the national level. Figure 1.6 reveals the total WBG and co-financing investments in each region, and Figure 1.7 illustrates the breakdown of co-financing alone.

In line with the findings for total investments, 73 percent of the $2,713 million parallel and co-investment funding supports biodiversity conservation and sustainable use in the LAC and Africa regions (see Figure 1.7). This is consistent with previous portfolio reviews.

Figure 1.6 Total Co-financing for Biodiversity Projects in Each Region (million USD)

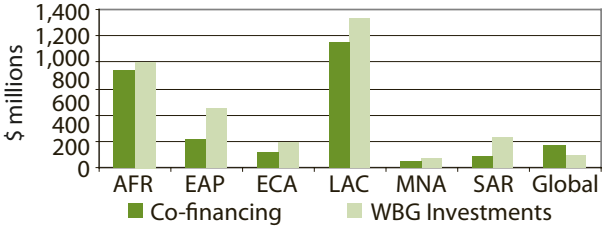


Figure 1.7 Percentage of Regional Co-financing

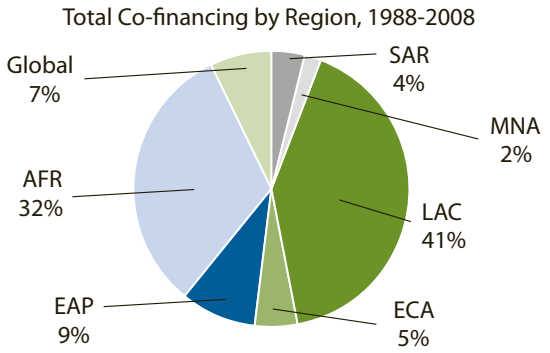
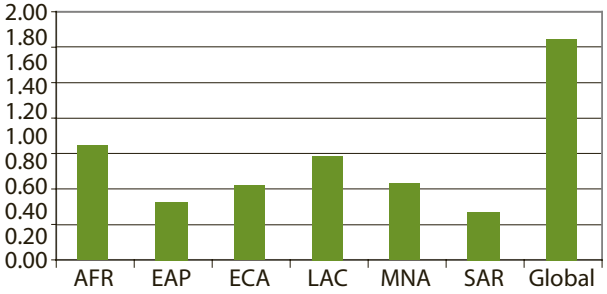


Figure 1.8 Ratio of Co-financing to Bank Investments in Each Region



Though co-financing amounts differ from project to project, it is clear from Figure 1.8 that the LAC and AFR regions attract over 80 cents in co-financing for each WBG dollar invested, whereas EAP and SAR attract only 40 cents.

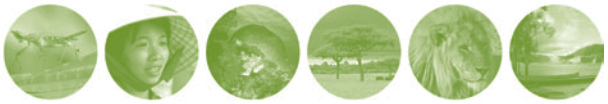
Support in WBG-funded projects covers the entire range of globally important ecosystems. Forest ecosystems received a majority of the investments with more than half of all projects focused on forest systems, including dry forests and rainforests. Fewer projects dealt with wetland ecosystems, coastal and marine ecosystems, drylands, and mountain ecosystems. Many projects provide support to protected areas and other conservation initiatives across more than one major ecosystem. Over the whole biodiversity portfolio, the largest amount of funding and support has gone to projects that include expansion and strengthening of protected areas, mechanisms for sustainable financing, and support for conservation activities in park buffer zones. The Bank is committed to maintaining support for protected areas, but increasingly is seeking opportunities to link such support to sectoral development programs, climate change, and biodiversity activities in the wider landscape.

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, complemented by access to trust funds and lending resources, can help to introduce biodiversity within national agendas as a critical part of sustainable development. As well as being a major funding source for biodiversity projects in developing countries, the Bank is a source of technical knowledge and expertise. Additionally, the Bank has the standing and convening power to facilitate participatory dialogue between client countries and networks of other relevant stakeholders on matters of regional biodiversity and climate change concern, such as loss of ecosystem resilience, forest law enforcement and governance, wildlife trade, and overharvesting of natural resources. The new multi-donor climate investment funds provide exciting new opportunities to further benefit biodiversity while addressing the climate change agenda.

2

Biodiversity, Climate Change, and Local Livelihoods: Challenges and Opportunities



Habitat loss and fragmentation, overexploitation, pollution, the impact of invasive alien species and, increasingly, climate change all threaten global biodiversity. Global warming will affect all species and exacerbate the other environmental stresses already being experienced by ecosystems. Climate change may thus further accelerate both the ongoing impoverishment of global biodiversity, caused by unsustainable use of natural capital, and the degradation of land, freshwater, and marine systems. For example, the warming of coastal waters, coral die-off, and impacts on coastal fisheries caused by climate change are exacerbating the impacts on marine systems of overexploitation by industrial and artisanal fisheries, as well as pollution from ships' waste and land sources. Moreover, this degradation and disturbance in terrestrial and aquatic ecosystems generate niches that can be exploited by invasive exotic species.

Impacts of Climate Change

Climate change, and more frequent extreme weather events such as hurricanes, will have repercussions on coastal development, water supply, energy, agriculture, and health, among other sectors. Table 2.1 shows the likely impact of potential climate-related threats in different Bank client countries, many of them among

Table 2.1 Six Climate Threats, and the 12 Countries Most at Risk from Each

Drought	*Flood*	*Storm*	*Coastal 1m*	*Agriculture*
Malawi	Bangladesh	Philippines	All low-lying Island States	Sudan
Ethiopia	China	Bangladesh	Vietnam	Senegal
Zimbabwe	India	Madagascar	Egypt	Zimbabwe
India	Cambodia	Vietnam	Tunisia	Mali
Mozambique	Mozambique	Moldova	Indonesia	Zambia
Niger	Laos	Mongolia	Mauritania	Morocco
Mauritania	Pakistan	Haiti	China	Niger
Eritrea	Sri Lanka	Samoa	Mexico	India
Sudan	Thailand	Tonga	Myanmar	Malawi
Chad	Vietnam	China	Bangladesh	Algeria
Kenya	Benin	Honduras	Senegal	Ethiopia
Iran	Rwanda	Fiji	Libya	Pakistan

☐ Low Income ☐ Middle Income

the poorest nations. Many countries would already suffer with a sea-level rise of only 1 meter, but a more dramatic rise of up to 5 meters would have even greater impacts, flooding large areas in the Philippines, Brazil, Venezuela, Senegal, and Fiji. Climate change is already affecting many ecosystems, especially those in higher latitudes. The impacts of permafrost melt in Mongolia, for instance, are already affecting water resources and biodiversity in Mongolia (see Box 2.1).

BOX 2.1

Linking Biodiversity and Climate Change: Permafrost Melt and Biodiversity Loss in Hövsgöl National Park, Mongolia

Hövsgöl National Park is centered on Lake Hövsgöl, one of the of the world's ancient lakes located about 200 km southwest of Lake Baikal, in mountainous northern Mongolia at 1,700m above sea level. The lake is 135 km long, about 20-30 km wide, with a depth of 262 m. Primary production in the lake is quite low, and the deep penetration of light down to 30 m gives it a blue hue, thus the name, "the blue pearl of Mongolia." The winters are long and vicious, with temperatures dropping to below -40° C. The Lake Hövsgöl area lies at the southern edge of the taiga forest, and is underlain by permafrost (layers of frozen soil).

Uncontrolled grazing by domestic animals—sheep, goats, and cattle—on the mountain slopes around the lake and the gathering of fuel wood have caused the forest edge to retreat. The loss of forest exposes the ground to sunlight; as a result, the permafrost melts at a faster rate than normal, and aerobic decomposition occurs, producing carbon dioxide. The region has already had an average temperature increase of about 1.4 C° over the last 35 years.

In 2001, the Mongolian Academy of Sciences received a five-year GEF grant to study the dynamics of biodiversity loss and permafrost melt in Hövsgöl National Park. The objectives of this study were to:

- Identify the impacts of pasture use and forest cutting on the dynamics of forest, steppe, riparian zones, and streams in tributary valleys of Lake Hövsgöl.
- Define how those impacts interact and are affecting the melting of permafrost (and thus release of carbon dioxide), soil characteristics, and plant and animal biodiversity.
- Inventory climate change effects in the Hövsgöl National Park.
- Determine sustainable resource use patterns that will also protect biodiversity, permafrost, and soil sequestration of carbon.
- Calculate the costs and benefits of alternative land use practices, especially as related to pastoral nomads.

The research determined that the active-layer thickness of the permafrost in the Hovsgol region varied in association with livestock grazing pressure. Surface ground data shows that different plant covers have different insulation values; removal of vegetation cover increases mean summer surface and ground temperatures, accelerating the rate of permafrost melt. Thus, the key to preserving permafrost and ecosystems, especially in the Hovsgol taiga zone, must be based on the protection of appropriate vegetation cover. The researchers concluded that climate change impacts on the steppe and forests are very similar to, and magnify, those caused by nomadic pastoralism and forest cutting. Accordingly herders need to change grazing strategies to adapt to changing conditions in this harsh and fragile environment. The conclusions regarding land use practices have been summarized in the recently published Herders' Handbook (English version on www.hovsgolecology.org). This includes recommendations for more frequent movements of livestock to reduce grazing pressure and improve range management. While little can be done to alter the immediate course of climate change, protecting vegetation cover through appropriate land-use practices can slow the rate of permafrost melt and help to protect Mongolia's water resources, biodiversity, and natural ecosystems. These lessons are also relevant to other areas within the great band of temperate forest-grassland mosaic in the mountains between Eastern Europe and eastern Russia/northern China.

The impacts of climate change in the Latin America and Caribbean Region (LAC) include potential sea-level rise that threatens coastal habitats and human settlements; increased sea surface temperatures; melting of tropical glaciers and snowcaps; warming, and drying out, of moorlands and other high altitude ecosystems in the Andes; higher frequency and distribution of forest fires; the spread of tropical disease vectors into the Andes piedmont; changes in agricultural productivity; and impacts on coastal and watershed ecosystems. These changes will have major impacts on the region's rich biodiversity as well as on human health and livelihoods.

The biogeophysical implications of sea-level rise will vary greatly in different coastal zones around the world depending on the nature of coastal landforms and ecosystems. For example, flooding conditions in the Pampas in the province of Buenos Aires would be exacerbated by any degree of sea-level rise because of the reduced effectiveness of the natural drainage system. Some coastal areas in Central America and on the Atlantic coast of South America, such as the river deltas of the Magdalena in Colombia, would be subject to inundation risk, as would the large, flat deltas of the Amazon, Orinoco, and Paraná rivers. Estuaries such as the Río de la Plata would also suffer increasingly from saltwater intrusion, creating problems in freshwater supply. Potential sea-level rise changes already reported for the Caribbean Basin range from 3 to 8 mm in three years and will impact both human populations and biodiversity. Anticipated increases will threaten aquifer-based freshwater supplies through saline intrusion in many of the smaller islands as well as leading to flooding of coastal zones. This is a major concern, given that over 50 percent of the people in most Caribbean states reside within 2 km of the coast. Resources critical to island and coastal populations—including beaches, wetlands, fresh water, fisheries, coral reefs and atolls, and wildlife habitat—are at risk.

Climate change will affect the physical and biological characteristics of coastal areas, modifying their ecosystem structure and functioning. As a result, coastal nations face losses of marine biodiversity, fisheries, and shoreline habitats such as wetlands and mangroves. Increases in ocean temperatures cause corals to bleach and, under sustained warm conditions, to die. Research in the Caribbean shows that nearly 30 percent of warm-water corals have disappeared since the beginning of the 1980s, a change largely due to increasingly frequent and intense periods of warm sea temperatures. The

increase of CO_2 in the atmosphere is also resulting in an acidification of the oceans, affecting the calcification of reef plants and animals, especially corals, and thus reducing the ability of reefs to grow vertically and keep pace with rising sea levels. The drowning of atolls and destruction of corals have long-term implications for coastal zone protection, ecosystem integrity, biodiversity, and productivity of the tropical seas and fisheries.

At the other end of the altitudinal spectrum, climate change is affecting mountain ecosystems. Glacial retreat in the Andes is occurring at an alarming rate. Recent measurements show catastrophic declines in glacier volumes, which are likely to result in substantial impacts on water flows to Andean valleys. At lower mountain altitudes, changes observed include loss of water regulation, increased likelihood of flash fires, and changes in ecosystem composition and resilience. Moreover, as temperatures increase, there is a substantive risk of recurring glacial overflows caused by ice melting, placing large downstream populations and infrastructure at imminent risk. Warming is also affecting the moorlands, high-altitude ecosystems with unique and abundantly diverse flora and fauna that are also a storage area for water and carbon in the soil. Recent research shows that climate change will be even more pronounced in high-elevation mountain ranges, which are warming faster than adjacent lowlands. Hydrological and ecological changes of this magnitude would result in a loss of unique biodiversity, as well as a loss of many of the environmental goods and services provided by these mountains, especially water supply, basin regulation, and associated hydropower potential.

To face these increasing challenges, governments, communities, and civil society seek a better understanding of the anticipated effects of climate change, as well as strategies to mitigate and adapt to its effects. The World Bank is assisting client countries to develop both mitigation and adaptation strategies. The Bank's involvement in adaptation was initiated in the Latin America region with the formulation of the Caribbean Planning for Adaptation to Climate Change (CPACC) Project in 1997, a regional enabling activity. It focused on the vulnerability of the island nations of the Caribbean to the impacts of climate change, with particular emphasis on the region's dependence on natural resources and environmental services. This effort has been followed by other regional and national planning programs and projects, which are supported by a variety of funding mechanisms, including GEF Adaptation funds and special climate and carbon funds (see Table 2.2).

Some of the most threatened ecosystems globally are Mediterranean-type ecosystems such as those found in the Cape Floral Kingdom, Mediterranean basin, and southern Chile. The Cape Floristic Region (CFR) is the smallest of the world's six floral kingdoms, protecting unique Mediterranean-type vegetation known as fynbos. It covers an area of 90,000 square kilometers and is the only floral kingdom to be located entirely within the geographical confines of a single country, South Africa. The CFR contains 9,600 species of vascular plants, many of them endemic; it has been identified as one of the world's "hottest" biodiversity hotspots. The rich biodiversity of the CFR is under serious threat as a result of the conversion of natural habitat to permanent agriculture and to rangelands for cattle, sheep, and ostriches; inappropriate fire management; rapid and insensitive infrastructure development; overexploitation of marine resources and wild flowers; and infestation by alien species. Some important habitats have already been reduced by over 90 percent. Less than 5 percent of land in the lowlands enjoys any conservation status. Climate change will increase the threats to these threatened ecosystems and put increasing pressure on water resources, while increasing vulnerability to fire and the spread of invasive alien species.

The Cape Floristic Region is one of the world's biodiversity hotspots, one of the 34 most species-rich regions on Earth. Together these hotspots harbor more than 75 percent of the most threatened mammals, birds and amphibians, yet they have already lost more than 85 percent of their original habitat cover. These critical areas for conservation are also home to millions of people who are highly dependent on healthy ecosystems for their livelihoods and

Table 2.2 Adaptation Activities in the Latin America

Region Region/ Country	*Project/Activity*	*GEF-TF amount (US$m)*		*Status*
Caribbean (CARICOM nations)	Caribbean Planning for Adaptation to Climate Change	5.8	GEF–Enabling activities	Completed
Caribbean (CARICOM nations)	Mainstreaming Adaptation to Climate Change	5.0	GEF–Enabling activities	Under implementation
Dominica, St. Lucia, and St. Vincent and The Grenadines	Implementation of Adaptation Measures in Coastal Zones	1.95	GEF–Strategic Priority on Adaptation	Under implementation
Colombia	Integrated National Adaptation Program	5.3	GEF–Strategic Priority on Adaptation	Under implementation
Central Andes	Adaptation to impacts from Tropical Glacier Melt	8.0	GEF–Strategic Priority on Adaptation	In preparation
Trinidad and Tobago	Nariva Wetlands restoration and Carbon Offset	3.0	BioCarbon Fund	In preparation
St. Lucia	Reducing uncertainties from projected impacts of climate change	0.3	Climate Change Special Program	Under implementation
Colombia	Measurement of climate trends and impacts in the central range of the Colombian Andes	0.4	Climate Change Special Program	Under implementation

Source: Vergara 2005

BOX 2.2

Mainstreaming Conservation in the Cape Floristic Region

The C.A.P.E. Biodiversity Conservation and Sustainable Development Project is building institutional capacity and collaboration among multiple stakeholders— including government agencies, private landowners, and local communities—to mainstream biodiversity conservation into the area's economic activities and enhance conservation of the Cape Floristic Region. The project is supporting the design of market-based mechanisms for conservation management, such as payment for environmental services, as well as micro-enterprise opportunities for conservation-related businesses, including small enterprises that improve livelihoods and social conditions for local communities. Biodiversity concerns are also being integrated into the activities of five watershed management agencies. On the protection side, management capacity will be strengthened for more effective management of protected areas; tourism development plans will be implemented; and stakeholders will receive direct and indirect benefits from protected areas. The project aims to expand the conservation area of the CFR by over 4,000 square kilometers, both in formal protected areas and through partnerships and conservancy agreements with private landowners. A primary focus is on land management for conservation and sustainable natural resource management in four mega-reserves, corridors from the mountains to the sea in the Cederberg, Kogelberg, Baviaanskloof, and along the Garden Route from the Tsitsikamma Mountains to the coast.

Protection of rare species in fragmented landscapes is being increased through conservation initiatives in the production landscapes through public-private partnerships, including the Biodiversity and Wine Initiative whereby winegrowers are setting aside important habitats for conservation within their vineyards. Other programs to encourage more biodiversity-friendly agriculture and reduce water use are focussing on the potato, rooibos (herbal tea) and flower harvesting industries. These programs are closely linked to, and complement, government-led initiatives in the CFR to remove water-hungry invasive alien species through the Working for Water and Working for Wetlands programs. These programs help to maintain biodiversity in mountain, freshwater, and estuarine ecosystems resources while protecting important water sources and creating new employment opportunities.

well-being. Several of these hotspots will be especially vulnerable to climate change, including island systems in the Caribbean and Pacific, high mountain systems such as the Tropical Andes and Himalayas, and desert systems such as the Succulent Karoo (see Box 2.3).

Why Biodiversity Matters in a Changing World

How can improved biodiversity management enhance resilience to climate change and contribute to adaptation strategies? Species and habitats are the building blocks on which human livelihoods depend, the foundation for productive forests, fisheries, and agricultural crops. Climate change is already impacting on ecosystems and livelihoods, but enhanced protection and management of biological resources can mitigate these impacts and contribute to solutions as nations and communities strive to adapt to climate change.

Protecting forests and other natural ecosystem can provide social, economic, and environmental benefits, both directly through more sustainable management of biological resources and indirectly through protection of ecosystem services.

The Bank is already a major global funder of biodiversity initiatives, including support to 598 projects in over 120 countries during the last 20 years. Many of those

BOX 2.3

Richtersveld Community Biodiversity Conservation

The Succulent Karoo Biome covers 116,000 square kilometers of desert along the Atlantic coast of South Africa and southern Namibia and supports the world's richest succulent flora. The transboundary area—comprising the Richtersveld, Gariep River, Ais-Ais, and the Fish River canyon—has a staggering 2,700 plant species, of which 560 are endemic. Compared to other hotspots, the vegetation in the Richtersveld remains relatively intact in spite of pressures from overgrazing and diamond mining. In recognition of these values, the Richtersveld Cultural and Botanical Landscape has recently been included in UNESCO's World Heritage List.

The Succulent Karoo is now globally recognized as an example of a biodiversity hotspot under apparent and imminent threat from climate change. Projected time frames for onset of significant impacts vary from 30 to 50 years, although some botanists believe that early signs of global warming may be already evident in the higher mortalities of Aloe species in the Richtersveld. The implications of climate change on ecosystems and livelihoods are highly significant. Given expected climate change scenarios and the fact that 75 percent of the Richtersveld is under communal management, a GEF-funded project in the Richtersveld has opted for a three-tiered strategy for conservation action: (1) forward planning by integrating biodiversity into land use management planning; (2) improved reactive management and implementation of environmental management plans for livestock and mining; and (3) monitoring the effectiveness of land use planning and management in achieving conservation objectives (for example, monitoring the distribution of *Aloe pillansii* as an indicator species for climate change).

More specifically, the unique attributes of the Richtersveld make the region highly suitable as an international ecological research location for the study of global climate change. The South African research community is currently engaged in the development of a network of long-term ecological research sites that act as ecological observatories for change in ecosystems. In this context, the people of the Richtersveld are in the process of forming research partnerships to study global climate change. Specific attention will be given to design a protected area network resilient to species loss. Maintaining ecological connectivity and the prevention of habitat degradation are essential "lines of defense" against the impacts of climate change.

projects are already promoting sound natural resource management that could contribute to mitigation and adaptation through maintaining and restoring natural ecosystems, improving land and water management, and protecting large blocks of natural habitats across altitudinal gradients. Improved protection of high biodiversity forests, grasslands, wetlands, and other natural habitats provides benefits for biodiversity as well as carbon storage. Integrating protection of natural habitats and improved management of natural and agricultural resources into adaptation plans can contribute to cost-effective strategies for reducing vulnerability to climate change.

Protected Areas: Meeting the Challenges of Conservation and Climate Change

Protected areas are the cornerstones of biodiversity conservation and a valuable buffer against the impacts of climate change. Around the world the World Bank Group is supporting the strengthening of protected area systems and innovative models of management and financing to ensure their sustainability. Projects include activities such as conservation planning and establishment of new protected areas and biological corridors (for example, in Georgia, Ghana, Central America, and Brazil); improved management of "paper parks" and existing protected areas (India, Pakistan, Madagascar, Uganda, Bolivia, Ecuador, and Russia); control of invasive exotic plants (Mauritius, Seychelles, and South Africa); protection and restoration of wetlands and other native habitats (Bulgaria, Croatia, and Indonesia); promoting community management of terrestrial and marine protected areas, indigenous reserves, sacred groves, and clan conservation areas (Colombia, Ecuador, Ghana, Indonesia, Peru, Papua New Guinea, and Samoa); and promoting mechanisms to ensure sustainable finance for protected areas and conservation (Bhutan, Madagascar, Tanzania, and Peru). Large areas of natural habitat are being conserved through transboundary projects in regions such as Central Asia and MesoAmerica, as well as by planning and establishing new protected areas within a mosaic of other improved management systems in the extensive forest wilderness areas of Brazil and Russia. A notable feature of many of these programs is the increasing involvement of local community organizations in implementation, providing communities with a key stake in sustainable resource management and biodiversity conservation.

Protected areas, and the natural habitats within them, can protect watersheds and regulate water flow, 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. Floodplain forests and coastal mangroves act as safety barriers against natural hazards such as floods and hurricanes, while natural wetlands filter pollutants and serve as nurseries for local fisheries. Although ecosystem services are rarely credited in national accounts, many protected areas can be justified on the basis of traditional economic cost-benefit criteria. A series of Bank-supported publications produced by the World Wide Fund for Nature (WWF) present compelling arguments for the role protected areas can play in the provision of water services and other services that help to mitigate the impacts of environmental change.

Although most protected areas are established primarily for their biodiversity values, many provide other ecosystem services, including watershed protection and provision of high quality water; carbon storage and sequestration; and coastal protection and reducing vulnerability to disasters such as floods, drought, and other natural hazards. The Amazon Region Protected Areas Program (ARPA), for instance, is assisting the government of Brazil to establish new protected areas in the Amazon (see Box 2.4). With new emphasis on the role of standing forests as carbon stores, Brazil is increasingly promoting the ARPA model as a response to climate change as well as biodiversity conservation.

BOX 2.4

Amazon Rainforest Protected Areas System (ARPA): A Storehouse for Carbon and Biodiversity

The ARPA program has been supporting the creation and implementation of protected areas in the Brazilian Amazon, a major biodiversity wilderness area and carbon sink. ARPA has created 22.28 million hectares of protected areas in the Brazilian Amazon since 2000, surpassing its first phase target of 18 million hectares. ARPA also supported strengthened management of an additional 8.65 million hectares of protected areas existing before 2000. With these 30.93 million hectares of biodiversity-rich forests—a mosaic of state, provincial, private, and indigenous reserves—ARPA is the biggest protected area program globally. Plans for the future are even more ambitious—to create a system of well-managed parks and other protected areas, including extractive and indigenous reserves, that together encompass some 193,000 square miles, an area surpassing in size the entire U.S. National Park system.

ARPA was established to protect biodiversity, but the mosaic of protected areas contributes to both Brazilian and global efforts to fight climate change through avoided deforestation. The carbon stock in ARPA reserves is estimated at 4.5 billion tons of carbon, with potential reductions in emissions estimated at 1.8 billion tons of carbon. This role is recognized in the 2006 Stern Review on the Economics of Climate Change.

The ARPA program has tested and demonstrated the value of public-private partnerships and different institutional models, both in implementation of the overall program and management arrangements at individual forest sites. The program funding is not disbursed through the government but through an NGO (the Brazilian Biodiversity Fund, or FUNBIO), which allows greater flexibility and innovation to improve operational effectiveness and creation of accounts that are co-managed by protected area managers in the field for small-scale service payments and purchases. A new trust fund to finance the recurrent costs to manage these areas has been created and capitalized up to $20 million.

The innovative design of ARPA has mainstreamed biodiversity conservation into land use planning and management under the Amazon's state governments and is now being replicated elsewhere. Many states are leveraging additional funds to support newly created federal and state areas. In addition, ARPA has been able to engage the private sector of Brazil and European donors to provide large funds to support protected areas. The project has worked with WWF and many other NGOs. This makes it a unique collaborative and global effort to protect Amazon biodiversity. Innovative institutional arrangements through the FUNBIO Foundation are now being scaled up and replicated in other large-scale projects and programs, such as the newly approved National Biodiversity Mainstreaming and Institutional Consolidation Project. In late 2007, FUNBIO also agreed with the state of Rio de Janeiro to develop a state environmental compensation fund and set up a program to support the state's protected areas based on the ARPA experience.

Corridors and Connectivity

Conservation biology confirms the need to protect large areas of habitat and maintain connectivity between natural habitats and across altitudinal gradients. Climate change studies show that a large part of the carbon being released into the climate is coming from stored carbon; that is, carbon from deforestation, changed land uses, and soil disturbances. Strengthened protection across large wilderness areas and initiatives to connect areas of natural habitats can serve a dual function, storing carbon and enhancing conservation of threatened species. Transboundary conservation efforts in the West Tien Shan in Central Asia foster international collaboration and cooperation across national boundaries, reducing disturbance on fragile mountain grasslands and promoting conservation of wide-ranging species (see Box 2.5).

BOX 2.5

Central Asia: Where the Mountains reach the Sky

Situated at a biological crossroads, the West Tien Shan, the westernmost range of the great Himalayan chain, is a biodiversity hotspot with some 3,000 recorded species of flora and fauna.

The mountain range is an area of high rainfall amid arid and semi-desert plains and steppes, covering a variety of ecosystems, from glaciers to deserts. These mountains support unique and globally significant communities of threatened species such as snow leopard, white-clawed bear, and Central Asian mountain goat and argali. The region is also a center for the wild relatives of commercially important horticultural and agricultural plants—including apples, walnuts, apricots, and tulips—and many other endemic species. These ecosystems are under threat from overuse of natural resources, poaching, overgrazing, and illegal logging. The dismantling of the Soviet Union created new challenges for managing this transboundary region and new pressures on the protected areas and surrounding landscapes as the populations of the newly independent republics of Kazakhstan, Kyrgyzstan, and Uzbekistan struggled to make a living.

A tri-national transboundary conservation project between 2000 and 2006 provided support for key protected areas—including Besh-Aral, Sary-Chelek, Akus-Dzhabagly, and Chatkal—through a mix of investments in capacity building, community awareness, education, research, and monitoring. Significant investments in infrastructure provided tangible benefits such as improved facilities for protected areas staff, including offices, "cordon" houses (rangers' houses), small nature museums, road rehabilitation, vehicles, horses, and equipment for rangers. Five new protected areas were established covering more than 500,000 hectares. Combined with training and management plans, this has significantly improved the management effectiveness of protected areas and led to increased numbers of protected species. A Small Grants Program provided financial and technical assistance to buffer zone communities and community-based organizations to finance demand-driven activities in sustainable agriculture, alternative livelihoods—for example, honey, medicinal plants, and tourism—and alternative energy systems.

A new Tien Shan Ecosystems Development Project will promote further protection for the juniper and walnut forests and other key mountain habitats. The project will cover Kyrgyzstan and Kazakhstan and benefit from funds through the GEF and BioCarbon Fund in recognition of the important role that mountain ecosystems play in biodiversity and carbon sequestration.

Fragmentation of habitats reduces the opportunity for species movements and dispersal, a factor that will become increasingly important to species survival with climate change. Already, many threatened and charismatic species will not survive without adequate protection of large and connected landscapes. This is especially true for wide-ranging species and migratory species—such as elephants, large herbivores, and migratory birds—and for the large carnivores at the head of the food chain. A new Bank-led initiative to promote tiger conservation in critical large landscapes was launched on June 9, 2008 by the president of the World Bank Group, Robert Zoellick (see Box 2.6). This initiative is a new partnership with governments and NGOs to complement other Bank projects, which have provided support for site-based conservation of tigers and other threatened wildlife in key protected areas.

Managing Marine Resources

Oceans are substantial reservoirs of carbon, with approximately 50 times more carbon than is presently in the atmosphere. New research indicates that marine vertebrates may also sequester carbon at depth. Although marine and coastal ecosystems, including coral reefs

BOX 2.6

Global Tiger Initiative: An Umbrella Species for Conservation

The Global Tiger Initiative (GTI), launched by the Bank and other partners including the GEF and members of the International Tiger Coalition, is aimed at arresting and reversing a dangerous decline of wild tiger populations (see http://www.worldbank.org/tigers). Tigers once ranged in an arc stretching from the Caspian Sea to the Indonesian islands; today, they occupy only 7 percent of that original area. Under threat across their range, they are currently found in 14 countries—from the prey-rich grasslands of northern India, through the mangrove swamps of Bangladesh, to the forests of East Asia and Sumatra. As Asia's largest top predator, the tiger is the region's most important and charismatic umbrella species. The health of tiger populations is a useful indicator of the health, effectiveness, and sustainability of the region's protected area networks and other conservation efforts, including efforts to combat poaching and the illegal wildlife trade. To maintain viable populations, effective conservation measures are required both within and beyond protected area boundaries to maintain biological corridors and tiger habitats within the broader production landscape. Conservation scientists have identified 76 Tiger Conservation Landscapes (TCLs) across the tiger's current range. Many of these critical forests and grasslands are also important carbon stores.

Under the Global Tiger Initiative, the World Bank committed to work with the tiger range states and other partners to ensure the long-term conservation of the tiger. Specifically, the Bank will support a five-point agenda to further the GTI, including:

- Reviewing, through the Bank's Independent Evaluation Group (IEG), Bank projects in tiger habitats
- Facilitating country workshops to develop new models of conservation
- Reviewing existing efforts and strategies to address illegal tiger trade
- Exploring and developing new funding mechanisms for tiger conservation
- Providing WBG support to host a Tiger Summit in 2010.

Carbon markets may be a potential new mechanism for supporting conservation of important tiger habitats in tropical forests.

and coastal wetlands, are important carbon sinks, they are also especially sensitive to climate change.

Coral reefs are some of the most species-rich and productive of all ecosystems, but are very sensitive to changes in temperature. Even slight increases in seasonal maximum sea surface temperatures are expected to affect coral reefs, while prolonged warming will kill sensitive corals. Increases in CO_2 and sea acidity will affect calcification and reduce the ability of reefs to grow vertically as sea levels rise. A GEF-funded project—Caribbean Planning for Adaptation to Climate Change (CPACC)—provided information on the bleaching of corals caused by exposure to high temperatures and explored the ecological and economic consequences for the economies of the Caribbean through monitoring stations in the Bahamas, Belize, and Jamaica. Studies confirmed the deteriorating state of coral reefs in the Caribbean and the need to set up marine protected areas. The global Coral Reef Targeted Research Project is providing the scientific underpinning for management practices to adapt reef and fisheries management to address the threats arising from global warming. Regional working groups have been established to monitor coral reefs and investigate the impacts of climate change and appropriate management responses.

Programs such as the MesoAmerican Barrier Reef Project and Coral Reef Management (COREMAP) in Indonesia have recognized the important links between sources and sinks, with marine reserves protecting vital fish

BOX 2.7

Marine Protected Areas, Fish Populations and Climate Change

Bank-led sector work on marine management determined that marine protected areas provide the following benefits to biodiversity conservation and carbon-sequestration.

- Marine protected areas (MPAs), regardless of their size, lead to increases in density, biomass, individual size, and diversity in all fish functional groups in communities ranging from tropical coral reefs to temperate kelp forests.
- The diversity of communities and the average size of the fish within a reserve are between 20 and 30 percent higher relative to unprotected areas. The density of organisms is roughly double in reserves, while the biomass of organisms is nearly triple. The abundance and average size of many larger carnivorous fishes increase within protected areas.
- Protecting areas from fishing leads to rapid increases in abundance, average body size, and biomass of exploited species. It also leads to increased diversity of species and recovery of habitats from fishing disturbance. Even relatively small reserves can produce regionally significant replenishment of exploited fish populations.
- The positive effects of MPAs on conserving fish populations and their habitat effectively enlarges the marine carbon sink.
- Networks of no-take MPAs can (1) help recover fish populations; (2) eliminate mortality of non-targeted species within protected areas due to bycatch, discards, and ghost fishing; (3) protect reserve habitats from damage by fishing gear; (4) increase the probability that rare and vulnerable habitats, species, and communities are able to persist; and (5) improve the quantity of carbon taken out by the marine sink.

nurseries on which local communities depend. Elsewhere, projects in Central America, Tanzania, Indonesia, and Vietnam focus on integrated coastal zone management and enhancing protection of mangroves, coastal wetlands, and off-shore reefs that sustain local fisheries and thriving tourism industries, but also offer increased protection from sea level rise and extreme weather events.

Valuing ecosystem services

Protecting forests 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. Mountain habitats, for instance, bestow multiple ecosystem, soil conservation, and watershed benefits. They are often centers of endemism, Pleistocene refuges, and source populations for recovery of more low-lying habitats. Mountain ecosystems play a role in influencing rainfall regimes and climate at local and regional levels, helping to contain global warming through carbon sequestration and storage in soils and plant biomass.

Over the last decade, an increasing number of World Bank projects have been making explicit linkages between sustainable use of mountain and forest ecosystems, biodiversity conservation, carbon sequestration and watershed values associated with erosion control, clean water supplies, and flood control. Bank watershed projects in the Middle East incorporate natural forests and endemic riparian woodlands as part of micro-catchment vegetation management with local communities, including the Lakhdar watershed in Morocco, the northern Yemeni wadis, and Turkey's Eastern Anatolia Basin. In China, mountain forests are being increasingly recognized for their role in clean water supply, water regulation, and flood control. The China Forest Protection Project is focusing on mountain and upper watershed forests and reallocating

BOX 2.8

COREMAP: Coral Reef Rehabilitation and Management in Indonesia

The Indonesian archipelago is a center of coral and marine diversity with some of the most species-rich reef ecosystems in the world. The fisheries they support are an important source of food and economic opportunities for about 67,500 coastal villages throughout the country, a source which has been increasingly threatened and overexploited in the last decade. For this reason, the government of Indonesia initiated a multi-donor Coral Reef Rehabilitation and Management Program (COREMAP) in 1998. COREMAP is a 15-year national program spread over three phases. As one of the main donors, the World Bank helped to finance efforts to improve the management of coral reef ecosystems in several pilot sites, including the national marine park at Taka Bone Rate, the world's third largest atoll. Other pilot efforts in the Padeido islands, Papua, and Nusa Tenggara focused on supporting community management of coral reefs.

The first phase of COREMAP highlighted some of the challenges facing coral reefs and the communities that depend upon them. Many of the coral reef ecosystems in Indonesia and the small-scale fisheries they support have reached a level and mode of exploitation where the only way to increase future production and local incomes is to protect critical habitats and reduce fishing effort. There is now a growing body of empirical evidence suggesting that marine reserves can rejuvenate depleted fish stocks in a matter of years when they are managed collaboratively with the resource users, and form the core of a wider multi-use marine protected area. For the second phase of COREMAP, the government of Indonesia has made a policy shift toward marine conservation and protected areas as an important tool in sustainable management of coral reef ecosystems and the small-scale fisheries they support. Through a participatory planning process with communities, COREMAP II will help to establish marine reserves within larger marine protected areas (MPAs) to ensure rejuvenation of coral reefs and the small-scale reef fisheries on which those communities depend.

A six-year, $80 million program will be implemented in 12 coastal districts, including 1,500 coastal villages and more than 500,000 residents. The centerpiece of these efforts will be collaboratively-managed marine reserves, many within existing national parks and MPAs of recognized global value. The government has committed to a target of 30 percent of the total area of coral reefs in each participating district being set aside as collaboratively managed and fully protected marine reserves by the year 2030. A key component of the program will be a learning network linking key marine sites and conservation efforts throughout the archipelago to exchange lessons learned and expertise. This is an ambitious program, and places Indonesia as one of the global leaders in the marine and coral reef conservation effort.

forests for their watershed and biodiversity protection functions as well as more sustainably managed production.

The Bank has been a leader in piloting payments for ecosystem services (PES). In Mexico, Bank projects have helped to establish payment systems to reduce logging in the Monarch Butterfly Reserve to protect important butterfly habitat. With support from the Mexican Nature Conservation Fund, an endowment has been established for El Triunfo Reserve in the Sierra Madre in Chiapas to support activities that protect the area's ecosystem services, especially water production. In Ecuador an integrated watershed management project is being prepared with a specific component to capture payment for environmental services provided by Andean forests. Meanwhile, Costa Rica is launching a second Bank/GEF project to build on the experience and success of early Ecomarkets projects in promoting biodiversity on privately-owned lands (see Box 2.10).

BOX 2.9

Tajikistan Community Watershed Project: Improving Management in Mountain Ecosystems

Tajikistan is a small (171,000 km^2) and highly mountainous country bordered by the Kyrgyz Republic, Uzbekistan, Afghanistan, and China. Mountains cover 90 percent of the country. Tajikistan has the greatest elevational range in the region, from 300m along the Syr Darya River to 7,495m at Mount Samani, the highest peak in the former Soviet Union. This altitudinal range is reflected in a rich diversity of natural ecosystems, including steppe and desert, forests (spruce, juniper, walnut, pistachio, and tugai), mountain meadows, and high mountain lakes.

Land degradation in Tajikistan is a common threat to rural livelihoods and biodiversity alike. Deforestation for fuelwood, livestock overgrazing, and unsustainable irrigation practices have led to erosion, salinization, and reduced productivity of mountain soils. The degradation and loss of biodiversity has direct adverse impacts on rural households. The new watershed management project aims to improve rural livelihoods while conserving fragile mountain lands and ecosystems. Through a participatory approach, local communities will identify and implement priority investments. Examples of eligible investments include:

- Planting trees—emphasizing economically and biologically important species such as walnuts, pistachios, fruit trees, and berry bushes—on slope fields, coupled with appropriate soil and moisture conservation measures, such as "mini-terracing," using trees as natural hedges and contour drainage channels
- Improving pasture management and reducing overgrazing through restoring watering points in remote pastures, fencing, re-seeding as appropriate, and introduction of improved grazing management
- Building small-scale infrastructure to control soil erosion and gullying and reduce siltation
- Supporting income-generating activities and small-scale cottage industries such as production of dried fruits and vegetables; bee-keeping; silk worm rearing and cocoon production; milk and wool production and processing; and crafts.

BOX 2.10

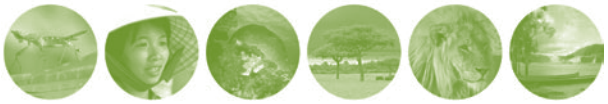
Valuing Ecosystem Services in Costa Rica

The Mainstreaming Market-Based Instruments for Environmental Management Project enhances the provision of environmental services and secures their long-term sustainability through a scaled-up payment for environmental services system (PSA) in Costa Rica. Since 2000, the Costa Rican program has been supported by the World Bank through the Bank/GEF-financed Ecomarkets Project. The initial project reached, or exceeded, all key project performance indicators. For example, 120,000 ha have been incorporated into the priority areas selected for biodiversity conservation by the Ecomarkets Project, exceeding the original target of 50,000 ha. These contracts promote conservation on privately-owned lands within Tortuguero, La Amistad Caribe, and Osa Peninsula Conservation Areas and an additional 70,000 hectares contracted on privately owned lands within other high priority conservation areas.

Costa Rica's priorities are to develop and implement new financing sources for the PSA Program, including introduction of a new water tariff and verified emission reductions sales. These financing sources will cover most of the program's long-term financing requirements for national priorities. The second phase project focuses on ensuring a continued flow of funds for sustainable natural resource management and rural development through a water tariff, the sales of verified emission reductions, and a dedicated tax on the consumption of fossil fuels. To ensure a continued flow of funds to achieve global environment objectives, the project will help to create an endowment fund—the Biodiversity Conservation Trust Fund—to conserve biodiversity of global significance through the PSA Program.

3

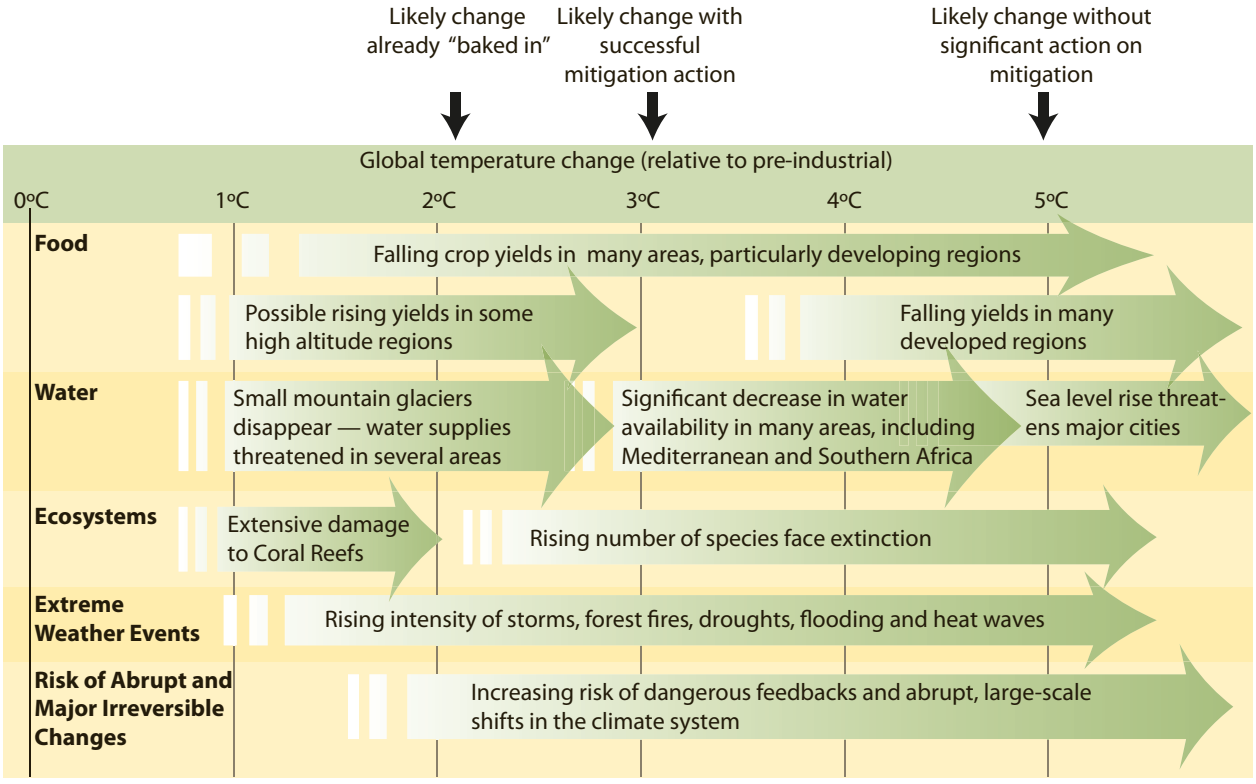
Mitigating Climate Change: The Role of Biodiversity



Climate change is already impacting on natural systems, weather events, and crop productivity. Even with immediate action to reduce greenhouse gas emissions, some impacts are inevitable. Figure 3.1 shows the likely impacts on global systems under different climate change scenarios. Countries need to act now to mitigate climate change and to prepare for the future.

Mitigation involves reducing greenhouse gas emissions from energy and biological sources or enhancing the sinks of greenhouse gases. Biological mitigation of greenhouse gases can occur through (a) conservation of existing carbon pools (for example, avoiding deforestation); (b) sequestration by increasing the size of carbon pools (e.g., through afforestation and reforestation); and (c) substitution of fossil fuel energy

Figure 3.1 Likely Changes to Earth Systems depending on Mitigation Activities Undertaken.



Source: Adapted from IPCC 2007.

by use of modern biomass. The estimated upper limit of the global potential of biological mitigation options through afforestation, reforestation, avoided deforestation, and agriculture, grazing land, and forest management is estimated at 100 GtC by the year 2050, which is equivalent to about 10–20 percent of projected fossil-fuel emissions during that period .

Land-use, land-use change, and forestry activities (LULUCF) can play an important role in reducing net greenhouse gas emissions to the atmosphere. Bank funding supports conservation and more sustainable management of the world's forests, both tropical and temperate. These projects produce net benefits for biodiversity and climate change mitigation. Russia, for example, contains about 22 percent of the world's forests, including 25 percent of all old-growth forests. These 770 million hectares of forests make up the largest share of temperate and boreal forests among World Bank client countries and harbor important endemic biodiversity. Because of Russia's large size and forest cover, there is a compelling need to balance economic development in the forest sector with sustainable management and conservation of biodiversity. Improving forest and fire management in the Russian Far East is not only helping to protect the region's rich biodiversity, including tigers and their prey base in Khabarovsk Kray, but is retaining important carbon stores in the boreal forests and underlying peat lands.

Afforestation and Reforestation

Under the Kyoto Protocol's Clean Development Mechanism, most mitigation activities focus on increased sequestration of carbon through afforestation and reforestation projects. Afforestation and reforestation projects will impact on biodiversity depending on the land use/ecosystem being replaced and management applied. The reforestation of degraded lands has the potential to produce the greatest benefits for biodiversity, especially with careful selection of species and site selection, with planting of native species and efforts to accommodate the range of needs of native wildlife. Plantations or natural reforestation may contribute to the dispersal capabilities of some species by extending areas of forest habitat or providing connectivity among habitat patches in a formerly fragmented landscape. Even single-species plantations may provide some benefits to local biodiversity if they incorporate features such as retaining borders of native forest along river banks or protecting natural wetlands. In contrast, planting with fast-growing exotic species, or species with known potential to become invasive, is likely to have few benefits for biodiversity, but may provide other immediate benefits by reducing soil erosion or providing a ready source of fuel wood and timber.

Plantations of native tree species will support more biodiversity than exotic species. Plantations of mixed tree species will usually support more biodiversity than monocultures, especially if designed to allow for the colonization and establishment of diverse understory plant communities. Since loss of soil carbon occurs for several years following harvesting and replanting—due to the exposure of soil, increased leaching and runoff, and reduced inputs from litter—long-rotation plantations in which vegetation and soil carbon is allowed to accumulate are more beneficial than short-rotation plantations. Short-rotation forests, with their simpler structure, foster lower species richness than longer-lived forests, but products from short-rotation plantations may alleviate harvesting pressure in primary forests.

BOX 3.1

Reforestation under the BioCarbon Fund

Brazil: Reforestation around Hydro Reservoirs

This project is restoring native vegetation cover on approximately 5,576 hectares of land around four reservoirs created by hydroelectric plants in the state of Sao Paulo. Planting a mix of at least 80 native species will regenerate forested areas, protect the recreational use of the area, and improve the value of the lands for tourism. Many of the targeted sites are connected to existing forested areas, and link to riverine habitats. Restoration of forest cover will increase critical habitats and create vital wildlife corridors, connecting the newly forested lands with existing conservation areas.

China: Pearl River Watershed Management

This project is reforesting 4,000 hectares in the Guangxi Zhuang Autonomous Region, which includes half of the Pearl River basin and is an area of high biodiversity value. The sites selected for planting are shrub land, grassland, and areas with less than 30 percent tree cover. Seventy-five percent of the species planted will be native. Eucalyptus, grown in China for a century, will make up most of the exotics. The restoration of the forests along the middle and upper reaches of the Pearl River will serve as a demonstration model for watershed management. The use of the carbon sequestered by a plantation as a "virtual" cash crop will generate income for local communities. As the first life-size LULUCF project in China, it will also test how afforestation activities can generate high-quality emission reductions in greenhouse gases that can be measured, monitored, and certified. The reforested land will restore forest connectivity between two nature reserves (Mulun and Jiuwandashan reserves in Huanjiang County) and provide a wildlife corridor for animal movements.

Kenya: Green Belt Movement

This project is reforesting 4,000 hectares of degraded public and private lands with high community access in the Aberdare Range and Mount Kenya watersheds. These forests host a high number of threatened fauna species and are internationally recognized as an Important Bird Area (IBA). Although many of these forests are officially protected as a reserve, they are threatened by illegal logging and cultivation. The project will pay local communities and provide them with the technology and knowledge to reforest and manage these lands. Communities will be organized into Community Forest Associations (CFAs) that will develop management plans. The long term goal is to use the re-grown forest in a sustainable manner for a variety of products, including fuel wood, charcoal, timber, medicinal, and other uses. Planting of trees on lands around the reserve forests is expected to reduce pressure on remaining natural forests, and the planting of native species will enrich local biodiversity.

Conserving Carbon Stores

Reducing Deforestation

About 20 percent of the world's greenhouse gas (GHG) emissions are caused by deforestation and land use changes globally. The problem is especially acute in tropical regions, which include some of the world's most biologically rich countries. In tropical regions, emissions attributable to deforestation and other land clearance are much higher, up to 40 percent of national totals. Indonesia and Brazil together, for instance, currently account for approximately 54 percent of all emissions from forest loss. Most of Indonesia's GHG emissions have come from deforestation and land clearance, including clearing and burning of peat swamp forests for agricultural production and oil palm production. If current rates of deforestation in Indonesia remain the same through 2012, it is estimated that emissions from this deforestation would equal almost 40 percent of the annual emission reduction targets set for Annex 1 countries under the Kyoto Protocol. Clearly

BOX 3.2

Forest Conservation in Aceh, Indonesia

In December 2004 a tsunami struck Aceh province, causing a tremendous humanitarian crisis, especially along the west coast. In this narrow coastal belt, communities and agricultural lands border directly on protected forests and the karst mountain ranges of the Gunung Leuser National Park and Ecosystem in the south and the Ulu Masen Forest Complex in the north. Over two-thirds of the province remains under forests. Even within Indonesia, a mega-diversity country, this area is unique, comprising the largest remaining contiguous forested area (3.3 million ha) with the richest assemblage of biodiversity in Southeast Asia, including tigers, elephants, rhinos, and orangutans. These areas also provide valuable ecological services needed for Aceh's recovery, including water supply, flood prevention, erosion mitigation, and climate regulation.

The post-disaster reconstruction effort raised concerns about how the enormous amount of timber needed for rebuilding would be obtained without endangering these forests. In August 2005, a long-awaited peace accord between the Indonesian government and the Free Aceh Movement effectively removed the barrier from logging activities. Two environmental NGOs, Leuser International Foundation (LIF) and Flora and Fauna International (FFI), both with a long history of working in Aceh, prepared a proposal to the Multi Donor Fund (MDF) for the Aceh Forest and Environment Project (AFEP) to ensure the protection of Aceh's forests.

The main objectives of AFEP are to a) protect the environmental services provided by Aceh's coastal and terrestrial forest ecosystems during and beyond the reconstruction, and b) mainstream environmental concerns in the reconstruction process. AFEP produces accurate and timely information on the state of the province's forests, and is building the capacity of the provincial forest and conservation administration. The project is helping develop a model for community-based sustainable forest management, and fostering integration of forest and conservation issues into the overall land-use planning process through development of provincial, district, and sub-district-level spatial plans. Forest monitoring is carried out at three mutually supportive levels: through remote sensing, aerial surveys, and ground-level community monitoring teams trained and hired by the project. Aceh's Governor Irwandi declared a logging moratorium to provide a time-out, during which new policies and programs can be formulated and implemented. The project's flexible approach to post-disaster, post-conflict reconstruction has benefited from local participation, including collaboration with religious leaders to include environmental and conservation messages into mosque sermons.

The project's flexibility has also allowed it to be a part of REDD discussions. Supporting the governor's plan to implement and benefit from REDD projects in Aceh, AFEP arranged a provincial REDD workshop in early October 2007, which provided an opportunity to discuss the REDD concept with district heads, forest communities, and other stakeholders. The project is also assisting the government of Aceh in developing and promoting an Aceh REDD pilot project plan, which has been submitted for international certification against Climate, Community and Biodiversity Alliance (CCBA) standards.

reducing deforestation and forest degradation in key biodiversity countries affords exciting new opportunities to address climate change and conservation.

The 13th Conference of the parties to the UN Convention on Climate Change in Bali in December 2007 called for greater action on avoided deforestation to provide new opportunities for rewarding nations and communities for improved forest protection and management. Slowing deforestation and forest degradation can provide substantial biodiversity benefits in addition to mitigating greenhouse gas emissions and preserving ecosystem services. The largest biological potential is projected to be in subtropical and tropical regions, but protecting temperate habitats, especially peat lands and mires, would also protect important carbon stores and wetland diversity.

BOX 3.3

Wetlands, Livelihoods and Climate Change in the Nile Basin

Wetlands and their biodiversity are the main source of livelihoods in the Nile Basin contributing to both ecosystem survival and hydrological replenishment of the waters of the Nile. The Nile Basin Initiative through its Shared Vision Project – specifically basin-wide activities under the Nile Transboundary Environmental Action Project (NTEAP) – is promoting the wise use of wetland habitats and species in the Nile Basin region, as important resources for livelihoods, biological wealth, and climate modulation. NTEAP is mainly investing in increasing knowledge and awareness and fostering professional networks. It is creating a better basin-wide understanding of the value of wetlands as a key component in transboundary management of biodiversity.

NTEAP has identified key wetlands and biodiversity hotspots that are currently not adequately protected and managed. Knowledge about wetlands and their biodiversity is crucial to understanding their contribution in supporting both livelihoods and climate modulation, including their role as indicators of climate change. NTEAP supports the sharing of knowledge and identification of threats for managing sites in the Nile system as a key component in transboundary management of wetlands and biodiversity. A better understanding of the linkages between wetlands, biodiversity and downstream benefits will promote the conservation of natural habitats. Sensitization efforts supported by NTEAP include education in schools and colleges, sensitization of policy makers, and communities who live with, and utilize, the resources.

The Nile Basin Initiative recognizes the importance of integrating the potential effects of climate change into basin-wide planning efforts. The Nile Council of Ministers has recently approved a concept note to further evaluate the effects climate change may have on natural resources and their use in the Nile Basin.

Many Bank projects focusing on forest management and protected areas are already contributing to maintaining carbon stores in natural habitats. The Bank is now also developing and testing new financing mechanisms to pilot modalities for reduced emissions from deforestation and degradation (REDD). The Ankeniheny-Mantadia-Zahamena Corridor Restoration and Conservation Carbon Project is an innovative initiative to conserve and restore the threatened humid forests of Madagascar. The project is promoting ecological restoration of around 3,020 hectares on degraded land along the buffer zone of two national parks: the Analamazaotra Special Reserve and Mantadia National Park complex. These reforestation activities are generating carbon credits that will be used to finance sustainable livelihood activities in the region, such as fruit tree gardens and fuel wood plantations, aiming at increasing local farmers' income, while at the same time reducing pressures on native forests. It is also one of the first concrete REDD experiences. Through the creation of a new protected area (*site de conservation*), the project will reduce emissions from deforestation and degradation of native forests in the region. These activities can generate carbon credits for the voluntary market.

. . . maintaining peat lands, marshes, and wetlands

Ecosystems are not all equal either in their value for biodiversity conservation or their role in carbon storage and other ecosystem services. Wetlands provide many ecosystem services that are critical to reduce the vulnerability of communities to climate change in general and to extreme weather events in particular. Protecting existing wetlands and restoring degraded wetlands provides an opportunity to enhance mitigation actions.

Peat lands and marshes contain large stores of carbon. In recent decades, drainage and conversion to agricultural lands and climate change has changed peatlands from a global carbon sink to a global carbon source. Avoiding degradation of peatlands, swamps, and wetlands is

BOX 3.4

Trinidad and Tobago: Nariva Wetland Restoration and Carbon Offsets

The Nariva Protected Area (7,000 ha) is one of the most important protected areas in Trinidad and Tobago. Its varied mosaic of vegetation communities includes tropical rain forest, palm forests, mangroves, and grass savannahs. However, these ecosystems have been threatened by hydrological changes arising from a newly constructed water reservoir upstream and more than 10 years (1985–96) of illegal forest clearing by rice farmers.

A project to restore the Nariva wetlands provides a unique opportunity to combine the goals of greenhouse gas mitigation with adaptation needs. The project will support carbon sequestration through the reforestation and restoration of the natural drainage regime of the Nariva wetlands ecosystem. Restoration of the wetlands will strengthen their natural buffer service for inland areas, representing an adaptation measure to anticipated increases in weather variability.

Carbon finance resources, through the BioCarbon Fund, will purchase the carbon credits, which in turn will make the restoration work viable. The project includes four activities:

- Restoration of natural hydrology to accelerate the restoration of Nariva's ecological functions. The hydrologic rehabilitation involves active management of the landscape to ensure the survival of the existing forest as well as reforested areas.
- Between 1,000 and 1,500 hectares are being reforested with native terrestrial and aquatic species. Mechanical and chemical treatment of invasive species may be required to open areas for more natural plant communities.
- A Fire Management Program will support the newly restored vegetation.
- A monitoring plan will record the response of reforestation activities and monitor biodiversity through key species.

a beneficial mitigation option. The lowland forests of Sumatra are some of the most endangered habitats on Earth. With current rates of deforestation, it has been estimated that they could all be lost by the year 2010. Working against this trend, Wetlands International has been collaborating with the provincial government and the Indonesian Conservation Department (PHKA) to establish a new 205,000 hectare national park in South Sumatra. The Sembilang Park adjoins Berbak National Park, Indonesia's first Ramsar site. Together, the two parks will protect some of Sumatra's most important remaining lowland forests, including large tracts of peat swamp forests (an important carbon store) and the most important mangroves in western Indonesia. Improved protection will provide benefits to conservation of large mammals (tiger, Sumatran rhino, and tapir), migratory birds, and breeding populations of rare storks. It will also benefit local economies, as the mangroves are major spawning and nursery grounds for inshore fisheries.

. . . restoring grasslands

Grasslands and natural pastures are capable of fixing significant amounts of carbon in the soil and vegetation cover; well-managed grasslands constitute a significant sink of global carbon. Changes in grassland vegetation due to overgrazing, conversion to crop land, desertification, fire, fragmentation, and introduction of non-native species affect their carbon storage capacity, and may in some cases even lead to a net source of $C0_2$. For example, it has been found that grasslands may lose 20 to 50 percent of their soil organic carbon content through cultivation, soil erosion, and land degradation.

. . . improving ecosystem services

Conservation of biodiversity and maintenance of ecosystem structure and function are important climate change mitigation strategies because genetically diverse populations and species-rich ecosystems have a greater

potential to adapt to climate change. While some natural pest-control, pollination, soil-stabilization, flood-control, water-purification, and seed-dispersal services can be replaced when damaged or destroyed by climate change, technical alternatives may be costly even when feasible. Conserving biodiversity (for example, genetic diversity of food crops, trees, and livestock races) means that options are kept open to allow human societies to adapt better to climate change. Promotion of on-farm conservation of crop diversity may serve a similar function.

Changing agricultural management activities can sequester carbon in soils. Conservation tillage and the use of erosion control practices—which include water conservation structures, protection of native vegetation as filters for riparian zone management, and agroforestry shelterbelts for wind erosion—can reduce the displacement of soil organic carbon and provide opportunities to increase biodiversity. Improved management of grasslands (for example, grazing management, protected grasslands and set-aside areas, grassland productivity improvements, and fire management) can enhance carbon storage in soils and vegetation while conserving biodiversity. Agroforestry systems also have the potential to sequester carbon, improve livelihoods, and provide functional links between forest fragments and other critical habitat as part of a broad landscape management strategy for biodiversity conservation. Silvopastoral projects in Central America have demonstrated the economic and ecological benefits of increasing tree cover in cattle pastures (see Box 3.7).

. . . protecting coral reefs

Coral reefs are important marine resources that are under threat from climate change. They support rich biodiversity and provide nutrient cycling within the marine environment. Their destruction signals a threat to the ocean's ability to store carbon. Since 1998, the impacts of

BOX 3.5

Safeguarding Grasslands to Capture Carbon: Lessons from China

The vast area and wide distribution of China's grasslands suggests that they could have widespread effects on regional climate and global carbon cycles. The Gansu and Xinjiang Pastoral Development project focuses on producing global environmental benefits by restoring biodiversity and increasing the productivity of grassland resources in the globally significant ecoregions of Tien Shan, Altai Shan, and Qilian Shan. These benefits will result from implementation of participatory grassland management plans, especially changed grassland utilization through delaying and shortening the spring and summer grazing periods in the high mountain grasslands. Reduced grazing pressures will lead to increased species diversity, increased biomass productivity, and improved grazing conditions for wild ungulates, as well as herds of sheep and other livestock managed by local herders.

Reduced grazing pressure resulting from implementation of participatory grassland management plans will also provide significant carbon benefits. Improved pasture management practices will increase the amount of carbon entering the soil as plant residues, suppress the rate of soil carbon decomposition, and reduce soil loss due to overgrazing. The project promoted more intensive management of lowland pastures, with inputs of inorganic and organic fertilizers, as well as production of livestock foodstuffs to reduce pressure on mountain pastures. The project also implemented improved grazing management practices (such as rotational grazing), including community-based regulation of grazing intensity and frequency. The economic benefits of carbon sequestration were estimated using the shadow price of $C0_2$ damages at $20 per ton of $C0_2$ per year (discounted at a 12 percent interest rate over the 20-year period), which is equivalent to $5.50 per ton of carbon. It was estimated that adoption of better management practices on the pastures would elicit a carbon gain of 0.1 to 0.5 Mg/ha/year, or about 3 to 15 tons of carbon per year, depending on the degree of pasture degradation. Over a 3- to 30-year period, carbon benefits from reduced grazing and improved management are expected to increase up to 50 tons per hectare.

BOX 3.6

Jordan: Integrated Ecosystem Management in the Jordan Rift Valley

The Jordan Rift Valley is an integral part of the Great Rift Valley and provides a globally critical land bridge between Africa, Europe, and Asia that supports a large variety of ecologically diverse habitats. Every year, millions of migrating birds follow these flyways between the continents, stopping to rest and feed along the way. The GEF-supported project aims to apply the principles of integrated ecosystem management to the existing land use master plan of the Jordan Rift Valley and establish a network of well-managed protected areas that meets local ecological, social, and economic needs.

Project implementation will rely on consultative planning and management procedures involving all relevant stakeholders. The project will establish a network of protected areas and special conservation areas defined under the land use planning framework, and develop management systems for these sites that become working models of integrated ecosystem management principles. Sustainable financing mechanisms for the protected areas will be strengthened through increased capitalization of $2 million for an existing endowment fund. Adoption of economically viable, nature-based livelihood options by local communities in the protected areas and special conservation areas will reduce pressures on natural resources. Project management and implementation is being undertaken by the Jordanian Royal Society for the Conservation of Nature.

BOX 3.7

Payments for Environmental Services to Protect Biodiversity and Carbon in Agricultural Landscapes

Protecting biodiversity in agricultural landscapes is important both in its own right and as a means to connect protected areas, thus reducing their isolation. The challenge is finding ways to do so. A GEF-financed project—Regional Integrated Silvopastoral Approaches to Ecosystem Management—was implemented in Costa Rica, Nicaragua, and Colombia from 2002–08 as a pilot project to demonstrate and measure the effects of the introduction of payment incentives for environmental services to farmers. By the time it closed in January 2008, the project had clearly demonstrated that silvopastoral practices generate substantial benefits in terms of biodiversity conservation, carbon sequestration, and water services, and that payments for environmental services (PES) can induce substantial land use changes that benefit the environment.

Silvopastoral production systems (SPS), which combine trees with cattle production, provide an alternative to current livestock production practices and can help improve the sustainability of cattle production and farmer income, while providing an environment that is also more hospitable to biodiversity. SPS supported by the project resulted in substantial carbon sequestration, both directly (by sequestering carbon in trees) and indirectly (by inducing lower applications of nitrogen fertilizers and, through improved nutrition, reducing methane emissions from livestock). SPS can also act as an adaptation measure to climate change, as they incorporate deeply rooted, perennial, native and naturalized, multi-purpose, and timber tree species that are drought-tolerant and retain their foliage in the dry season. They provide large amounts of high quality fodder and shade that results in stable milk and beef production, maintains the animals' condition, and secures farmers' assets. Under extreme climate change conditions affecting temperatures and rainy seasons, cattle ranching in pastures without trees would be more vulnerable than in those with trees.

Based on the documented results of this pilot project, new projects are under preparation in Colombia and Nicaragua to scale up and adopt biodiversity-friendly SPS at a larger scale. Among other environmental and socioeconomic benefits, the program will help to address climate change and its consequences in the livestock sector.

BOX 3.8

Addressing the Impacts of Climate Change on Ocean Ecosystems and Coastal Communities.

The International Year of the Reef 2008 is a worldwide campaign to raise awareness about the value and importance of coral reefs and threats to their sustainability, and to motivate people to take action to protect them. These threats include climate change, which is leading to widespread coral damage. The year 1998 witnessed an unprecedented climatic event in the world's oceans when a strong El Niño-Southern Oscillation episode caused abnormally high sea surface temperatures and affected more than 16% of the world's coral reefs. These events emphasized the urgent need to better protect natural resources and their ecosystem services, and to prepare coastal-dependent people to adapt to climate change. At the same time human population growth in tropical coastal zones is also causing tremendous use and transformation pressure that degrades and threatens coral reefs and associated resources.

The Coral Reef Targeted Research and Capacity Building for Management (CRTR) program is a proactive research and capacity building partnership designed to improve the scientific knowledge needed to strengthen management and policy to protect coral reefs. The CRTR is filling crucial knowledge gaps in targeted research areas such as Coral Bleaching, Connectivity, Coral Diseases, Coral Restoration and Remediation, Remote Sensing and Modeling and Decision Support. The CRTR partnership was formed to build capacity for management-driven research in countries where coral reefs are found, and to use this information to improve the management effectiveness of coral reefs and the welfare of the human communities that depend on them. The Program is working with stakeholders and local governments through its regional Centers of Excellence to increase awareness of the growing risks facing coral reefs from local and global sources, and the implications in economic and social terms for the tens of millions of people who depend on them for livelihoods, food security and coastal protection. Through capacity building CRTR is linking science to management, and translating research findings into an action agenda for managers and policy makers that can make a difference to the future of the world's reefs and all who value them. While policymakers in the international arena grapple with formulas and cost effective means to bring down CO_2 emissions to well below 1990 levels over the next 50 years, the CRTR is putting local marine resource managers in a position to buy time for coral reefs. A number of interventions are addressing immediate threats to reef ecosystem health to increase resilience to changing ocean conditions associated with climate change.

climate change have become increasingly clear, and additional high ocean temperatures have occurred in various ocean regions in 2000, 2002, 2005 (which experienced the highest temperature in the Caribbean Basin in more than 100 years) and in 2007 in the South China Sea. Protecting coral reefs is a step towards maintaining the oceans as a globally important carbon sink.

Investing in Alternative Energy

Hydropower and other renewable energy sources such as wind and wave energy solutions have significant potential to mitigate climate change by reducing the greenhouse gas intensity of energy production. However, they require careful site selection and evaluation of likely impacts on habitats and wildlife. Large-scale hydropower development can also have high environmental and social costs such as changes in land use, disruption of migratory pathways, and displacement of local communities. The ecosystem impacts of specific hydropower projects may be minimized depending on factors such as the type and condition of pre-dam ecosystems, type and operation of the dam (for example, water-flow management), and the depth, area, and length of the reservoir. Run-of-the-river hydropower and small dams have generally less impact on biodiversity than large dams, but the cumulative effects of many small units should be taken

into account. With careful planning, however, biodiversity can also benefit under new energy projects. Protection of the forests around the Nam Theun 2 Dam in Lao PDR, and a 30-year conservation fund to manage the watershed, is a critical factor in extending the lifespan of the hydropower generation facility (see Box 3.9).

New Partnerships to Address Biodiversity and Climate Change

In collaboration with FAO and IUCN and support from IIED, the World Bank is supporting the implementation of

BOX 3.9

Nakai Nam Theun: Forest Conservation to Protect a Hydropower Investment in Lao PDR

The Nam Theun 2 hydropower project in central Lao PDR will inundate 450 square kilometers of the Nakai Plateau, including substantial areas of semi-natural forest habitat. To offset this impact, a Bank loan for the environment will provide an unprecedented level of support for conservation in the adjacent Nakai Nam Theun National Protected Area. At around 4,000 square kilometers (including corridors), Nakai Nam Theun NPA is the largest single protected area in Laos, with 403 species of birds and a large number of mammals, including elephants and the rare saola (*Pseudoryx nghetinhensis*) and other large mammals discovered as recently as the 1990s. The PA sits upon the spine of Indochina, the Annamite Mountains, a center of high biodiversity and species endemism. The borders of Nakai Nam Theun stretch from wet evergreen forests along the Vietnamese border to the limestone karst formations of central Lao, which harbor a new family of rodents that were first described in 2005. Married to this biodiversity is an astonishing ethno-linguistic diversity. The people living in, and immediately around, the protected area include 28 linguistically distinct groups and can name a greater number of forest products than have been recorded from any other area in Laos.

Under a new conservation authority established during the preparation of the Nam Theun 2 hydropower project, the PA will be managed according to an integrated conservation and development model. Village agreements will be developed to detail resource use rules and regulations consistent with PA zonation, including controlled use and totally protected zones. Village conservation teams provide a platform for management of natural resources and for biodiversity monitoring and enforcement. Sustainable alternative livelihood options will mitigate negative impacts resulting from restrictions on resource use in key core conservation areas. Communities will be empowered through provision of secure land rights, capacity building, recognition of indigenous knowledge, and equitable distribution of benefits to ensure that the most vulnerable (and often most forest-dependent) groups are included in the process.

Previous conservation efforts in Laos have been undermined by lack of staff and long-term funding. Perhaps the most promising innovation in Nakai-Nam Theun is a new financial and administrative model. Since the protected area covers around 95 percent of the catchment for the Nam Theun 2 hydropower project, the developer will pay $1 million annually for PA protection over the 30-year concession period. The government of Laos is keen to apply similar financial models elsewhere, as it exploits its abundant water resources to mobilize resources for poverty reduction while maintaining the biodiversity base critical for many rural households. The funding for Nakai Nam Theun will be some two orders of magnitude greater than the total presently allocated from the central budget to the rest of the Lao protected areas system. The Bank is therefore establishing another fund for other local conservation areas to provide modest, demand-driven funding at a level appropriate to existing local capacity. Sustained support for the fund would also come from the revenues generated by natural resource industries. Through direct financing, and promotion of integrated development models, the Bank is providing biodiversity funding over a sufficient time-frame for conservation success to become its own champion in Lao PDR.

the Growing Forest Partnerships (GFP) initiative, which was informed by an independent, global consultation of over 600 forest stakeholders, including a special survey of Indigenous Peoples. The GFP aims to facilitate bottom-up, multi-stakeholder partnership processes in developing countries to identify national priorities, to better access the increasing forest financing being made available through a wide variety of international means and mechanisms (e.g. carbon finance, private sector investments, and ODA). The GFP also aims to provide a platform to ensure that marginalized, forest-dependent groups can participate in the formulation of national priorities and be included in the international dialogue on forests. The GFP will work through locally-based institutions and will build on existing partnership structures. The World Bank is supporting this initiative with start-up funding from the Development Grant Facility.

The GFP will provide a platform to achieve progress in the following target areas by the year 2015: (a) creating an enabling environment for carbon-based forestry activities (b) promoting the use of forests for poverty alleviation under conditions of climate change; (c) significant growth in sustainably managed, and legally traded, forest products and the expansion of the area of responsibly managed forests; (d) an increase in the establishment, management, and financial sustainability of protected forest areas; and (e) a decrease in area of primary forest converted to alternative land uses. The GFP will facilitate and scale up activities associated

BOX 3.10

Can Carbon Markets Save the Sumatran Tigers and Elephants?

Riau Province in central Sumatra harbors populations of the critically endangered Sumatran tiger and the endangered Sumatran elephant within a high-priority Tiger Conservation Landscape. Riau has lost 65 percent of its original forest cover and has one of the highest rates of deforestation in the world, due to loss and conversion of forest for agriculture, pulpwood plantations and for expanding industrial oil-palm plantations to serve the surging biofuels market. If the current rate of deforestation continues, estimates suggest that Riau's natural forests will decline from 27 percent today to only 6 percent by 2015. All of this comes at a global cost. The average annual CO_2 emissions from deforestation in Riau exceed the emissions of the Netherlands by 122 percent and are about 58 percent of Australia's annual emissions. Between 1990 and 2007, Riau alone produced the equivalent of 24 percent of the targeted reduction in collective annual greenhouse gas emissions set by the Kyoto Protocol Annex I countries for the first commitment period of 2008–12.

Can carbon trading provide a new economic incentive to protect Riau's forests, especially the carbon-rich peat swamp forests? At present, countries do not get rewarded for retaining forest canopy (avoided deforestation)—the emphasis is on afforestation. Second, although there are new programs under consideration to provide incentives for conserving forests, the prevailing price of carbon may be too low to shift incentives from clearing for biofuels or pulp to conservation. Third, even if the price of carbon rises sufficiently, Riau's forests may not get priority over other forests with higher carbon sequestration potential since the proposed new systems pay only for carbon with little attention to the biodiversity value of forests.

Yet carbon markets may have potential to promote conservation in less productive lands. In parts of South Asia the returns (present value) of arable land are often as low as $100 to $150 per hectare. Clearing a hectare of tropical forest could release 500 tons of CO_2. At an extraordinarily low carbon price of even $10 per ton of CO_2, an asset worth $5,000 per hectare is being destroyed for a less valuable land use. A modest payment through the newly proposed avoided deforestation scheme would be sufficient to shift incentives in some of the unproductive arable land in South Asia.

Source: Damania et al. 2008

with the implementation of the Bank's Forest Strategy. It will link existing and new partnership programs that promote enabling conditions in the Forests sector (for example, the Forest Law Enforcement and Governance Initiative, the Multi-donor Program on Forests) with the Bank's existing lending and financial instruments, as well as sources of new concessional financing.

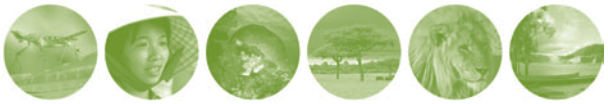
Innovative Financing for Carbon and Biodiversity

The Bank has been a leader in promoting incentives for protecting ecosystem services for carbon sequestration and biodiversity benefits. Initiatives, such as the BioCarbon Fund and the Forest Carbon Partnership Facility, afford opportunities to protect forests for carbon sequestration and other multiple benefits, including conservation of biologically rich habitats, and greater community benefits from native forest management and watershed protection.

The Forest Carbon Partnership Facility (FCPF) aims to build the capacity of developing countries in the tropics to tap into financial incentives for reducing emissions from deforestation and forest degradation (REDD) under future regulatory or voluntary climate change regimes (see Box 1.1). FCPF became operational in June 2008 with the start of operations of the Readiness Mechanism, which was triggered by the Readiness Fund having been capitalized at the required minimum ($20 million). As of today, Australia, Finland, France, Japan, Norway, Spain, Switzerland, the United Kingdom, and the United States have contributed $55 million to the Readiness Fund and $21 million to the Carbon Fund. The Readiness Fund will finance activities designed to (a) establish a national reference scenario for emissions; (b) adopt national REDD strategies; and (c) design national monitoring systems.

4

Adapting to Climate Change: The Role of Biodiversity



During the course of human history, societies have often needed to cope with managing the impacts of adverse weather events and changing climatic conditions. Nevertheless, the pace of global change is now so rapid that additional measures will be required to reduce the adverse impacts of projected global climate change in the near and long term. Moreover, vulnerability to climate change can be exacerbated by other stresses, including the loss of biodiversity, damage to ecosystem services, and land degradation.

Adaptation will become an increasingly important part of the development agenda. Enhanced protection and management of natural ecosystems and more sustainable management of natural resources and agricultural crops can play a critical role in adaptation strategies. Adaptation activities can have positive impacts on biodiversity through:

- Maintaining and restoring native ecosystems
- Protecting and enhancing ecosystem services
- Actively preventing, and controlling, invasive alien species
- Managing habitats for rare, threatened, and endangered species
- Developing agroforestry systems in transition zones between ecosystems
- Monitoring results and changing management regimes accordingly.

Reduction of other pressures on biodiversity arising from habitat conversion, overharvesting, pollution, and alien species invasions can also contribute to climate change adaptation measures. Since mitigation of climate change itself is a long-term endeavor, reduction of other pressures may be among the most practical short-term options. For example, increasing the health of coral reefs, by reducing the pressures from coastal pollution and practices such as fishing with explosives and poisons, may allow them to be more resilient to increased water temperature and to reduce bleaching. Similarly, countering habitat fragmentation through the protection and/or establishment of biological corridors between protected areas will increase forest resilience. More generally, mosaics of interconnected

BOX 4.1

Studying the Economics of Adaptation

A multi-donor research study, led by the World Bank, aims to assess the resource implications and eventual trade-offs for developing countries to adapt to different scenarios of climate change as they continue to advance their development and poverty reduction agendas. The specific objectives of the study are to (a) develop sectoral and global cost estimates of adaptation, and (b) develop and transfer to developing countries a working methodology to assess adaption costs and improve these estimates as more data and analyses become available. The methodology includes identifying and quantifying damage costs of climate change without adaptation measures; developing cost-benefit analyses of adaption actions; considering different climate scenarios; and integrating regional and sector analyses with national and global computable general equilibrium models. Assessing the critical costs associated with the loss and fragmentation of natural habitats, and the ecosystem services they provide, will provide important input to developing effective, low-cost, nature-based adaptation strategies.

BOX 4.2

Adaptation in the Caribbean

Between 1997 and 2002, the World Bank—in collaboration with the University of the West Indies (UWI), the CARICOM Secretariat, and the Organization of American States (OAS)—was engaged in the implementation the Caribbean Planning for Adaptation to Climate Change Project (CPACC). This regional project supported 12 CARICOM countries to address the adverse effects of global climate change (GCC), particularly sea-level rise, in coastal and marine areas through vulnerability assessments, adaptation planning, and capacity building linked to adaptation planning.

More specifically, the project assisted national governments in:

- Strengthening regional capacity for monitoring and analyzing climate and sea level dynamics and trends, seeking to determine the immediate and potential impacts of global climate change
- Identifying areas particularly vulnerable to the adverse effects of climate change and sea-level rise
- Developing an integrated management and planning framework for cost-effective response and adaptation to the impacts of climate change on coastal and marine areas
- Enhancing regional and national capabilities to prepare for the advent of climate change through institutional strengthening and human resources development
- Identifying and assessing policy options and instruments to help initiate the implementation of a long-term program of adaptation to GCC in vulnerable coastal areas.

terrestrial, freshwater, and marine multiple-use reserves and protected areas are better adapted to meet conservation needs under changing climate conditions.

Small-island states will be especially vulnerable to climate change. Accordingly, some of the first Bank projects on adaptation focused on small-island states in the Pacific (Kiribas) and the Caribbean. The Caribbean Planning for Adaptation to Climate Change Project, a regional enabling activity, focused on the vulnerability of the island nations of the Caribbean to the impacts of climate change. The economic impacts of climate change on SIDs are likely to be substantial. Potential economic impacts for the Caribbean Community (CARICOM) countries, for instance, are estimated at between $1.4 and $9 billion, assuming no adaptation measures. The largest category of impacts is the loss of land, tourism infrastructure, housing, other buildings, and infrastructure due to sea-level rise. Impacts on agriculture are also potentially significant for CARICOM countries. Most

of the remaining impacts are due to reduced tourism demand, caused by rising temperatures and loss of beaches, coral reefs, and other ecosystems (15–20 percent), and damage to property and life due to the increased intensity of hurricanes and tropical storms (7–11 percent).

Maintaining and Restoring Native Ecosystems

Enhanced protection and management of natural ecosystems and more sustainable management of natural resources and agricultural crops needs to be a critical part of adaptation strategies. Biodiversity conservation and protected areas can play an important and cost-effective role in protecting biological resources and reducing vulnerability to climate change. The Bank has already recognized the important role that enhanced protection of natural forests can play in protecting development investments. Thus the Dumoga-Bone National Park in Indonesia was established to protect a major irrigation investment in North Sulawesi. Similarly, a new conservation area in Laos will protect the forests around the Nam Theun 2 Dam, extending the lifespan of the hydropower generation facility. Coastal protected areas in Croatia, Bangladesh, Indonesia, Honduras, and Lithuania are protecting coastal forests, swamps, floodplains, and mangroves, important for shelter belts and flood control. Forest services such as coastal protection and nursery grounds for quality fisheries are increasingly being recognized as essential to these countries' coastal economies and the livelihoods of the communities who depend upon them. In Bulgaria, the Bank is working with WWF and other partners to restore natural wetlands along the Danube River as filter beds to remove pollutants and provide habitat for native wildlife.

Systematic conservation planning to maintain a range of species and habitats requires strategies for managing whole landscapes, including areas designated for both production and protection. Protected areas must be complemented by off-reserve management. The combination of areas with different use regimes can meet the needs of a wide range of actors while ensuring the conservation of critical habitats and species. Many Bank projects are already contributing to improved biodiversity protection and conservation across large landscapes through mosaics of different land use. In Colombia, the Andes GEF project has a specific component dedicated to building ecological corridors through the highly devastated cloud forests and paramo habitats of the mountain chain. More than 70 percent of Colombia's 41 million inhabitants have occupied the high Andes plateaus and mountains, transforming the original habitats into agriculture and pasturelands. The project has already identified new areas for conservation through private reserves and is currently working with farmers to raise awareness of the need to establish biological corridors (see Box 4.3).

Wetlands are some of the most threatened ecosystems on earth, yet they provide many vital ecosystem functions. Montane wetlands and freshwater habitats serve as vital water recharge areas, an important source of water for irrigation and consumption to downstream communities. Coastal wetlands act as natural barriers protecting coastal

BOX 4.3

Colombia: Biodiversity in the Andes

The Andean paramos ecoregion in Colombia stretches across an altitude range from 500 to 5,000 meters, covering three parallel mountain chains and two main internal river valleys. Climate and habitat ranges from hot and cold deserts to dry and wet high-cold mountains. Soils are mainly young in evolution but are derived from almost all kinds of material. As a result, the paramo hosts a great variety of ecosystems: paramos, wet and dry mountainous forests, wetlands, and xerofitic and subxerifitic environments. A project to increase conservation, knowledge, and sustainable use of globally important biodiversity of the Colombian Andes is testing various conservation strategies, including (a) regional systems of protected areas, (b) biodiversity conservation in rural landscapes, (c) inventory and monitoring of Andean biodiversity, (d) educational programs, and (e) inter-sectoral coordination. The project has been designed as an umbrella project for all other projects in the Andes.

The project includes the Los Nevados National Park, regional reserves, and private reserves, as well as agroecosystems, including shade and sun-grown coffee; mountain livestock systems, agroforestry, potato fields, and orchards of Andean fruit trees. The project is executed by the Institute Alexander von Humboldt, working with smallholders and farmers, campesinos, indigenous groups, research communities (universities), and environmental NGOs. Outcomes are expected to include natural regeneration of mountain ecosystems and improved connectivity between fragments of natural habitats in agricultural areas, thereby creating corridors for wildlife and gene flow. The Colombian Andes project will:

* Support the development of a more representative, effective, and viable Andean protected area system
* Identify conservation opportunities in rural landscapes, and develop and promote management tools for biodiversity conservation
* Expand, organize, and disseminate the knowledge base on biodiversity in the Andes to a wide audience of stakeholders and policy makers, and implement monitoring tools
* Promote inter-sectoral coordination to address some root causes of biodiversity loss in the Andes.

settlements from storms and other natural hazards, reducing the risk of disaster. Inland areas protected by healthy mangroves have generally suffered less than more exposed communities from extreme weather events such as the 2004 tsunami that hit Southeast Asia and the 2008 Cyclone Nargis that hit southern Myanmar. Wetlands and freshwater rivers and lakes produce high yields of fish and other protein on which many of the world's poorest communities depend. Similarly mangroves are important nurseries for fish, prawns and other marine invertebrates. Recent studies in the Gulf of Mexico for instance suggest that mangrove-related fish and crab species account for 32 percent of the small-scale fisheries landings in the region and that mangrove zones can be valued at $37,500 per hectare annually. The destruction of mangroves has a strong economic impact on local fishing communities and on food production in the region.

Landscape Connectivity

Maintaining connectivity between natural habitats and along altitudinal gradients will be a key strategy to allow plant and animal species to adapt to climate change. Corridors of natural habitats within transformed production landscapes and linking protected areas provide opportunities for species to move and maintain viable populations. Bank-supported projects are promoting connectivity in the Maloti-Drakensberg Transfrontier corridor in Lesotho and South Africa; the Vilicabamba-Amboró corridor in Venezuela, Colombia, Ecuador, Peru, Bolivia, and northern Argentina; and through a network of corridors in Bhutan. The Critical Ecosystem Partnership Fund (CEPF), a multi-donor partnership, is providing strategic assistance to engage nongovernmental organizations, indigenous and community groups, and other civil society partners,

BOX 4.4

Rebuilding Resilience in Wetland Ecosystems

The Gulf of Mexico possesses one of the richest, most extensive, and productive ecosystems on earth—coastal wetlands that cover an area of over 14,000 square kilometers. The coast is flanked by 27 major systems of estuaries, bays, and coastal lagoons that serve as shelter, feeding, and reproduction areas for numerous species of important riverine and marine fishes. Moreover, the coastal swamps of Tabasco and Campeche are home to 45 of the 111 endemic species of aquatic plants in Mexico. These coastal wetlands play an important role in the water cycle. Climate change is already beginning to impact on these ecosystems.

Sea-level rise in the Gulf of Mexico is leading to saltwater intrusion, forcing sea water into the boundary layer of freshwater. Anticipated modifications in rainfall patterns in northern Mexico will affect natural drainage systems, further deteriorating the natural water balance of these coastal wetland systems. Degraded marshlands and mangroves will be less likely to withstand extreme weather events in the Gulf of Mexico. The number of high-intensity hurricanes that have reached landfall in the Gulf of Mexico have increased by more than 40 percent compared to the 1960s. These storms often cause serious disruption with loss of property and human life. The ecological and economic consequences of all these impacts can be staggering.

The World Bank is preparing a project to address these concerns through improved water resource and wetland management. The project will pilot several measures, including:

- Restoring wetlands, taking into account sand dynamics and hydrology; initial activities will include the removal of soil or sand sediments obstructing water flows and the maintenance of waterways that feed wetland restoration
- Integrating climate change adaptation measures and resource management programs
- Restoring mangrove swamp ecosystems by establishing permanent/seasonal closed areas as well as by reducing/preventing changes in land use and promoting more efficient water management strategies, including restoration and reintroduction of native mangrove species in areas degraded by economic activities
- Maintaining water supply for production sectors
- Developing mechanisms to promote sustainable land-use patterns that maintain the functional integrity of wetland ecosystems in the region.

including the private sector, in biodiversity conservation within 18 of the world's biodiversity hotspots. In many of those critical ecosystems, CEPF support is targeted to activities that strengthen protection and management of key biodiversity areas, including protected areas and biological corridors (see Box 4.5).

Adaptation in Agricultural Landscapes

Climate change and expected rainfall patterns are expected to have significant impacts on agricultural productivity, especially in arid and semi-arid regions. One study estimates that climate change could lead

BOX 4.5

Biological Corridors in a Changing World

The MesoAmerican Biological Corridor (MABC) is a natural corridor of tropical rainforests, pine savannas, montane forests, and coastal wetlands that extends from Mexico to Colombia. Within the corridor, the Bank is supporting a number of national interventions in Guatemala, Mexico, Panama, Nicaragua, and Honduras to conserve the Atlantic forests of Central America. In Nicaragua, for instance, a GEF grant supported the incremental costs of protected areas and conservation-based land use in the corridor as part of an integrated development and conservation project. Management was strengthened in three key protected areas along the Caribbean coast: Cerro Silva natural reserve (339,400 hectares), Wawashan natural reserve (231,500 hectares), and the Cayos Miskitos biological reserve, which protects nesting grounds of five of the world's seven species of marine turtles. Within the corridor, indigenous communities were assisted to gain tenure over indigenous lands and to develop livelihoods based on sustainable management of natural habitats and resources. By making development work to reduce pressures on native forests, the project promoted conservation of both biodiversity and ethnic cultures in one of the most intact parts of the MesoAmerican corridor.

The Atlantic Forests of Brazil are one of the most threatened ecosystems in Latin America, where only 7 percent of the original habitat remains in a few isolated forest patches. The area has an extraordinarily high level of endemism. The Bank, through the Pilot Program for the Brazilian Rain Forest and G7 donors, is working on increasing the connectivity of these patches through its Ecological Corridors project, which brings together states, municipalities, NGOs, and academic institutions to plan and act in a concerted way. Similarly, in the highly threatened Chaco Andean system in Ecuador, a Bank-funded project has strengthened biological corridors through funding for private reserves and innovative conservation models.

The Critical Ecosystem Partnership Fund is supporting civil society activities to address threats to biodiversity across landscapes that include a matrix of uses, from protected areas to high-value conservation sites in production landscapes. A critical ecosystem profile identifies the priorities for each hotspot; many of those priority activities are targeted toward key biological corridors. CEPF has already supported activities in the Sierra Madre in the Philippines, Barisan Selatan in Sumatra, key forest corridors in Madagascar, the West Guinea forest and Eastern arc forests in Africa, mountain corridors in the Caucasus and eastern Himalayas, and the Choco-Manabi and Vilcabamba-Amboro corridors in the Tropical Andes. A new phase of funding will target important biological landscapes and corridors in Indochina, including the Mekong corridor, and the highly diverse tropical forests of the Western Ghats in India.

to a 50 percent reduction in crop yields for rain-fed agricultural crops by 2020. Most climate modeling scenarios indicate that the drylands of West Asia and North Africa, for instance, will be severely affected by droughts and high temperatures in the years to come. A greater frequency of droughts and flash floods has already been observed in recent years. These largely rain-fed agricultural areas are the most vulnerable to the impact of climate change. A new suite of Bank projects are helping countries to adapt agricultural practices to cope with changing climatic patterns, often building on traditional knowledge and management practices (see Box 4.6).

Adaptation in Marine and Coastal Areas

Climate change will have significant impacts on coastal environments and fisheries. Mangroves and other coastal wetlands are especially vulnerable to climate change and rising sea levels. The loss of mangroves in turn makes coastal communities vulnerable to extreme weather events such as tsunamis. Climatic factors affect the elements that influence the number and distribution of marine fish species by reducing food availability, fragmenting and destroying breeding habits, and changing the presence and species composition of competitors and predators. The loss of near-shore fish

BOX 4.6

Adaptation to Climate Change Using Agrobiodiversity Resources in the Rainfed Highlands of Yemen

The communities in the highlands in Yemen retain important agrobiodiversity and traditional knowledge related to the utilization of their agrobiodiversity resources. This knowledge and practice has evolved over more than 2,000 years to increase agricultural productivity in areas of limited rainfall. The construction and management of terraces, for instance, helps to improve water use efficiency and minimize land degradation. Most of the landraces and local crop varieties have been selected to meet local needs and have adaptive attributes for coping with adverse environmental and climatic conditions. Yemen is considered an important primary and secondary center of diversity for cereals, so these crops are important genetic resources. This local agrobiodiversity is, however, threatened by global, national, and local challenges, including land degradation, climate change, globalization, anthropogenic local factors, and loss of traditional knowledge.

A $4 million GEF-supported project, currently under preparation, aims to enhance coping strategies for adaptation to climate change for farmers who rely on rain-fed agriculture in the Yemen highlands. The project focuses on the conservation and utilization of biodiversity important to agriculture (particularly the local landraces and their wild relatives) and associated local traditional knowledge. This GEF project will complement the Bank-IDA supported Rainfed Agriculture and Livestock Project. The project will have four components:

- Agrobiodiversity and local knowledge assessment: Document farmers knowledge on (adaptive) characteristics of local landraces and their wild relatives in relation to environmental parameters to develop vulnerability profiles for the crops.
- Climate modeling assessment: Develop initial local predictive capacity of weather patterns, climatic changes, and longer term climate change scenarios for these rain-fed areas.
- Enhancement of coping mechanisms : Identify a menu of coping mechanisms (such as in-situ conservation, improved terracing with soil and water conservation practices, choice of crops and cropping patterns) designed and piloted to increase resilience of farmers to climate variability and reduce vulnerability to climatic shifts.
- Enabling policies, institutional and capacity development: Improve the capacity of key line agencies and stake-holders to collect and analyze data, improve climate predictions, and systems of information and information flow for enhanced uptake of coping mechanisms in the agricultural sector.

nursery habitats to increased severe weather events, coastal development, and rising sea levels may also cause significant change to ecosystems and losses to marine biodiversity. The construction of dikes and sea walls, as well as other coastal structures designed to protect terrestrial resources from sea water, only further increase the stress on marine resources.

Reducing Vulnerability

Protection, restoration of natural habitats, and/or establishment of biologically diverse ecosystems may constitute important adaptation measures. Maintenance or restoration of mangroves can offer increased protection of coastal areas to sea level rise and extreme weather events. Restoration of degraded mangroves in the Mekong Delta in Vietnam has improved management of coastal forests, improving coastal protection and safeguarding important nursery grounds for local fisheries. The rehabilitation of upland forests and of wetlands can help regulate flow in watersheds, thereby moderating floods from heavy rain and ameliorating water quality. Strengthening protection of cave systems and natural forests can safeguard important aquifers and freshwater supplies (see Box 4.8).

BOX 4.7

Managing Marine and Coastal Resources

The Tanzania Marine and Coastal Environment Management Project (MACEMP) aims to strengthen the sustainable management and use of Tanzania's Exclusive Economic Zone (EEZ), territorial seas, and coastal resources to enhance resilience to climate change and other environmental threats and to improve the livelihoods of coastal communities. Blueprint 2050 lays out the vision for protecting and managing 100 percent of the seas and coastline of Tanzania and Zanzibar, to be implemented with support from MACEMP. It draws on the best available science (ecological, cultural, and social), with inputs from a range of stakeholders representing the 8 million people who inhabit the coastal districts. Sustainable financing and creation of alternative income-generating activities are important elements of this strategy. Stakeholder involvement in decision making is a cross-cutting theme.

The project has three main components. First, it aims to establish and implement a common governance regime for the EEZ that contributes to the long-term sustainable use and management of EEZ resources based on an integrated coastal management approach. Second, it will support a comprehensive system of managed marine areas in the territorial seas, building on strategies that empower and benefit coastal communities and enhance long-term resilience. The third component empowers coastal communities to gain access to opportunities to request, implement, and monitor subprojects that contribute to improved livelihoods, risk management, and sustainable marine ecosystem management. A Marine Legacy Fund is being established to ensure long-term financial sustainability.

BOX 4.8

Protecting Karst and Cave Ecosystems in Croatia

Post-war Croatia is on a fast track toward economic development, spurred in part by prospects of future EU accession. Historically, the tourism industry, once a mainstay of the Croatian economy, was based on mass tourism rather than nature tourism. Expanding tourism development, and other infrastructure development such as roads and hydropower, increasingly threaten some of Croatia's most important natural ecosystems and biodiversity.

Croatia is famous for its karst freshwater ecosystems. The travertine barriers, some estimated to be over 40,000 years old, have led to the spectacular lakes and waterfalls now protected within two national parks. Large areas of the Dinarids, particularly in the Velebit Mountains, are densely covered by forest communities of beech, fir, spruce, and black pine, a relict alpine sub-species found only in the Velebit area. The karst region contains the largest area of unfragmented forest in Croatia, the integrity of which is evidenced by viable populations of large carnivores (wolf, brown bear, and lynx). Plitvice Lakes National Park is on the United Nations Educational, Scientific, and Cultural Organization's (UNESCO) World List of Natural and Cultural Heritage. The Velebit Mountain Range is part of the UNESCO Man and the Biosphere Program, and has been identified by WWF's Forest Hot-spot Initiative as one of the 10 most important forest areas in the Mediterranean region. The region's rich karst and cave systems also play an important role in freshwater regulation, recharging underground aquifers.

Both the subterranean and terrestrial karst ecosystems are known to be fragile, interconnected, and dependent upon a delicate balance between relief, hydrology, climate, and vegetation. The predominant surface ecosystems of natural forest and traditional pastoral land generally buffer the subterranean ecosystems, but the effectiveness of this function can be significantly reduced by subtle changes in climate, land use, and vegetation cover.

The recently completed Karst Ecosystem Conservation Project supported protected areas and sustainable inland nature-based tourism to draw discerning tourists away from Croatia's coastline. The grant provided support to (a) strengthen institutional and technical capacity for biodiversity conservation of the Karst environment; (b) integrate biodiversity conservation into physical planning and sectoral strategies; (c) strengthen management of protected areas; and (d) promote entrepreneurial and tourism activities that support sustainable natural resource use and conservation. The project aimed to conserve the biological diversity and ecological integrity of the karst ecosystems in Croatia, particularly in the Dinarid Mountains, which contain an estimated 8,000 caves—among the deepest and most extensive in the world.

In response to climate change, many countries are likely to invest in more infrastructure for coastal defenses and flood control to reduce the vulnerability of human settlements. Increased water shortages will increase demand for new irrigation facilities. Such strategies could further threaten biodiversity if new development leads to destruction of natural habitats through creation of dams, sea walls, and flood canals. Instead, in Ecuador and Argentina, flood control projects utilize the natural storage and recharge properties of critical forests and wetlands by integrating them into "living with floods" strategies that incorporate forest protected areas and riparian corridors (see Box 4.9).

Adopting Indigenous Knowledge to Adapt to Climate Change

Indigenous Peoples have played a key role in climate change mitigation and adaptation. In Brazil, Colombia, and Nicaragua, many territories of indigenous groups who have been given the rights to their lands have been better conserved than the adjacent agricultural lands. A climate change agenda fully involving Indigenous Peoples has many more benefits than if only government and/or the private sector are involved. Indigenous peoples are some of the most

BOX 4.9

Protecting Natural Forests for Flood Control

The irregular rainfall patterns prevailing in Argentina cause floods and droughts. Under all climate change scenarios, these boom-and-bust cycles will become exaggerated. Currently, about one-fourth of the country is repeatedly flooded. This is particularly true for northeastern Argentina, which has three major rivers— the Paraná, the Paraguay, and the Uruguay—and extensive, low-lying plains. The seven provinces of this area (Entre Ríos, Formosa, Chaco, Corrientes, Misiones, Buenos Aires, and Santa Fe) make up nearly 30 percent of the country. Nearly half of Argentina's population inhabits the latter two provinces, and an additional 12 percent live in the remaining five.

Flooding is the major regulating force in the ecosystems around these rivers; virtually all ecological events in the floodplains are either positively or negatively related to its extent and regularity. Typical habitats include the Pampas grasslands, Mesopotamia savannah, Paraná forests, Chaco estuaries and forests, and the Paraná River islands and delta. The Paraná forests in the province of Misiones have the highest level of faunal biodiversity, followed by the Chaco estuaries and forests. Overall, 60 percent of Argentina's birds and more than 50 percent of its amphibians, reptiles, and mammals are found in the floodplains.

The first phase of a two-stage Flood Protection Program aimed at providing cost-effective flood protection coverage for the most important economic and ecological areas, and developing a strategy to cope with recurrent floods. The project included the development and enforcement of flood defense strategies, the maintenance of flood defense installations, early flood warning systems, environmental guidelines for flood-prone areas, and flood emergency plans. Extensive areas of natural forest were protected as part of the flood defense system. This incorporation of natural habitats into flood defenses provided a low-cost solution as an alternative to costly infrastructure, with the added benefit of high biodiversity gains. As changing climate increases the likelihood of extreme weather events and flooding, the Argentina case provides some useful lessons on how to best harness natural habitats to reduce vulnerability of downstream communities.

Table 4.1 Reducing the Environmental Impacts of Infrastructure Projects to Protect Carbon Sinks and Biodiversity

Sectors: Energy, Hydropower	
Environmental impacts	*Mitigation/ conservation actions*
Flooding of natural habitats near reservoirs; displacement/ loss of wildlife; loss of biodiversity; deterioration of water quality; accumulation of vegetation before reservoir filling; upstream and downstream hydrological changes; alteration of fish communities and other aquatic life; invasion of aquatic vegetation and its associated disease vector species; sedimentation of reservoirs; generation of quarries and borrow pits; construction of multiple dams in one river; human resettlement; changes in hydrodynamics	Creation of compensatory protected areas; species conservation in situ and ex situ; minimization of flooded habitats; water pollution control/vegetation removal; water release management; minimum (ecological) stream flow maintenance year round; construction of fish passages and hatchery facilities; application of fishing regulations; physical removal of containments; biological and mechanical pest control; draw-down of reservoir water levels; watershed management; sediment management techniques; landscape treatment; environmental assessment of cumulative impacts
Sectors: Energy–Pipelines; Transportation–Roads; Telecommunications–Access Corridors	
Environmental impacts	*Mitigation/ conservation actions*
Barriers to species dispersal; habitat loss, fragmentation, and simplification; spread of tree diseases: insect infestation; introduction of invasive species; human and domestic animal intrusions; runoff, erosion, and landslides; fire generation and/or natural fire frequency alteration; land use changes; wetlands and stream deterioration; water quality alterations; modifications of indigenous peoples' and local communities' ways of life	Generation of wildlife corridors to connect habitats; minimization of project footprint; creation of compensatory protected areas; management plans; use of native plant species as barriers to avoid or reduce undesirable intrusions; minimization of access roads and right of way (ROW) width for pipelines; minimization of forest edges; implementation of management and maintenance plans for all routes; revegetation along all routes; ROW maintenance; improvement of land use management; elaboration and implementation of zoning plans; environmental education and awareness programs
Sector: Water and Sanitation/Flood Protection	
Environmental impacts	*Mitigation /conservation actions*
Coastal erosion downstream from river breakwaters; pollutant removal by dredging bottom sediment; pollution of water supply sources; deterioration of wetlands; loss of connectivity between rivers/wetlands/riparian zones; displacement/loss of wildlife; generation of artificial wetlands; invasions of aquatic weeds and disease vectors; worsening of water quality due to sewage disposal water bodies; encroachment; land use changes; storm-induced floods within enclosed areas protected by dikes	Land use management; zoning; execution of pollution controls; water quality monitoring; elaboration and implementation of environmental education and awareness programs; implementation of management plans for wetland areas; maintenance of wildlife corridors, channels, and flooded areas; mechanical control of aquatic weeds; biological control of disease vectors; adequate site selection and engineering design; establishment of physical barriers; adoption of design criteria aimed at discouraging encroachment into natural habitats

Source: Quintero 2007

vulnerable groups to the negative effects of climate change. Also, they are a source of knowledge for solutions that will be needed to avoid or ameliorate those effects. For example, ancestral territories often provide excellent examples of a landscape design that can resist the negatives effects of climate change.

Over the millennia, Indigenous Peoples have developed adaptation models to climate change. They have also developed genetic varieties of medicinal and useful plants and animal breeds with a wider natural range of resistance to climatic and ecological variability. Box 4.10 illustrates how indigenous people are using traditional knowledge to adapt to climate change.

BOX 4.10

Measures to Address Climate Change in the Salinas and Aguada Blanca National Reserve in Peru

GEF has supported the Participatory Management of Protected Areas Project in Peru since 2005. The Salinas and Aguada Blanca National Reserve is one of the protected areas supported under the project. Located north of Arequipa city, at an altitude between 3,600 and 6,000 meters, the Salinas and Aguada Blanca National Reserve is the habitat of wild cameloids, such as vicuña and guanaco, and home to a wide range of migratory and sedentary birds that breed around various mountain lakes, dams, and rivers. Created in 1979 to preserve the endangered flora and fauna of the area, it recently has been extended to 366,936 hectares. The volcanoes Misti, Chachani, and Pichu Pichu are within the limits of the reserve, as well as the beautiful Salinas lagoon, which creates an ideal habitat for flamingos. The Indio lagoon is another important refuge for water birds. The Salinas and Aguada Blanca National Reserve is the habitat for some 23 mammals and 138 birds, including vizcacha, Andean huemul, culpeo fox, vicuña, guanaco, and flamingos.

The reserve protects the main source of water for the city of Arequipa, as well as other smaller towns. The natural ecosystems are threatened from deforestation by the 14 local communities that inhabit the reserve. Around 8,000 inhabitants live within the reserve; many of them are engaged in cameloid farming. Water resources are scarcer every day due to the melting of the glaciers and because the area receives less precipitation than in the past. This water decrease can be attributed to climate change. The GEF project has supported sub-projects to help the local communities adapt to climate change, including water conservation and management activities that have had a positive impact on biodiversity conservation. Water retention terracing to collect water during the rainy season improves filtration and conservation. Technologies include infiltration ditches, small barrages, water mirrors (small lakes), and rustic canals. These traditional technologies were developed by ancestral indigenous peoples in the area, but died out after the Spanish conquest. A recent revival of these methods has increased water availability, especially during the summer season, and the vegetation has recovered in some parts of the reserve.

Over the last two decades, 109 Bank projects have supported or are supporting Indigenous Peoples programs and needs. Several of these projects have supported the conservation of tropical forests and reforestation activities that are directly linked to avoided deforestation; only a few have had direct benefits from carbon payments. The following activities supporting climate change and indigenous objectives are commonly found in these 109 projects: (a) Indigenous Peoples and protected-areas co-management, (b) titling and demarcation of indigenous lands, (c) indigenous life plans, (d) establishment of indigenous conservation areas, (e) indigenous community management and zoning plans, (f) indigenous community mapping and conservation, (g) community sustainable livelihood, and (h) capacity building and training.

BOX 4.11

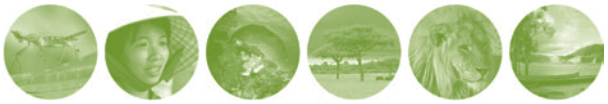
Using Land Tenure to Facilitate Greater Adaptation to Climate Change

Many within, and outside, the Bank consider the Brazil Indigenous Lands Project a best-practice example of a project that strategically has helped large populations of Indigenous Peoples in Brazil, particularly in the Amazon region, to demarcate their own territories. Since the beginning of the 20th century, Brazilian law has accorded legal recognition to Indigenous Peoples' land rights, which constitute about 103 million hectares, or 20.6 percent of the Legal Amazon. Legalization of indigenous lands requires that they be formally identified, delimited, demarcated, decreed, and registered. When the Brazil Indigenous Lands Project was prepared, only 50 percent of 556 Indigenous lands recognized by Brazil's National Indian Foundation had been legalized. The project enhanced the well-being of Indigenous Peoples and promoted the conservation of their natural resources by completing the legalization and assisting in the protection of approximately 121 indigenous areas in the Brazilian Amazon. It has also sponsored targeted studies, capacity building, and community-driven protection activities. This $22-million project was financed by the Rain Forest Trust Fund, the German government, and Brazilian counterpart funds. As of 2008, more than 65 of these indigenous territories have been demarcated, covering 45 million hectares (equivalent to more than 10 percent of the Amazon forest or an area larger than Germany, the Netherlands, and Switzerland combined). As a result of this project, these indigenous groups are now in a better position to participate in the various private and public carbon payments from avoided deforestation.

This project has been an innovative and pioneering effort not only to regularize indigenous lands in the Brazilian Amazon, but also to improve capacity and to increase indigenous participation and control in the processes of regularizing, protecting, and managing their lands. Satellite maps clearly show that the area of the Amazon covered by indigenous lands represents one of the largest remaining reserves of essentially intact tropical forest. After many years of conflict and unresolved land tenure, the Indigenous Peoples of the upper and middle Rio Negro in Brazil are finally having their lands legally recognized. The 106,000-square-kilometer area is home to 19 ethnic groups. Especially satisfying is that the project supports an alternative way of demarcating the land. The regional indigenous organization and a national NGO (the Socio-Environmental Institute) are actively involved in the process, as are all the indigenous communities who live there.

5

Biodiversity Conservation and Food, Water and Livelihood Security: Emerging Issues



Three of the world's greatest challenges over the coming decades will be biodiversity loss, climate change, and water stress. These three issues are closely linked to agricultural productivity and food security. For some years, the World Bank has recognized that climate change poses a threat to achieving poverty reduction and development goals. Climate change will exacerbate the rate of biodiversity and habitat loss and land degradation, in part through the spread of invasive alien species. Although many natural and economic sectors will be affected by climate change, impacts on agriculture and water availability will have the greatest potential to negatively affect the livelihoods of the poor in rural areas, as well as national economic growth in the least-developed countries, especially in Africa.

Agriculture, Climate Change, and Biodiversity

Agriculture is one of the greatest threats to biodiversity worldwide. Expanding agriculture leads to habitat loss and fragmentation, drainage of wetlands, and impacts on freshwater and marine ecosystems through sedimentation and pollution. The Millennium Ecosystem Assessment confirmed that agricultural land uses are the dominant terrestrial influence on ecosystems and that without major changes in current farming practices and agricultural landscape management, many efforts to conserve biodiversity are likely to fail. At the same time, agriculture is highly dependent on soil biodiversity and agrobiodiversity (for example, crop varieties) as well as the ecosystem services that natural habitats and biodiversity provide (see Box 5.1). In many of the poorest countries and rural areas with chronic hunger, achieving the MDG to reduce hunger and poverty will require significant increases in agricultural production and productivity, as well as the rehabilitation of degraded lands and natural resources critical for food security.

The Bank has a large and expanding agriculture portfolio. Few of these projects explicitly target biodiversity conservation, although many promote more sustainable agricultural practices, such as rotational cropping and soil conservation measures, which are more ecologically friendly and designed

BOX 5.1

Downstream Benefits from Forest Conservation in Madagascar

Economic analysis can be a useful tool for demonstrating the benefits of protected areas and conservation. A World Bank study showed that the economic benefits of biodiversity conservation far outweigh costs in Madagascar. The cost of sustainably managing a network of 2.2 million hectares of forests and protected areas over a 15-year period was estimated at $97 million (including opportunity costs forgone in future agricultural production), but would result in total benefits of $150 to $180 million. About 10 to 15 percent of these benefits are from direct payments for biodiversity conservation, 35 to 40 percent from ecotourism revenues, and 50 percent from watershed protection, primarily from averting the impacts of soil erosion on smallholder irrigated rice production.

The study considered potential winners and losers from forest conservation and pointed to the needs for equitable transfer mechanisms to close this gap, but emphasized that conservation will help to maintain or improve the welfare of at least half a million poor peasants. The study contributed to a government decision to increase forest protected areas to more than 6 million hectares in Madagascar. The Bank and other donors are helping to fund the expanded protected area network through the Third Environment Program, including capitalization of a conservation trust fund to provide sustainable financing. Carbon finance will also provide support to protect Madagascar's rich forests, as well as the island's unique lemurs and other endemic fauna.

to increase harvest yields. During the last decade the Bank has become engaged in developing a suite of pilot biodiversity conservation projects that target agriculture in, and around, protected areas or in larger landscapes of conservation interest. Such projects usually try to change production practices to provide greater biodiversity benefits (such as promotion of shade coffee) or attempt to substitute other income-earning opportunities for harmful agricultural practices. A few projects have also promoted more biodiversity-friendly policies in the agricultural sector, such as promotion of integrated pest management in Indonesia to reduce dependence on high levels of pesticides.

Recent work has focused on providing guidance at a global and regional level on how to improve agricultural production while reducing the impact of agriculture on the natural world. The Bank—with UNEP and other donors—is supporting *The International Assessment of Agricultural Science and Technology for Development (IAASTD)* to analyze the effects of agricultural policies, practices, technologies and organizational arrangements on ecosystems and their goods and services, including biodiversity. Some of the questions that are being addressed include:

- How can biodiversity be mainstreamed into the production landscape?
- How do initiatives, such as training in sustainable harvesting or pest ecology, affect the capacity of small-scale or subsistence producers to utilize threatened habitats without inflicting further harm?
- What are the economic and environmental (including species biodiversity) concerns surrounding biomass production?
- How are intellectual property rights important to conservation and the sustainable use of biodiversity?
- How have past changes in agricultural biodiversity affected rural livelihoods and nutritional security?
- What are the impacts of climate change on agricultural biodiversity and loss of agricultural biodiversity on adaptability to climate change?

The knowledge generated by the IAASTD will strengthen the capacity of institutions to design and implement integrated management approaches, appropriate policies, and incentive structures that could contribute to reducing the overall rate of natural resource loss and land degradation, as well as enhancing landscape biodiversity in both production and protected areas.

Sustainable agricultural practices and improved natural resource management will contribute to improving livelihoods, food security, and health.

Agriculture and Food Security

Climate change and global warming will lead to decreased water availability, especially in arid and semi-arid lands. A reduction in agricultural productivity is anticipated, especially in the tropics and sub-tropics, as a result of increased temperatures and increased evapotranspiration. Climate change impacts will disproportionately affect the rural poor who rely on agriculture through increased risk of crop failure, pest infestation, water scarcity, and livestock deaths. These impacts are already imposing economic losses and undermining food security, and they are likely to get far more severe as global warming continues.

According to crop-climate models, in tropical countries even moderate warming can reduce yields significantly (1°C for wheat and maize and 2°C for rice) because many crops are already at the limit of their heat tolerance.

For temperature increases above 3°C, yield losses are expected to occur everywhere and be particularly severe in tropical regions. Areas most vulnerable to climate change—centered in South Asia and Sub-Saharan Africa—also have the largest number of rural poor and rural populations dependent on agriculture. This makes climate change a core development problem, and biodiversity actions a critical part of the solution.

The Bank's response to the threats presented by climate change to agriculture focus on both mitigation and adaptation efforts and can be divided into four strategic objectives:

- Monitoring impacts of climate change on crops, forests, livestock and fisheries (adaptation)
- Providing risk management strategies for farmers and lenders against climate change impacts (adaptation)
- Preventing crop and livestock losses due to changing climatic factors and increased pest pressure through improved management techniques and tolerant crop varieties/livestock breeds (adaptation)
- Improving land and resource management to prevent degradation of the sustainable production base (mitigation).

BOX 5.2

Supporting Climate Risk Management in Africa

Land degradation poses a serious threat to livelihoods and economic growth in Sub-Saharan Africa. TerrAfrica is a partnership between African countries, UN organizations, donor countries, national, regional, and international agencies, civil society and the research community with a mandate to scale up and harmonize country-driven, sustainable land management practices (SLM) across Sub-Saharan Africa. TerrAfrica works closely with the New Partnership for Africa's Development (NEPAD) and the Comprehensive Africa Agricultural Development Programme (CAADP), and supports the objectives of the United Nations Convention to Combat Desertification. The partnership recognizes climate risk management as an integral component of its activities, which include coalition building at the global, regional and national level, knowledge development and management, and project investments.

The regional and national investments planned under the TerrAfrica umbrella are expected to improve land use practices and carbon sequestration while promoting more sustainable land management and biodiversity conservation. The Bank is already assisting several countries in sub-Saharan Africa—including Burundi, Ethiopia, Madagascar, Mauritania, and Senegal—to integrate sustainable land management into poverty reduction strategies and investments to address land degradation. For more information on TerrAfrica, see www.terrafrica.org.

These objectives encompass a broad range of activities, which are currently being addressed through economic and sector work studies, non-lending technical assistance, IDA lending in support of disaster management, supporting clean development mechanisms, and sponsoring science and management to improve land, water, and forest resources. Moreover, teams assisting IDA countries on climate change can also draw on Bank instruments, including carbon offsets, with operations in IDA countries (Albania, India,

BOX 5.3

Bank Studies and Projects related to Climate Change and Agriculture and Natural Resource Management

- The Social Development Department (SDV) and the Agriculture and Rural Development Department (ARD) are planning a study on the implications of climate change for local rural institutions and livelihoods. The study would address the different factors that might jeopardize the livelihoods of agrarian societies in dry lands and how those impacts differ by social groups.
- SDV has initiated a working paper on the implications of climate change for rural social organization and policy to understand the role that rural institutions can play in mitigation, adaptation, and climate change awareness at the community level.
- The Energy, Water and Transport (ETW) Department is developing a study on Water and Adaptation to Climate Change: Implications on Investment and Project Design, which includes water for agriculture.
- The Development Research Group (DECRG) has completed a series of studies on (a) Impacts of, and Adaptation to, Climate Change in Agriculture in Africa and South America; (b) Climate Change and Rural Development in South America; (c) Measuring the Impact of, and Adaptation to, Climate Change by Farm Types using Agro-ecological Zones in Africa; and (d) Climate Change and Agriculture: An economic analysis of global impacts, adaptation, and distributional effects.
- ARD, WBI, and the Africa (AFR) Region (in collaboration with CEEPA and the University of Pretoria) have completed a project on Climate, Water and Agriculture: Impacts and Adaptation of Agro-ecological Systems in Africa.
- AFR is carrying out rural risk management studies in Ethiopia and Senegal. Projects for Burkina Faso, Ethiopia, Kenya, Madagascar, and Mozambique include components on adaptation to climate change for agriculture and rural development.
- The Middle East and North Africa (MENA) Region is working on a series of studies, including (a) assets at risk in the Nile Delta under alternative sea-level rise scenarios; (b) impacts of climate change on cereals and high-value export crops, and implications for agricultural policies in Morocco; and (c) impacts of climate change on the agriculture sector in Tunisia.
- The South Asia Region (SAR) has (a) undertaken a study on Adaptation to Drought in Andhra Pradesh, India; (b) completed a study on Water, Natural resources, and Environment Nexus for Development and Growth in NE India (c) completed a study on Addressing Vulnerability to Climate Variability and Climate Change through an assessment of adaptation issues and options in India, focused on the agricultural and rural sectors; and (d) is scoping a study on Adaptation to Climate Variability and Change in Nepal, with a focus on water, agriculture, and livelihoods. Three pipeline projects deal with adaptation and climate change in India, with a focus on agriculture.
- LAC is initiating work on adaptation in agriculture in the Pampas in Argentina and southern Brazil. A project on adapting to rapid glacier retreat in the tropical Andes (Bolivia, Ecuador and Peru) also considers the impacts of climate change on agricultural activities.
- In EAP, a major project is in the pipeline for China focusing on mainstreaming adaptation to climate change into water resources management and agricultural development.
- ECA has provided technical assistance at the regional and country level on adapting to the impacts of climate change, primarily in the agriculture and water sectors.

Honduras, Moldova, Nepal, and Nicaragua) that focus largely on afforestation, biogas, and soil conservation. GEF grants in countries such as Benin, Cameroon, Kiribati, Albania, Kenya, and Uganda focus on management of land, forest, and ecosystem resources.

As agricultural programs take account of climate change and changing rainfall patterns, there is an increasing emphasis on community-driven development. This is encouraging more sustainable agriculture to avoid overgrazing and land degradation and promote new agroforestry systems and multi-species cropping. Increased attention is also being paid to conserving agrobiodiversity in crop gene banks and to traditional agricultural practices, which maintain diversity of varieties and crops for food security (see Box 4.6).

Invasive Alien Species

Invasive alien species (IAS) are now widely regarded as the second greatest threat to biodiversity after direct habitat destruction and fragmentation. Changing land use patterns and global warming will affect species distributions, exacerbate other environmental stresses, and may facilitate the establishment and spread of invasive alien species. Most introductions of exotic species to new environments have been facilitated by human agency either deliberately (most vertebrate and terrestrial plants, other than agricultural weeds) or accidentally, including the majority of invertebrate taxa, for example, in the ballast of ships. The spread of IAS is on the increase globally, facilitated by increasing trade, tourism, international traffic and even development assistance. Invasive alien species are a threat to biodiversity and economic development, reducing crop and fisheries yields; contributing to land degradation; clogging irrigation canals, reservoirs, and hydroelectric dams; and reducing the lifespan of development investments.

Development programs for agriculture, especially agroforestry programs and aquaculture, can facilitate both deliberate and unintentional introductions of invasive alien species. Such misjudgments and accidents are costly; indeed, their negative effects may be far greater

and longer lasting than the positive impacts of the aid programs from which they arose. 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. Problems resulting from intentional introductions under development assistance programs include water hyacinth, *Tilapia* fish for aquaculture in Central America, and a number of agroforestry trees and shrubs.

The introduction of new and adaptable exotic species for agriculture and to meet increasing demands for biofuels, mariculture, aquaculture, and reforestation presents a particular challenge. Ironically, in some cases, the very characteristics that make a species attractive for introduction under development assistance programs (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.

The threats to agricultural productivity posed by IAS (weeds, pests, and diseases of crops and livestock) have long been recognized. In recent years, our understanding of the impacts of IAS on natural ecosystems, the services they provide, and wider human livelihoods has increased. For example, exotic plants can come to dominate freshwater bodies and waterways, affecting nutrient dynamics, oxygen availability, food webs, and fisheries. Other IAS, from microbes to mammals, pose a major threat to agricultural and natural ecosystems, and to human health and livelihoods. The economic impacts of IAS are expensive, costing an estimated $140 billion annually in the United States. Water hyacinth in Lake Victoria costs around $150 million per year for control and removal, and threatens local fisheries; eradication of donkeys and goats from parts of the Galapagos Islands to protect fragile ecosystems, endemic species and the local tourist economy costs more than $8 million annually.

BOX 5.4

The Global Invasive Species Programme (GISP)

GISP is a voluntary association between the World Conservation Union (IUCN), CAB International (CABI), The Nature Conservancy, USA (TNC) and the South African National Botanical Institute (SANBI). GISP has a small, dedicated secretariat, now based in Nairobi.

The GISP mission is to conserve biodiversity and sustain human livelihoods by minimizing the spread and impact of invasive alien species. To this end, GISP seeks to:

- Improve the scientific basis for decision making on invasive species
- Develop capacities to employ early warning and rapid assessment and response systems
- Enhance the ability to manage invasive species
- Reduce the socioeconomic impacts of invasive species and control methods
- Develop better risk assessment methods
- Strengthen international agreements.

A key focus for GISP is to support the implementation of relevant international legal instruments, including the IAS work program of the Convention on Biological Diversity. The World Bank has formed a partnership with GISP by supporting the GISP secretariat and key capacity building activities with funding through the Bank Netherlands Partnership Program (BNPP) and the Development Grant Facility (DGF).

For general information about some of the world's most invasive species, see the database of the Invasive Species Specialist Group at www.issg.org, and the website of the Global Invasive Species Programme at www.gisp.org.

The impacts of IAS on land and water management and agriculture will be greatest in some of the poorest countries, including those in Africa, where land degradation and food security are already major concerns. The Bank is working with the Global Invasive Species Programme (GISP) to better understand the implications of IAS on food production, food security and health, including assessment of best practice guidelines for avoiding the introduction of species known to be invasive. Assisting clients, especially the least-developing countries and Small Island Developing States (SIDS), to better understand and manage IAS problems will be an important part of the adaptation and development agenda. With funding through the Bank Netherlands Partnership Program and the Development Grant Facility, the Bank has supported GISP to develop tools and methodologies to assess the economic costs of IAS and to demonstrate the benefits of containing and managing invasive alien species. Workshops have been held in eastern and southern Africa to build capacity to deal with the economic and legal aspects of IAS. These capacity building efforts have been complemented by specific projects to control, manage, and eradicate IAS in South Africa (wattles and pines), Lake Victoria (water hyacinth), India, the Seychelles, and South and Central America.

Climate change is likely to exacerbate the spread of IAS, with serious environmental and economic consequences. Already, invasives are a serious problem in some vulnerable habitats such as the Cape Floristic Region (CFR) in South Africa. It is estimated that 43 percent of the Cape Peninsula alone is covered in alien vegetation, consuming up to 50 percent of the region's river runoff. The availability of freshwater is a key limiting factor to development in the Western Cape; where water is available, it is already fully utilized. It has been estimated that the spread of exotic trees in the mountain catchment areas surrounding Cape Town could reduce water resources for this rapidly growing city by 30 percent. These losses could mean that more (and expensive) dams have to be built much earlier to meet water demands. Additionally, invasive plants in indigenous grasslands and scrublands increase fuel loads and fire risk, which leads to increased soil erosion, degradation and biodiversity loss in mountain catchments. The South African government has taken serious action to address these threats through the Working for Water and Working for Fire programs, which are collaborating with the Bank/GEF C.A.P.E. program to better manage and control IAS in the CFR. Support to the Working for Water Program from the Bank's Development Marketplace has increased employment opportunities for marginalized people through small-scale industries that utilize, and add value to, harvested alien trees.

BOX 5.5

The Inter-American Biodiversity Information Network (IABIN)

IABIN is an Internet-based forum for technical and scientific cooperation that seeks to promote greater coordination among Western Hemisphere countries in the collection, sharing, and use of biodiversity information relevant to decision making and education. As one of its six thematic priorities, IABIN is addressing the need for a regional network of invasive species knowledge bases. National databases provide easily accessible data to relevant agencies so they can assess which species are invasive or potentially invasive in particular habitats, and use this information in their planning efforts. The IABIN Invasives Information Network (I3N) includes Argentina, Brazil, Bahamas, Bolivia, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Jamaica, Mexico, Paraguay, Peru, Venezuela, and the United States. The network has produced a series of useful tools and products such as I3N standards, national I3N catalogues, an inter-operable search engine, fact sheets, and an I3N thesaurus.

Biofuels for Renewable Energy

New initiatives under the climate change agenda provide both opportunities and challenges for biodiversity conservation. Bio-energy plantations can substitute for fossil fuels and may also provide benefits to small farmers engaged in their production.

However, without careful planning, biofuel production could lead to further clearance of natural habitats, either for biofuels themselves or for new agricultural land to replace converted crop lands. Moreover, many species being promoted for biofuel production are known to become invasive in some countries where they have been introduced (see Table 5.1).

With the rapidly rising global concern about climate change, there has been intense interest in the potential for

Table 5.1 Known Invasive Species Listed in Different Countries as Suitable for Biofuel Production

Species Name	*Common Name*	*Native Range*	*Invasive Status*
Artocarpus communis, A. altilis	Breadfruit	Pacific Islands, Southeast Asia	Fiji, Kiribati, Line Islands
Arundo donax	Giant reed	Eurasia	United States, Mexico, the Caribbean, Southern Europe, South Africa, Thailand, Australia, New Zealand, Hawaii
Azadirachta indica	Neem	India, Burma, Sri Lanka, Myanmar, Bangladesh	West Africa, Australia, Fiji, Mauritius
Brassica napus	Rapeseed/canola	Eurasia	Australia, Ecuador, Fiji, Hawaii, New Caledonia
Camelina sativa	False flax	Eastern Europe and Southwest Asia	North America, Western Europe, Australia, Central America, South America, Japan
Elaeis guineensis	African oil palm	West Africa, Madagascar	Brazil, Micronesia, Florida USA
Gleditsia triacanthos	Honey locust	Eastern North America	Central Argentina, South Africa, Australia, USA, New Zealand
Jatropha curcas	Jatropha/ physic nut	Tropical America	Australia, South Africa, USA, Pacific Islands, Puerto Rico
Maclura pomifera	Osage orange	Central United States	Europe, USA, Australia, South Africa
Morus alba	Mulberry	Asia	Brazil, Ecuador, United States
Olea europaea	Olive tree	Mediterranean Europe	Australia, Hawaii, New Zealand
Phalaris arundinacea	Reed canary grass	Europe, Asia, North America	United States, South Africa, Australia, New Zealand, Chile, most temperate countries
Prosopis spp.	Mesquite	America	Eastern Africa (Sudan, Eritrea, Ethiopia, Djibouti), Southern Africa, India, Australia
Ricinus communis	Castor bean	East Africa	Brazil, Australia, Pacific islands, New Zealand, South Africa, Mexico, USA, Western Europe
Sorghum halepense	Johnson grass	Mediterranean to India	United States, Australia, Pacific Islands, Central and South America, Indonesia, Thailand
Ziziphus mauritiana	Chinese apple/jujube	India, China	Australia, Africa, Afghanistan, China, Malaysia, northern Australia, Pacific and Caribbean region

Source: GISP, 2007

expanding the amount of energy generated by biofuels as a substitute for the unsustainable burning of fossil fuels. Biofuels offer a potential source of renewable energy and could lead to large new markets for agricultural producers. There is considerable public support for biofuels as a replacement for fossil fuels, as a response to mitigation of climate change, and a contribution to energy security. Policies in the United States and EU that mandate specific targets for biofuels in meeting fuel needs are fueling rapidly growing biofuel industries. However, few current biofuel programs are economically viable without subsidies and many have potential social and environmental costs, including intensified competition for land and water and possibly deforestation. While biofuel plantations on degraded and/or abandoned agricultural lands may prove beneficial, the expansion of biofuels in the tropics is also leading to clearance and loss of natural ecosystems, with consequent loss of biodiversity. The clearance of peat swamp forests for oil palm production in Indonesia, for instance, is estimated to have been a major contributor to Indonesia's GHG emissions, making Indonesia the third largest emitter of GHGs in 2006.

Pilot projects of various scales are already under way or in the planning stages in many parts of the world, particularly in Asia, Africa, and South America to establish smallholder plantations of biofuel species such as *Jatropha curcas* for job creation, poverty alleviation, and restoration of degraded land. *Jatropha curcas* is a fast-growing, drought-resistant shrub or small tree that is native to southern Mexico and Central America, but has been introduced to many tropical and subtropical regions of the world. It is a member of the euphorbia family and can tolerate marginal, nutrient-poor soils and arid conditions, although it is relatively sensitive to frost. Because it is unpalatable to livestock, it has been widely used in rural communities in Africa as a hedge or 'living fence' around crops. Once mature, the trees annually produce about 4kg of seed, which have an oil content of 30–40 percent. The seeds are toxic to humans and animals, but have been used in traditional medicines as a purgative or laxative. The oil has also been used by rural communities to make soap and other products, such as hair treatments. The Bank is assessing the social and economic benefits of promoting *Jatropha* for biofuel production in Kenya.

There is increasing evidence that biofuels are not a silver bullet. Economists, environmentalists, and social scientists, among others, have presented compelling evidence that (a) some biofuels are not economically attractive alternatives to fossil fuels in the absence of subsidies; (b) they may not provide significant savings in greenhouse gas production; (c) the cultivation of plant-based biofuels has serious environmental costs in terms of its impact on biodiversity; and that (d) the social impacts of the expansion of plant-based biofuels can have detrimental impacts on food availability and affordability, as well as other negative impacts on the poorest populations in the developing world (see Box 5.6). Accordingly, the Bank is working with WWF to produce a prototype score card to assess when, where, and what biofuel production is environmentally and socially sustainable. This Biofuels Sustainability Scorecard is modeled on the WWF-World Bank Protected Areas Management Effectiveness Tracking Tool. The biofuels scorecard will allow the user to rate a potential biofuel on a defined, qualitative scale on a series of criteria that are key to the expected environmental sustainability of the biofuel and its production system.

Sustainable Land Management

The Millennium Ecosystem Assessment confirmed that land degradation/desertification is potentially the most threatening ecosystem change that impacts the livelihoods of the poor. Land degradation diminishes biological diversity and many of the ecosystem goods and services on which human societies depend. Up to 75 percent of Africa's poor live in rural areas with livelihoods critically dependent on efficient use of increasingly scarce land, water, biodiversity, and nutrients. Land degradation marginalizes efforts to secure long-term food security, rural productivity, and development. Climate change is likely to put further stress on already fragile ecosystems. Desertification in some regions is already triggering large-scale migrations, instability, and potential conflicts over scarce resources. As one of the leading financiers

BOX 5.6

Biofuels—Too Much of a Good Thing?

With oil prices at record highs and with few alternative fuels for transport, several countries are actively supporting the production of liquid biofuels from agriculture—usually maize or sugarcane for ethanol, and various oil crops for biodiesel. As the economic, environmental, and social effects of biofuels are widely debated, they need to be carefully assessed before extending public support to large-scale biofuel programs. Those effects depend on the type of feedstock, the production process used, and the changes in land use.

Global production of ethanol as a fuel in 2006 was around 40 billion liters. Of that amount, nearly 90 percent was produced in Brazil and the United States. In addition, about 6.5 billion liters of biodiesel were produced in 2006, of which 75 percent was produced in the European Union. Current biofuel policies could, according to some estimates, lead to a fivefold increase in the share of biofuels in global transport—from just over 1 percent today to around 6 percent by 2020.

Are biofuels economically viable—and what is their effect on food prices?

Governments provide substantial support to biofuels so that they can compete with gasoline and conventional diesel. Such support includes consumption incentives (fuel tax reductions); production incentives (tax incentives, loan guarantees, and direct subsidy payments); and mandatory consumption requirements.

Rising agricultural crop prices caused by demand for biofuels have come to the forefront in the debate about a potential conflict between food and fuel. Rising prices of staple crops can cause significant welfare losses for the poor, most of whom are net buyers of staple crops. But many other poor producers, who are net sellers of these crops, benefit from higher prices. For example, biofuel production has pushed up feedstock prices.

Nonmarket benefits and risks are context-specific. The possible environmental and social benefits of biofuels are second only to energy security as the most frequently cited arguments in support of public funding and policy incentives for biofuel programs. But these come with risks also.

Potential environmental benefits. Environmental benefits need to be evaluated on a case-by-case basis because they depend on the greenhouse gas (GHG) emissions associated with the cultivation of feedstocks, the biofuels production process, and the transport of biofuels to markets. Changes in land use, such as cutting forests or draining peatland to produce feedstock such as oil palm, can cancel the GHG emission savings for decades. Similarly, land use changes born of a need to replace land for food crops that is now used for biofuel production, can eliminate GHG savings and irreversibly damage wildlife and wild lands.

Benefits to smallholders. Biofuels can benefit smallholder farmers by generating employment and increasing rural incomes, but the scope of those benefits is likely to remain limited with current technologies. Ethanol production requires fairly large economies of scale and vertical integration because of the complexity of the production process in the distilleries. Small-scale production of biodiesel could meet local energy demand, but rising food and feedstock prices could negate any gains in cheaper energy.

Source: World Development Report 2008

of measures aimed at combating land degradation and desertification, the World Bank continues to invest in activities that promote appropriate sustainable land management (SLM) practices and protection of ecosystem services (see Box 5.7). New carbon markets may also afford opportunities to invest in land rehabilitation, as well as more sustainable agricultural practices to restore productive agricultural systems and alleviate poverty.

BOX 5.7

Conserving Biodiversity through Sustainable Land Management in India

Uttar Pradesh is India's most populous state and also one of the poorest. While agriculture dominates Uttar Pradesh's economy, a growing challenge in the state is the declining productivity of food grains (wheat and rice) due to water-related land degradation such as sodification (making the land too salty to grow crops). Poorly managed irrigation has left millions of hectares of land barren. Under the Uttar Pradesh Sodic Lands Reclamation Project I (IDA, $54.7 million; 1993) and II (IDA, $194.1 million; 1998), a total of 253,715 hectares of formerly sodic lands have been reclaimed and are being productively farmed. Within the reclaimed lands, soil quality and productivity have increased. Improved crop husbandry led to increased cropping intensity from a baseline of 63 percent to an average of 198 percent. Rice yields increased from 0.9 to 3.5 t/ha, and wheat from 0.4 to 3.0 t/ha. Environmental quality improved as evidenced by an over five-fold increase in floral and faunal diversity as well as microbial biomass in sampled areas. The market value of land increased fourfold. More than 552,000 households (more than 1 million people) benefited directly from project activities. Wage rates doubled and additional rural jobs for 86,710 persons/year were generated from expansion and intensification of cultivated areas. More importantly, the poverty level declined from 72 percent to 48 percent. This shows that investing in sustainable land management is good for poverty alleviation and environmental stewardship at the grassroots level.

Ecoagriculture is an umbrella term for a diverse set of strategies for managing agricultural landscapes in ways that enhance sustainable agricultural production and rural livelihoods, and also conserve or restore biodiversity and ecosystem services at a meaningful landscape scale. The Bank is providing DGF funding to Ecoagriculture Partners, an NGO that is mobilizing partnerships among farmers, conservationists, agriculturalists, public land managers, agribusiness, and researchers to support, develop, and promote ecoagriculture innovations. The project will develop indicators and methods for documenting the ecological and economic value of different agricultural practices and test these through in-depth case studies. A draft "Toolkit" set of basic indicators and methods is now being developed.

In Central America, the Bank has been supporting improved livestock management linked to payments for ecosystem services (see Box 3.7). The large-scale conversion of forests to pastures in Central America has resulted in the loss of biodiversity and the disruption of ecological processes. Pastures are often poorly managed and quickly become degraded, with reduced pasture productivity. Currently, at least 30 percent of the region's pastures are considered to be degraded and are of little economic and ecological value. A BNPP-funded project, implemented through the Tropical Agricultural Research and Higher Education Center (CATIE), is exploring the relationships between silvopastoral systems, biodiversity conservation, and farmer livelihoods to determine how silvopastoral systems contribute to both conservation and development goals. This research will provide important information on more sustainable resource management that can contribute to biodiversity conservation and carbon storage while improving farmers' livelihoods.

Water Services

Climate change, rising temperatures, and the increasing need for irrigated agriculture in arid regions will all increase pressure on scarce water resources. 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. Municipal water accounts for less than a tenth of human water use, but

BOX 5.8

Conservation Farming in Practice in South Africa

A GEF-funded MSP showed that conservation farming on some South African farms reduced input costs, increased profits, and improved sustainability. These farming practices also conserve biodiversity, contribute to carbon sequestration, and improve the quantity and quality of water runoff.

Farming for flowers on the Bokkeveld Plateau

From the western rim to the eastern margin of the Bokkeveld Plateau, rainfall decreases from 500 mm to 200 mm per year over a distance of 15 km. Over this transition, the vegetation changes from fynbos on infertile sandy soils through renosterveld to succulent karoo. The area supports about 1,350 plant species, 97 of which are endangered. The small village of Nieuwoudtville on the Bokkeveld Plateau is the "bulb capital of the world," with a staggering 241 bulb species. The richest concentration of bulbs, both in terms of species and individuals, occurs on the highly fertile clays. Unfortunately, large areas of bulb-rich veld have been ploughed up and replaced with cereals and pasture crops.

About 30 years ago, one farmer—Neil McGregor, on the farm Glen Lyon,—decided that this form of agriculture was not sustainable. Instead, he began to nurture the indigenous veld to provide better plant cover. With the diversity of indigenous plants, McGregor was able to maintain productivity for much longer through the dry summer season than his neighbours did with their planted crops. By using biodiversity-friendly practices, and refraining from the use of pesticides, he was able to boost sheep productivity and reduce his inputs. Moreover, he found that aardvark and porcupine, considered troublesome on crop farms, actually promoted the proliferation of bulbs and hence forage for his livestock. Therefore, he abandoned attempts at controlling these so-called problem animals. One consequence of this conservation farming was unparalleled displays of wild flowers with a profusion of bulb species flowering from mid-winter through to late spring. These displays draw tourists to Namaqualand, catalyzing additional tourist income to the farm and district. Glen Lyon has become a role model in the region and many farmers are now following conservation farming practices. Recently Glen Lyon farm has been declared a national botanical garden in recognition of its biodiversity values.

Getting the most out of the veld

The semi-arid summer rainfall area of South Africa known as the Nama Karoo is characterized by highly variable rainfall from year to year. The natural veld comprises a very diverse flora of palatable shrubs and grasses interspersed with unpalatable shrubs. This area also supports an extremely important livestock industry, based mainly on wool and mutton production. Over the last century, the condition of ranch land over much of the Nama Karoo has deteriorated, with proliferation of a few unpalatable species replacing more palatable species.

One farm in Elandsfontein in the Beaufort West district instituted a grazing regime that simulated pre-farming natural conditions when the veld was grazed by migrating herds of ungulates. Livestock were separated into small units and kept in one area until that area was well-grazed before being moved to another unit. The condition of the veld improved. Livestock were forced to eat both palatable and unpalatable plant species. Since the unpalatable plants are not adapted to being grazed, they lose their competitive edge, become weakened, and their numbers reduced. Secondly, the higher number of small management areas ensured a lengthened rest period between exposure to grazing, thereby enabling much of the range land to recover. Studies show that implementation of this system resulted in the highest productivity in the district, as well as ecological buffering and greater resilience of the veld against drought, with benefits both for biodiversity and production.

clean drinking water is a critical need. Today, half of the world's population lives in towns and cities and one-third of this urban population live without clean drinking water. These billion have-nots are unevenly distributed: 700 million city dwellers in Asia, 150 million in Africa, and 120 million in Latin America and the Caribbean. With expanding urban needs, cities face immediate problems of access to clean water and mounting problems of supply. In recent years, governments and city councils have begun to take an increasing interest in the opportunities for offsetting or reducing some of the costs of maintaining urban water supplies—and, perhaps even more importantly, water quality—through management of natural resources and particularly forests.

Water provides a powerful argument for protection of natural habitats. Among the world's largest cities, many draw some or all of their drinking water from protected forests, including Jakarta, Mumbai (formerly Bombay), Karachi, Tokyo, Singapore, Mexico City, New York, Bogota, Rio de Janeiro, Los Angeles, Cali, Brasilia, Vienna, Barcelona, Nairobi, Dar Es Salaam, Johannesburg, Sydney, Melbourne, and Brisbane. Elsewhere, half of Puerto Rico's drinking water comes from the last sizable area of tropical forest on the island, which is in the Puerto Rico National Park. Quito, the capital of Ecuador, draws its water from a system of protected areas. Mount Kenya , the second highest mountain in Africa, is one of Kenya's five main "water towers" and provides water to over 2 million people (see Box 5.9).

Looking Forward: The Strategic Framework for Climate Change and Development

The WBG is developing a new Stategic Framework for Climate Change and Development (SFCCD) to address the challenges of climate change and adaptation. In addition

BOX 5.9

Protected Areas as Water Towers

Protected areas are usually established for biodiversity conservation, but many have a much broader relevance to sustainable development and climate change adaptation. Many mountain protected areas can be justified through provision of ecosystem services, such as clean water, soil conservation, and protection of downstream and vulnerable communities from natural hazards such as floods and unstable hillsides.

A number of Bank biodiversity projects have provided funding to protected areas in forest watersheds, which safeguard the drinking supplies for some of the world's major cities. Panda reserves in the Qinling Mountains, China, protect the drinking water supplies for Xi'an. The Gunung Gede-Pangrango in Indonesia 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. Similarly, Kerinci N.P. in Sumatra safeguards water supplies for more than 3.5 million people and 7 million hectares of agricultural land, while two of the Andean protected areas in Ecuador provide drinking water supplies for 80 percent of Quito's population. The La Visite and Pic Macaya national parks in Haiti safeguard water supplies for the cities of Port au Prince and Les Cayes respectively. In Mexico, the Monarch Butterfly Reserve protects an amazing biological phenomenon and the drinking water of Mexico City. The Aberdare Mountains and Mount Kenya national parks in Kenya provide critical water to Nairobi, while the Udzungwas in the eastern arc mountains of Tanzania supply Dar es Salaam. In South Africa, the recognized value of the mountains of the Cape Peninsula and Drakensberg in providing water supplies for Cape Town, Johannesburg, and Durban has led to serious national investments to address invasive species through the Working for Water programs, as well as biodiversity investments through the World Bank.

to focusing on immediate actions to promote cleaner and renewable energy, the SFCCD recognizes that ecosystems and biodiversity provide essential services that underpin every aspect of human life, including food security, carbon storage, climate regulation, livelihoods, ethnic diversity, and cultural and spiritual enrichment. Enhanced protection and management of natural habitats and biological resources can contribute to climate change mitigation, as well as providing effective and low-cost options to reduce vulnerability and adapt to climate change.

Bank projects and programs are already supporting biodiversity conservation and protection of natural habitats as effective mitigation and adaptation strategies, but more needs to be done, including:

- Protecting terrestrial, freshwater, and marine ecosystems and ecological corridors to conserve terrestrial and aquatic biodiversity
- Integrating protection of natural habitats into strategies to reduce vulnerability and disaster risks (including climate change and natural disasters such as floods, cyclones)
- Scaling up country dialogue and sector work on valuation of ecosystem services and the role of natural ecosystems and ecosystem services in underpinning economic development
- Emphasizing the linkages between protection of natural habitats and regulation of water flows and quality of water, essential for agriculture, food security, and domestic and industrial supplies
- Scaling up investments for protected areas and ecosystem services linked to sector lending, such as infrastructure, agriculture, tourism, water supply, fisheries, forestry
- Promoting greater action on management of invasive alien species, which are linked to land degradation, food security, and water supply and quality
- Emphasizing the multiple benefits of forest conservation and sustainable forest management (carbon sequestration, water quality, reducing risks from natural hazards, poverty alleviation, biodiversity conservation)
- Promoting investments in natural ecosystems as a response to mitigation (avoided deforestation) and adaptation (wetland services)
- Integrating indigenous crops and traditional knowledge on agricultural and water management into agriculture projects as part of adaptation strategies
- Promoting more sustainable natural resource management strategies linked to agriculture, land use and restoration, forest management and fisheries
- Developing new financing mechanisms and integrating biodiversity benefits into new adaptation and transformation funds
- Using strategic environment assessments as tools to promote protection of ecosystem services and biodiversity
- Monitoring investments in ecosystem protection within mainstream lending projects and documenting good practices for dissemination and replication
- Developing new tools that measure the benefits of integrated approaches (ecosystem services, biodiversity, carbon and resilience).

Climate change has become the key environmental concern of the decade, and governments and donors around the globe are focused on this issue. Much attention is rightly focused on reducing carbon emissions and greenhouse gases from industrial, energy, and transport sources through reduction in fuel use and improved technologies. Nevertheless, as countries look to medium and longer-term mitigation and adaptation measures, protection of natural habitats should be a key part of climate change strategies. Strengthened support for protected areas, and more sustainable resource management, can contribute to adaptation strategies, as well as to protection of the biological resources and ecosystem services on which the world's poorest communities depend.

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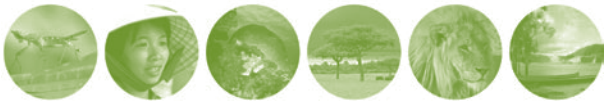

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Annex 1

The World Bank Group Biodiversity Portfolio

	Investments in Projects with a Biodiversity Component								Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
Africa	Madagascar	Forest Management and Protection	1988	Closed	IDA	22.60	9.20	2.86	*		*	*	*		*			
Africa	Ghana	Forest Resource Management	1989	Closed	IDA	64.60	5.10	3.11					*					
Africa	Madagascar	Environment I	1990	Closed	IDA	85.53	45.05	9.55	*		*	*	*		*			
Africa	Guinea	Forestry and Fisheries Management	1990	Closed	IDA	21.00	4.00	2.46				*						
Africa	Cote d'Ivoire	Forestry Sector	1990	Closed	IBRD	147.80	8.40	8.40	*	*								
Africa	Central African Republic	Natural Resources Management	1990	Closed	IDA	26.20	3.00	2.18	*	*	*	*	*		*	*	*	
Africa	Burkina Faso	Environmental Management	1991	Closed	IDA	25.20	3.80	2.48					*					
Africa	Mauritius	Environmental Monitoring and Development	1991	Closed	IBRD	20.53	4.40	2.00				*						
Africa	Kenya	Forestry Development	1991	Closed	IDA	83.80	39.49	0.00		*			*					
Africa	Nigeria	Environmental Management	1992	Closed	IDA	37.90	3.30	2.18	*		*	*						
Africa	Lesotho	Lesotho Highlands Water Phase 1A	1992	Closed	IBRD	24.14	5.55	4.60				*						
Africa	Benin	Natural Resource Management	1992	Closed	IDA	24.40	1.70	0.99	*	*	*	*	*			*	*	
Africa	Mali	Natural Resource Management	1992	Closed	IDA	32.10	6.78	4.31	*	*	*	*	*					
Africa	Kenya	Protected Areas and Wildlife Services	1992	Closed	IDA	143.00	143.00	60.00	*	*	*	*			*			
Africa	Seychelles	Biodiversity Conservation and Marine Pollution Abatement	1993	Closed	GEF REG	2.00	2.00	1.80										*
Africa	Ghana	Coastal Wetlands Management	1993	Closed	GEF REG	8.30	8.30	7.20		*	*	*	*					
Africa	Seychelles	Environment and Transport	1993	Closed	IBRD	5.00	0.19	0.17	*		*	*						
Africa	Ghana	Environmental Resource Management	1993	Closed	IDA	27.60	0.99	0.66	*	*	*							
Africa	Gabon	Forestry and Environment	1993	Closed	IDA	38.20	12.44	6.44	*	*		*						
Africa	Congo	Wildlands Protection and Management	1993	Closed	GEF REG	13.90	13.90	10.10	*	*	*	*	*					
Africa	Cameroon	Biodiversity Conservation and Management	1995	Closed	GEF REG	12.39	12.39	5.96	*	*	*	*	*		*	*		

1 Institution building, policies and strategic planning
2 Inventory, research, and monitoring
3 Public awareness and education
4 Protected areas
5 Production landscape

Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
Africa	Uganda	Conservation of the Bwindi Impenetrable and Mgahinga Gorilla National Parks	1995	Closed	GEF REG	4.89	4.89	4.00	*	*	*	*	*	*	*			
Africa	Benin	Environmental Management	1995	Closed	IDA	9.30	4.65	4.00	*		*							
Africa	Malawi	Lake Malawi Nyasa Biodiversity Conservation	1995	Closed	GEF REG	5.44	5.44	5.00				*						
Africa	Central African Republic	Livestock Development and Rangeland Management	1995	Closed	IDA	32.45	0.30	0.15					*		*		*	
Africa	Mauritius	Biodiversity Restoration	1996	Closed	GEF REG	1.60	1.60	1.20	*	*	*	*	*				*	*
Africa	Uganda	Environmental Management Capacity Building	1996	Closed	IDA	15.20	1.38	1.08	*		*							
Africa	Regional (West Africa)	Pilot Community-Based Natural Resource and Wildlife Management	1996	Closed	GEF REG	13.19	13.19	7.00	*	*	*		*		*	*	*	
Africa	Namibia	Strengthening Marine Environmental Research Capacity	1996	Closed	TF (IDF)	0.46	0.30	0.30	*	*								
Africa	Malawi	Environmental Support	1997	Closed	IDA	13.70	6.85	6.20	*	*	*	*						
Africa	Zambia	Environmental Support Program	1997	Closed	IDA	20.80	10.40	6.40	*	*	*			*				
Africa	Regional (East Africa)	Lake Victoria Environmental Management	1997	Closed	GEF REG	35.00	14.15	13.30					*					*
Africa	Regional (East Africa)	Lake Victoria Environmental Management	1997	Closed	IDA	44.40	8.60	8.60					*					*
Africa	Kenya	National Biodiversity Strategy, Action Plan and Report	1997	Closed	GEF EA	0.16	0.16	0.16	*									
Africa	Eritrea	National Biodiversity Strategy, Action Plan and Report	1997	Closed	GEF EA	0.28	0.28	0.28	*	*								
Africa	Regional (Central Africa)	Regional Environment Information Management (REIMP)	1997	Closed	GEF REG	19.79	19.79	4.10	*	*	*							
Africa	Cote d'Ivoire	Rural Land Management and Community Infrastructure Development	1997	Closed	IDA	71.50	1.64	0.94		*	*		*	*			*	
Africa	Madagascar	Second Environment Program	1997	Closed	GEF REG	20.80	20.80	12.80	*	*	*	*	*	*	*			

6 Sustainable financing and market mechanisms
7 Nature tourism
8 Indigenous Peoples
9 Agrobiodiversity
10 Invasives alien species

	Investments in Projects with a Biodiversity Component								Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
Africa	Madagascar	Second Environment Program	1997	Closed	IDA	134.20	56.00	12.52	*	*		*	*				*	
Africa	Senegal	Sustainable and Participatory Energy Management	1997	Closed	GEF REG	4.70	4.70	4.70			*	*	*					
Africa	Senegal	Sustainable and Participatory Energy Management	1997	Closed	IDA	15.20	4.38	1.50	*	*	*						*	
Africa	Kenya	Tana River National Primate Reserve	1997	Closed	GEF REG	7.14	7.14	6.20			*				*			
Africa	Mozambique	Transfrontier Conservation Areas Pilot and Institutional Strengthening	1997	Closed	GEF REG	8.10	8.10	5.00	*	*	*	*	*					
Africa	South Africa	Cape Peninsula Biodiversity	1998	Closed	GEF REG	91.20	91.20	12.30	*	*	*	*	*	*	*			*
Africa	Ghana	High Forest Conservation	1998	Closed	GEF REG	8.70	8.70	8.70	*	*	*	*	*		*			
Africa	Chad	Household Energy	1998	Closed	IDA	6.31	1.36	1.14			*		*					
Africa	Lesotho	Lesotho Highlands Water Phase 1B	1998	Closed	IBRD	113.20	33.35	1.56				*						
Africa	Uganda	National Biodiversity Strategy, Action Plan and Report	1998	Closed	GEF EA	0.13	0.13	0.13	*									
Africa	Ghana	Natural Resource Management	1998	Closed	IDA	53.50	53.50	20.00	*	*	*	*	*				*	
Africa	Zimbabwe	Park Rehabilitation and Conservation	1998	Closed	IDA	70.00	70.00	62.50	*		*	*	*					
Africa	Zimbabwe	Park Rehabilitation and Conservation	1998	Closed	GEF REG	5.00	5.00	5.00			*	*	*		*			
Africa	Mozambique	Agricultural Sector Public Expenditure Program (PROAGRI)	1999		IDA	216.50	25.10	1.00	*	*	*		*					
Africa	South Africa	Conservation of Globally Significant Biodiversity in Agri-cultural Landscapes through Conservati-on Farming	1999	Closed	GEF MSP	1.72	1.72	0.75	*	*			*				*	
Africa	Uganda	Institutional Capacity Building for Protected Areas Management and Sustainable Use (ICB-PAMSU)	1999	Closed	GEF REG	2.00	2.00	2.00	*			*	*					
Africa	Uganda	Institutional Capacity Building for Protected Areas Management and Sustainable Use (ICB-PAMSU)	1999	Closed	IDA	18.29	18.29	12.37	*			*	*		*		*	

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
Africa	Uganda	Kibale Forest Wild Coffee	1999	Closed	GEF MSP	4.15	4.15	0.75		*	*	*	*	*	*	*		
Africa	Kenya	Lewa Wildlife Conservation	1999	Closed	GEF MSP	3.94	3.94	0.75			*	*		*				
Africa	Seychelles	Management of Avian Ecosystems in Seychelles	1999	Closed	GEF MSP	1.06	1.06	0.74	*	*	*	*			*		*	*
Africa	Regional (Coastal East Africa)	Oil Spill Contingency Planning	1999	Closed	GEF REG	4.64	1.17	0.98			*		*					
Africa	Sao Tome & Principe	BSAP, First National Report and Clearing House Mechanism	2000	Closed	GEF EA	0.16	0.16	0.16	*									
Africa	Mozambique	Coastal & Marine Biodiversity Management	2000		GEF REG	4.10	4.10	4.10	*	*	*	*	*		*	*		
Africa	Mozambique	Coastal & Marine Biodiversity Management	2000		IDA	6.40	6.40	5.60	*	*	*	*	*		*	*		
Africa	Regional (Southern Africa)	Community Outreach Programme for Conservation and Sustainable Use of Biological Resources	2000	Closed	GEF MSP	0.89	0.89	0.73	*			*	*					
Africa	South Africa	Conservation Planning for Biodiversity in the Thicket Biome	2000	Closed	GEF MSP	0.86	0.86	0.74	*	*								
Africa	Seychelles	Marine Ecosystem Management	2000	Closed	GEF MSP	1.40	1.40	0.74	*	*	*	*	*					*
Africa	Benin	National Parks Conservation and Management Program	2000	Closed	GEF REG	26.14	26.14	6.76	*			*	*		*			
Africa	South Africa	Sustainable Protected Area Development in Namaqualand	2000	Closed	GEF MSP	5.37	5.37	0.75	*			*						
Africa	Burkina Faso	Community-Based Rural Development	2001	Closed	IDA	114.85	3.82	2.22					*	*				
Africa	Ethiopia	Conservation and Sustainable Use of Medicinal Plants	2001		GEF REG	1.81	1.81	1.81	*	*	*	*	*				*	
Africa	Ethiopia	Sustainable Land Management	2008		GEF REG	9.00	3.50	1.20	*	*			*					
Africa	Ethiopia	Sustainable Land Management	2008		IDA	28.80	0.35	0.80	*	*			*					
Africa	Ethiopia	Conservation and Sustainable Use of Medicinal Plants	2001		IDA	3.37	3.37	0.78	*	*			*				*	
Africa	Regional (Coastal East Africa)	Coral Reef Monitoring Network	2001	Closed	GEF MSP	2.41	2.41	0.74	*	*	*	*						

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
Africa	Malawi	Mulanje Biodiversity Conservation	2001	Closed	GEF REG	8.02	8.02	6.75		*	*	*	*	*	*		*	*
Africa	Mauritius	Restoration of Round Island	2001		GEF MSP	1.40	1.40	0.75				*						*
Africa	Rwanda	Rural Sector Support	2001		IDA	53.00	18.97	18.97	*	*	*							
Africa	Eritrea	Assessment of Capacity Building Needs for Biodiversity	2002		GEF EA	0.19	0.19	0.17	*	*								
Africa	Uganda	Environment Management and Capacity Building II	2002		IDA	24.10	12.05	11.00	*		*							
Africa	Uganda	Institutional Capacity Building for Integration of Indigenous Knowledge	2002	Closed	TF (IDF)	0.43	0.43	0.43		*						*		
Africa	Gambia	Integrated Coastal and Marine Biodiversity Management	2002		GEF MSP	1.77	1.77	0.96				*						
Africa	Tanzania	Lower Kihansi Environmental Management	2002		IDA	6.40	6.40	6.30	*	*		*						
Africa	Lesotho	Maloti-Drakensberg Transfrontier Conservation and Development Area	2002		GEF REG	8.40	8.40	7.32	*	*	*	*	*		*	*		*
Africa	South Africa	Maloti-Drakensberg Transfrontier Conservation and Development Area	2002		GEF REG	33.89	33.89	15.25	*	*	*	*	*		*			*
Africa	Nigeria	Micro-watershed and Environmental Management Program	2002		GEF REG	8.00	8.00	8.00	*	*		*						
Africa	Nigeria	Micro-watershed and Environmental Management Program	2002		IDA	107.35	12.88	12.00	*	*	*		*	*			*	
Africa	Burkina Faso	Natural Resources Management Partnership	2002		GEF REG	13.46	10.09	6.90	*			*						
Africa	Ghana	Northern Savanna Biodiversity Conservation	2002		GEF REG	16.80	16.80	7.90	*	*	*	*	*	*		*	*	
Africa	Ghana	Northern Savanna Biodiversity Conservation	2002		IDA	11.30	11.30	11.30								*	*	
Africa	Burkina Faso	Partnership for Natural Ecosystem Management (PAGEN)	2002		GEF REG	13.63	13.63	7.50	*			*	*					

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
		Investments in Projects with a Biodiversity Component							Biodiversity Activities									
Africa	Uganda	Supplemental Credit to the Lake Victoria Environmental Management	2002	Closed	IDA	4.64	2.65	2.57	*	*	*		*			*		
Africa	Zambia	Sustainable Land Management in the Zambian Miombo Woodland Ecosystem	2002		GEF MSP	1.35	0.25	0.25			*		*				*	
Africa	Niger	Community-Based Ecosystem Management	2003		GEF REG	43.83	6.00	2.50	*		*		*					
Africa	Tanzania	Eastern Arc Forests Conservation and Management	2003		GEF REG	7.00	7.00	7.00	*			*	*	*		*		*
Africa	Tanzania	Eastern Arc Forests Conservation and Management	2003		IDA	38.67	38.67	31.10	*			*	*	*		*		*
Africa	Nigeria	Local Empowerment and Environment Management	2003		GEF REG	91.33	9.81	8.00	*	*	*	*						
Africa	Nigeria	National Capacity Needs Self-Assessment for Environmental Management	2003	Closed	GEF EA	0.23	0.06	0.06	*	*								
Africa	Uganda	Protected Areas Management and Sustainable Use	2003		IDA	30.00	30.00	23.40	*		*	*	*		*	*	*	
Africa	Uganda	Protected Areas Management and Sustainable Use Supplemental Credit	2003		GEF REG	8.00	8.00	8.00	*		*	*	*		*	*	*	
Africa	South Africa	Richtersveld Community Biodiversity Conservation	2003		GEF MSP	2.45	2.45	0.88	*		*	*	*		*			
Africa	Kenya	Agricultural Productivity and Sustainable Land Management	2004		IDA	73.15	13.20	3.80	*	*			*				*	
Africa	South Africa	C.A.P.E. Biodiversity and Sustainable Development	2004		GEF REG	55.13	55.13	9.00	*	*	*		*	*	*	*	*	
Africa	Ghana	Community-based Integrated Natural Resources Management in Okyeman	2004		GEF MSP	1.48	1.48	0.85	*	*	*		*		*	*		
Africa	South Africa	Greater Addo Elephant National Park	2004		GEF REG	39.94	39.94	5.50				*		*	*			

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	Investments in Projects with a Biodiversity Component								Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
Africa	Seychelles	Improving Management of NGO and Privately Owned Nature Reserves and High Biodiversity Islands	2004	Closed	GEF MSP	1.88	1.88	0.81	*		*	*		*	*			*
Africa	Tanzania	Innovations in Livestock & Wildlife Integration Adjacent to Protected Areas	2004		GEF MSP	4.55	4.55	0.88	*			*			*			*
Africa	Namibia	Integrated Community-Based Ecosystem Management	2004		GEF REG	32.43	11.26	4.28		*				*			*	
Africa	Senegal	Integrated Marine & Coastal Biodiversity Conservation	2004		GEF REG	5.00	5.00	5.00	*			*	*	*	*			
Africa	Senegal	Integrated Marine & Coastal Biodiversity Conservation	2004		IDA	11.49	11.49	2.50	*			*	*	*	*			
Africa	Tanzania	Lolkisale Biodiversity Conservation Support	2004		GEF IFC	0.89	0.89	0.48				*			*			
Africa	Burkina Faso	Sahel Integrated Lowland Ecosystem Management	2004		GEF REG	4.91	1.38	1.28					*					
Africa	Regional (West Africa)	Senegal River Basin Water and Environmental Management	2004		GEF REG	21.20	0.15	0.15										*
Africa	Madagascar	Third Environment Program	2004		GEF REG	9.00	9.00	9.00	*		*	*	*	*	*			
Africa	Madagascar	Third Environment Program	2004		IDA	148.90	71.50	31.50	*		*	*	*	*	*			
Africa	Regional (East Africa)	Transboundary Diagnostic Analysis and Strategic Action Program Development for the Lake Victoria Basin	2004		GEF MSP	1.00	0.20	0.20	*	*			*					*
Africa	Regional (East Africa)	Transboundary Diagnostic Analysis and Strategic Action Program Development for the Lake Victoria Basin	2004		IDA	5.60	1.12	0.60	*	*			*					*
Africa	Burundi	Agricultural Rehabilitation and Support (PRASAB)	2005		GEF REG	5.00	0.50	0.50					*					
Africa	Guinea-Bissau	Coastal and Biodiversity Management	2005		GEF REG	5.15	5.15	5.15	*	*		*	*	*				
Africa	Guinea-Bissau	Coastal and Biodiversity Management	2005		IDA	4.40	4.40	1.50	*	*		*	*	*				

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
Africa	Chad	Community Based Integrated Ecosystem Management	2005		GEF REG	6.00	6.00	6.00	*	*	*	*		*	*			
Africa	Chad	Community Based Integrated Ecosystem Management	2005		IDA	46.00	8.39	2.80			*							
Africa	Mali	Gourma Biodiversity Conservation	2005		GEF REG	9.08	9.08	5.50	*			*			*			
Africa	Rwanda	Integrated Management of Critical Ecosystems	2005		GEF REG	5.30	2.65	2.15	*	*		*	*					
Africa	Tanzania	Lake Victoria Environmental Management Second Supplemental Credit	2005	Closed	IDA	3.60	0.81	0.79	*	*		*						*
Africa	Tanzania	Marine and Coastal Environmental Management	2005		GEF REG	10.00	5.68	4.90	*		*	*		*	*			
Africa	Tanzania	Marine and Coastal Environmental Management	2005		TF (JSDF)	1.88	1.88	1.88			*		*	*				
Africa	Tanzania	Marine and Coastal Environmental Management	2005		IDA	52.75	25.50	20.00	*		*	*		*	*			
Africa	Namibia	Namibian Coastal Conservation and Management	2005		GEF REG	29.08	29.08	4.90	*		*	*						
Africa	Gabon	Natural Resources Management	2005		GEF REG	10.00	7.87	7.87	*	*	*	*	*		*			
Africa	Gabon	Natural Resources Management	2005		IDA	31.48	7.87	7.87								*		
Africa	Regional (Southern Africa)	Protection and Strategic Uses of Groundwater Resources in the Transboundary Limpopo Basin and Drought Prone Areas	2005		GEF REG	13.32	1.74	1.74	*		*			*				
Africa	Liberia	Sapo National Park	2005		GEF MSP	2.43	2.43	1.00	*		*	*		*		*		
Africa	Zambia	Support for Economic Expansion and Diversification (SEED)	2005		IDA	28.15	10.18	8.00		*		*			*			
Africa	Zambia	Support for Economic Expansion and Diversification (SEED)	2005		GEF REG	4.00	4.00	4.00		*		*			*			
Africa	Zambia	Support for Economic Expansion and Diversification (SEED)	2005		TF (PHRD)	6.00	6.00	6.00		*		*			*			

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
Africa	Mozambique	Transfrontier Conservation Areas and Tourism Development	2005		GEF REG	10.00	10.00	10.00	*			*	*		*			
Africa	Mozambique	Transfrontier Conservation Areas and Tourism Development	2005		IDA	23.72	21.35	15.00	*			*	*		*			
Africa	Kenya	Western Kenya Integrated Ecosystem Management Project	2005		GEF REG	8.30	8.30	4.10	*		*			*		*		*
Africa	Kenya	Western Kenya Integrated Ecosystem Management Project	2005		TF (PHRD)	0.40	0.40	0.40	*		*			*		*		*
Africa	Madagascar	Andasibe-Mantadia Biodiversity Corridor	2006		CF	11.50	11.50	7.50	*	*			*					
Africa	Guinea	Coastal Marine and Biodiversity Management	2006		IDA	18.53	18.53	11.70	*			*						
Africa	Guinea	Community-Based Land Management	2006		GEF REG	7.00	2.50	2.50					*					
Africa	Guinea	Community-Based Land Management	2006		IDA	11.70	4.50	2.50					*					
Africa	Cameroon	Forest and Environment Sector Program	2006		GEF REG	10.00	10.00	10.00	*			*				*		
Africa	Cameroon	Forest and Environment Sector Program	2006		IDA	41.80	12.42	5.00	*			*				*		
Africa	Benin	Forests and Adjacent Lands Management	2006		GEF REG	27.00	27.00	6.00	*				*	*				
Africa	Kenya	Greenbelt Movement	2006		CF	2.20	2.20	2.20			*		*					
Africa	Nigeria	Second National Fadama Development Critical Ecosystem Management	2006		GEF REG	63.22	12.50	10.03			*	*	*				*	
Africa	Gabon	Strengthening Capacity for Managing National Parks and Biodiversity	2006		GEF REG	26.99	26.99	10.00								*		
Africa	Cameroon	Sustainable Agro-Pastoral and Land Management Promotion	2006		GEF REG	6.30	3.00	3.00	*				*			*	*	
Africa	Mozambique	Transfrontier Conservation Areas and Tourism Development	2006		TF (PHRD)	3.72	1.00	1.00	*			*	*		*			
Africa	Tanzania	Lower Kihansi Environmental Management 2	2007		IDA	3.50	3.50	3.50	*	*		*						
Africa	Kenya	Natural Resource Management	2007		IDA	68.50	3.03	2.82					*	*		*	*	

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
Africa	Regional (West Africa)	Regional Biosafety	2007		GEF REG	24.30	10.00	5.40		*								
Africa	Regional (Coastal East Africa)	Southwest Indian Ocean Fisheries	2007		GEF REG	35.00	8.50	7.41			*							
Africa	Regional (Coastal East Africa)	Western Indian Ocean Marine Highway Development and Coastal and Marine Contamination Prevention	2007		GEF REG	26.00	8.70	8.70			*							
Africa	Kenya	Western Kenya Community-Driven Development and Flood Mitigation	2007		IDA	100.00	20.70	19.60	*				*					
Africa	Benin	Community-based Coastal and Marine Biodiversity Management	2008		GEF REG	11.60	11.60	4.30	*	*	*							
Africa	Liberia	Consolidation of Protected Areas Network	2008		GEF MSP	5.40	5.40	0.86	*		*	*						
Africa	Liberia	Forestry Sector Management	2008		TF (Liberia)	2.00	1.10	1.10	*		*	*	*	*				
Africa	Senegal	Energy Sector Adjustment	1998	Closed	IDA	100.00	1.00	1.00	*				*					
Africa	Guinea	Coastal Marine and Biodiversity Management	2006		GEF REG	5.00	5.00	5.00	*			*						
EAP	Indonesia	First Forestry Institutions and Conservation	1988	Closed	IBRD	63.00	6.40	3.79	*		*	*						
EAP	Malaysia	Sabah Land Settlement and Environmental Management	1989	Closed	IBRD	216.00	1.20	1.20	*			*			*			
EAP	Indonesia	Second Forestry Institutions and Conservation	1990	Closed	IBRD	33.10	3.10	1.87	*		*	*			*			
EAP	Philippines	Environment and Natural Resources Sector Adjustment	1991	Closed	IBRD	280.20	140.10	79.00	*				*					
EAP	Philippines	Environment and Natural Resources Sector Adjustment	1991	Closed	IDA	66.00	33.00	33.00	*				*					
EAP	China	Biodiversity Conservation Action Plan	1993	Closed	GEF EA	0.40	0.40	0.40	*									
EAP	China	Environmental Technical Assistance	1993	Closed	IDA	76.00	29.40	20.00	*	*	*							
EAP	Indonesia	Biodiversity Collections	1994	Closed	GEF REG	11.40	11.40	7.20	*	*	*							

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
EAP	Philippines	Conservation of Priority Protected Areas	1994	Closed	GEF REG	22.86	22.86	20.00	*	*	*	*	*	*		*		
EAP	Lao PDR	Forest Management and Conservation	1994	Closed	IDA	15.30	7.75	4.35	*	*			*			*	*	
EAP	China	Forest Resource Development and Conservation	1994	Closed	IDA	333.10	20.55	12.34	*	*	*		*				*	
EAP	Indonesia	Integrated Swamps Development	1994	Closed	IBRD	106.00	3.10	1.89	*			*						
EAP	Lao PDR	Wildlife and Protected Areas Conservation	1994	Closed	GEF REG	5.20	5.20	5.00		*		*	*			*		
EAP	China	Nature Reserves Management	1995	Closed	GEF REG	23.60	23.60	17.90	*	*	*	*	*		*			
EAP	Indonesia	Kerinci Seblat ICDP	1996	Closed	GEF REG	15.00	15.00	15.00		*		*	*				*	
EAP	Indonesia	Kerinci Seblat ICDP	1996	Closed	IBRD	32.20	32.20	19.20	*		*		*					
EAP	Philippines	Community Based Resource Management	1998		IBRD	67.50	7.80	7.80	*				*	*		*	*	
EAP	Indonesia	Coral Reef Management and Rehabilitation (COREMAP)	1998	Closed	IBRD	8.70	8.70	6.90	*	*	*		*					
EAP	Indonesia	Coral Reef Rehabilitation and Management (COREMAP)	1998	Closed	GEF REG	4.10	4.10	4.10	*	*	*	*						
EAP	Vietnam	Forest Protection and Rural Development	1998	Closed	IDA	32.39	7.00	5.00			*	*	*		*			
EAP	China	Sustainable Resource Coastal Development	1998	Closed	IBRD	200.00	15.60	9.57	*	*		*	*					
EAP	Lao PDR	District Upland Development and Conservation	1999	Closed	IDA	2.25	2.25	2.00		*	*	*	*	*		*	*	
EAP	Samoa	Marine Biodiversity Protection and Management	1999		GEF MSP	1.10	1.10	0.90			*	*	*			*		
EAP	Papua New Guinea	National Biodiversity Strategy, Action Plan and Report	1999		GEF EA	0.18	0.18	0.18	*									
EAP	Mongolia	Assessment of Capacity Building Needs and Country Specific Priorities in Biodiversity	2000		GEF EA	0.23	0.22	0.20	*									
EAP	Indonesia	Biodiversity Strategy and Action Plan (IBSAP)	2000		GEF EA	0.44	0.44	0.44	*									

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
EAP	Vietnam	Coastal Wetlands Protection and Development	2000	Closed	IDA	65.60	15.00	7.27		*	*		*			*	*	
EAP	Indonesia	Conservation of Elephant Landscape in Aceh Province, Sumatra	2000		GEF MSP	1.04	0.74	0.74	*	*	*		*					
EAP	Cambodia	Forest Concession Management and Control	2000	Closed	IDA	5.42	1.10	0.98	*	*								
EAP	Regional (East Asia)	Mekong River Commission Water Utilization	2000		GEF REG	16.30	5.50	3.71	*	*	*							
EAP	Philippines	Mindanao Rural Development	2000	Closed	IBRD	39.70	0.99	0.68	*					*		*	*	
EAP	Philippines	Mindanao Rural Development and Coastal Resource Conservation	2000	Closed	GEF REG	1.30	1.30	1.30	*	*	*	*	*	*		*	*	
EAP	Cambodia	Biodiversity and Protected Areas Management	2001	Closed	GEF REG	3.00	3.00	2.75	*	*	*	*	*	*		*		
EAP	Cambodia	Biodiversity and Protected Areas Management	2001	Closed	IDA	1.91	1.91	1.91	*	*	*	*	*	*		*		
EAP	Mongolia	Biodiversity Loss and Permafrost Melt in Lake Hovsgol National Park	2001		GEF MSP	1.46	1.46	0.83		*		*	*			*		
EAP	Vietnam	Conservation of Pu Luong-Cuc Phuong Limestone Landscape	2001	Closed	GEF MSP	1.31	1.31	0.75	*	*	*	*	*	*	*	*		
EAP	Vietnam	Hon Mun Marine Protected Area Pilot	2001	Closed	GEF MSP	2.17	2.17	1.00	*	*	*	*	*	*	*			
EAP	Indonesia	The Greater Berbak-Sembilang Integrated Coastal Wetlands Conservation	2001		GEF MSP	1.60	1.60	0.73	*	*	*	*	*					
EAP	Indonesia	Indonesia Forests and Media (INFORM)	2002		GEF MSP	1.23	1.23	0.94			*	*	*					
EAP	China	Lake Dianchi Freshwater Biodiversity Restoration	2002		GEF MSP	1.86	1.86	1.00		*	*		*					*
EAP	Indonesia	Sangihe-Talaud Forest Conservation	2002	Closed	GEF MSP	1.14	1.14	0.82	*	*	*	*	*			*		
EAP	China	Sustainable Forestry Development	2002		GEF REG	16.00	16.00	16.00	*	*	*	*	*					
EAP	China	Sustainable Forestry Development	2002		IBRD	214.58	26.85	11.75	*	*			*	*		*	*	

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
EAP	Mongolia	Conservation of the Eg-Uur Watershed	2003		GEF MSP	1.93	1.93	1.00		*	*			*	*			
EAP	China	Gansu and Xinjiang Pastoral Development	2003		GEF REG	10.50	8.30	8.30	*	*	*		*			*	*	*
EAP	China	Gansu and Xinjiang Pastoral Development	2003		IBRD	98.72	3.00	1.99	*	*			*			*		*
EAP	Lao PDR	Sustainable Forestry for Rural Development	2003	Closed	IDA	16.45	1.10	0.66	*	*			*			*	*	
EAP	Philippines	Asian Conservation Foundation (Tranche I)	2004		GEF REG	16.90	16.90	1.60	*	*	*		*	*	*			
EAP	Vietnam	Conservation of Pu Luong-Cuc Phuong Limestone Landscape	2004	Closed	TF (JSDF)	0.32	0.32	0.32		*	*	*	*	*				
EAP	Indonesia	Coral Reef Management and Rehabilitation (COREMAP II)	2004		GEF REG	7.50	7.50	7.50	*	*	*	*						
EAP	Indonesia	Coral Reef Management and Rehabilitation (COREMAP II)	2004		IBRD	44.10	44.10	33.20	*	*	*	*	*	*				
EAP	Indonesia	Coral Reef Management and Rehabilitation (COREMAP II)	2004		IDA	23.00	23.00	23.00	*	*	*		*					
EAP	Vietnam	Forest Sector Development	2004		GEF REG	9.00	9.00	9.00	*					*				
EAP	Vietnam	Forest Sector Development	2004		IDA	65.59	6.97	0.50	*					*				
EAP	Vietnam	Hai Van Range Green Corridor	2004		GEF MSP	2.00	2.00	1.00	*	*	*	*	*			*		
EAP	Regional (East Asia)	I-Marine Aquarium Market Transformation Initiative (Tranche I)	2004		GEF IFC	22.28	22.28	6.92	*	*		*	*	*				
EAP	Indonesia	Livelihoods	2004		TF (JSDF)	1.36	0.85	0.85			*		*				*	
EAP	Philippines	Asian Conservation Company (Tranche II)	2005		GEF IFC	5.10	5.10	2.90	*		*	*		*	*			
EAP	Lao PDR	Bolikhamxay Integrated Ecosystem and Wildlife Conservation	2005		GEF MSP	1.61	1.61	1.00	*		*	*			*			
EAP	Vietnam	Intergrating watershed and biodiversity management in Chu Yang Sin National Park	2005		GEF MSP	1.74	1.74	1.00		*	*	*			*	*		
EAP	Indonesia	Komodo Collaborative Management Initiative (KCMI)	2005		GEF IFC	16.98	16.98	5.38				*		*				
EAP	Indonesia	Lambusango Forest Conservation, Sulawesi	2005		GEF MSP	4.49	4.49	1.00		*	*	*	*		*			

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
EAP	Lao PDR	Lao Environment and Social Program	2005		IDA	4.80	1.54	1.28	*	*	*	*		*	*	*		
EAP	Lao PDR	Nam Theun 2 Social and Environment Program	2005		IDA	24.00	5.00	5.00	*		*	*		*		*		
EAP	Mongolia	Netherlands Mongolia Trust Fund for the Environment (NEMO)	2005		TF (NEMO)	6.00	1.23	1.23	*	*	*	*						
EAP	Indonesia	Aceh Forest and Environment	2006		TF (MDF)	17.50	14.00	14.00										
EAP	Kirabati	Adaptation Program (KAP II)	2006		GEF REG	6.69	4.33	1.02	*	*	*	*						
EAP	China	Changjiang/Pearl River Watershed Rehabilitation	2006		IDA	200.00	9.70	6.08										
EAP	China	Guangxi Integrated Forestry Development and Conservation	2006		CF	2.00	2.00	2.00	*		*	*			*		*	
EAP	China	Guangxi Integrated Forestry Development and Conservation	2006		GEF REG	5.25	5.25	5.25	*		*	*			*		*	
EAP	China	Guangxi Integrated Forestry Development and Conservation	2006		IBRD	204.50	22.00	20.05	*		*	*			*		*	
EAP	China	Ningbo Water and Environment	2006		GEF REG	5.35	5.35	5.35					*					
EAP	China	Ningbo Water and Environment	2006		IBRD	140.10	12.12	1.20					*					
EAP	Philippines	National Program for Environment and Natural Resources Management	2007		GEF REG	7.00	7.00	7.00			*	*						
EAP	Philippines	National Program for Environment and Natural Resources Management	2007		IBRD	80.35	18.50	13.70			*	*						
EAP	Indonesia	Partnerships for Conservation Management of the Aketajawe-Lolobata National Park, North Maluku Province	2007		GEF MSP	2.09	2.09	0.99				*	*					
EAP	Mongolia	The Netherlands-Mongolia Trust Fund for Environmental Reform (NEMO II)	2007		TF (NEMO)	2.57	2.57	2.44	*	*	*	*						

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
ECA	Poland	Forest Biodiversity Protection	1992	Closed	GEF REG	6.20	6.20	4.50	*	*		*	*				*	
ECA	Turkey	Eastern Anatolia Watershed Rehabilitation	1993	Closed	IBRD	109.80	7.76	5.44		*			*				*	
ECA	Belarus	Forest Biodiversity Protection	1993	Closed	GEF REG	1.25	1.25	1.00	*	*	*	*					*	
ECA	Czech Republic	Biodiversity Protection	1994	Closed	GEF REG	2.75	2.75	2.00				*		*	*			
ECA	Slovak Republic	Biodiversity Protection	1994	Closed	GEF REG	2.86	2.86	2.17	*	*		*		*	*			
ECA	Belarus	Forestry Development	1994	Closed	IBRD	54.70	2.13	0.50	*	*							*	
ECA	Poland	Forestry Development	1994	Closed	IBRD	335.40	14.00	2.00	*			*	*				*	
ECA	Ukraine	Transcarpathian Biodiversity Protection	1994	Closed	GEF REG	0.58	0.58	0.50	*	*	*	*	*					
ECA	Romania	Danube Delta Biodiversity	1995		GEF REG	4.80	4.80	4.50	*		*	*	*					
ECA	Ukraine	Danube Delta Biodiversity	1995	Closed	GEF REG	1.74	1.74	1.50	*	*		*	*	*				
ECA	Estonia	Haapsalu and Matsalu Bays Environment	1995	Closed	IBRD	8.37	0.48	0.11	*			*						
ECA	Lithuania	Klaipeda Environment	1995	Closed	IBRD	23.10	1.50	0.10	*			*			*			
ECA	Latvia	Liepaja Environment	1995	Closed	IBRD	21.17	0.50	0.10	*									
ECA	Estonia	Agriculture	1996	Closed	IBRD	30.90	0.90	0.46					*					
ECA	Russia	Biodiversity Conservation	1996	Closed	GEF REG	26.00	26.00	20.10	*	*	*	*	*		*			
ECA	Albania	Forestry	1996	Closed	IDA	21.60	4.15	1.54	*			*	*					
ECA	Croatia	Coastal Forest Reconstruction and Protection	1997	Closed	IBRD	67.00	2.90	2.90	*				*		*			
ECA	Albania	National Biodiversity Strategy, Action Plan and Report	1997	Closed	GEF EA	1.00	1.00	1.00	*									
ECA	Croatia	National Biodiversity Strategy, Action Plan and Report	1997	Closed	GEF EA	0.10	0.10	0.10	*									
ECA	Georgia	National Biodiversity Strategy, Action Plan and Report	1997	Closed	GEF EA	0.12	0.12	0.12	*									
ECA	Kyrgyz Republic	National Biodiversity Strategy, Action Plan and Report	1997	Closed	GEF EA	0.11	0.11	0.11	*									
ECA	Lithuania	National Biodiversity Strategy, Action Plan and Report	1997	Closed	GEF EA	0.07	0.07	0.07	*									

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
ECA	Slovak Republic	National Biodiversity Strategy, Action Plan and Report	1997	Closed	GEF EA	0.08	0.08	0.08	*									
ECA	Ukraine	National Biodiversity Strategy, Action Plan and Report. Phase I	1997	Closed	GEF EA	0.12	0.12	0.11	*									
ECA	Regional (Central Asia)	Aral Sea Basin Program: Water and Environmental	1998		GEF REG	21.50	3.90	2.21					*					
ECA	Bosnia-Herzegovina	Forestry	1998	Closed	IDA	20.20	1.85	0.64	*			*						
ECA	Regional (Central Asia)	Lake Ohrid Conservation	1998	Closed	GEF REG	4.37	1.95	1.83	*				*					
ECA	Czech Republic	National Biodiversity Strategy, Action Plan and Report	1998	Closed	GEF EA	0.10	0.10	0.10	*									
ECA	Slovenia	National Biodiversity Strategy, Action Plan and Report	1998	Closed	GEF EA	0.09	0.09	0.09	*									
ECA	Moldova	National Biodiversity Strategy, Action Plan and Report (Phase I)	1998	Closed	GEF EA	0.13	0.13	0.13	*									
ECA	Croatia	Reconstruction for Eastern Slavonia, Baranja and Western Srijem	1998	Closed	IBRD	61.10	2.20	1.00					*					
ECA	Romania	Biodiversity Conservation	1999		GEF REG	8.80	8.80	5.50	*		*	*			*			
ECA	Regional (Central Asia)	Central Asia Transboundary Biodiversity	1999		GEF REG	13.65	13.65	10.15	*			*	*	*				
ECA	Turkey	In-Situ Conservation of Genetic Biodiversity	1999	Closed	GEF REG	5.70	5.70	5.10	*	*			*				*	
ECA	Georgia	Integrated Coastal Management	1999		GEF REG	1.20	1.20	1.20	*		*	*						
ECA	Georgia	Integrated Coastal Management	1999		IDA	6.30	4.80	2.60	*			*						
ECA	Croatia	Kopacki Rit Wetlands Management	1999	Closed	GEF MSP	2.36	2.36	0.75	*		*	*			*			
ECA	Albania	Support to Butrint National Park Management	1999	Closed	TF (IDF)	0.23	0.23	0.23	*			*						
ECA	Turkey	Biodiversity and Natural Resource Management	2000		GEF REG	11.54	11.54	8.19	*	*	*	*	*		*		*	

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	Investments in Projects with a Biodiversity Component								Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
ECA	Slovak Republic	Conservation and Sustainable Use of Central European Grasslands	2000		GEF MSP	1.10	1.10	1.10	*			*	*					
ECA	Bosnia-Herzegovina	Environmental Capacity Building	2000	Closed	TF (IDF)	0.29	0.15	0.15	*									
ECA	Poland	Rural Environmental Protection	2000	Closed	GEF REG	3.00	0.75	0.75	*		*		*					
ECA	Russia	Sustainable Forestry Pilot	2000		IBRD	74.50	11.20	9.02	*	*		*	*	*			*	
ECA	Moldova	Assessment of Capacity Building Needs and Country Specific Priorities in Biodiversity (Phase II)	2001	Closed	GEF EA	0.34	0.34	0.30	*									
ECA	Ukraine	Assessment of Capacity-building Needs and Country-specific Priorities in Biodiversity, Phase II	2001		GEF EA	0.37	0.37	0.32	*	*								
ECA	Macedonia	National Strategy and Action Plan of Biological and Landscape Diversity	2001	Closed	GEF EA	0.37	0.37	0.34	*									
ECA	Georgia	Protected Areas Development	2001		GEF REG	30.30	30.30	8.70	*	*	*	*	*					
ECA	Kazakhstan	Syr Darya Control and North Aral Sea Phase-I	2001		IBRD	85.80	2.00	0.42					*					
ECA	Romania	Agricultural Pollution Control	2002		GEF REG	10.80	1.09	0.52					*					
ECA	Ukraine	Azov Black Sea Corridor Biodiversity Conservation	2002	Closed	GEF REG	6.90	6.90	6.90	*	*	*	*	*					
ECA	Moldova	Biodiversity Conservation in the Lower Dniester Delta Ecosystem	2002	Closed	GEF MSP	1.71	1.71	0.98	*		*	*	*	*		*		
ECA	Albania	Fishery Development	2002		IDA	6.66	1.19	1.00	*	*	*		*		*			
ECA	Croatia	Karst Ecosystem Conservation	2002		GEF REG	8.37	8.37	5.07	*	*	*	*	*		*			
ECA	Russia	Khabarovsk Habitat Conservation	2002		GEF MSP	1.75	1.75	0.75	*		*	*	*					
ECA	Armenia	Natural Resources Management and Poverty Reduction	2002		GEF REG	5.21	5.21	5.21	*	*	*	*	*	*		*	*	*

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
ECA	Armenia	Natural Resources Management and Poverty Reduction	2002		IDA	16.00	5.99	5.20	*	*	*		*	*		*		
ECA	Bulgaria	Wetlands Restoration and Pollution Reduction	2002		GEF REG	13.28	10.60	5.99	*	*	*	*	*		*			
ECA	Regional (Central Asia)	Baltic Sea Regional I	2003		GEF REG	12.12	1.41	0.64	*	*	*		*					
ECA	Uzbekistan	Drainage, Irrigation & Wetlands Improvement-Phase I	2003		IBRD	43.55	0.50	0.40				*						
ECA	Uzbekistan	Drainage, Irrigation & Wetlands Improvement-Phase II	2003		IDA	31.00	0.50	0.40				*						
ECA	Kazakhstan	Drylands Management	2003		GEF REG	9.70	0.46	0.25	*	*	*		*					
ECA	Georgia	Forest Development	2003		IDA	21.34	5.00	3.67	*	*	*		*				*	
ECA	Romania	Forest Development	2003		IBRD	31.89	2.44	1.91	*	*	*		*	*				*
ECA	Bosnia-Herzegovina	Forest Development and Conservation	2003		IDA	5.09	1.80	1.32	*	*	*					*		
ECA	Romania	Afforestation of Degraded Agricultural Land Proto-Carbon	2004		CF	13.76	1.65	0.44					*					*
ECA	Turkey	Anatolia Watershed Rehabilitation	2004		GEF REG	16.46	2.82	1.62			*		*					
ECA	Turkey	Anatolia Watershed Rehabilitation	2004		IBRD	28.65	3.84	2.75			*		*					
ECA	Tajikistan	Community Watershed Development	2004		GEF REG	4.50	1.70	1.70	*		*			*			*	
ECA	Tajikistan	Community Watershed Development	2004		IDA	15.29	1.00	0.50	*		*			*			*	
ECA	Tajikistan	Dashtidzhum Biodiversity Conservation and Risk Mitigation	2004		GEF MSP	0.97	0.97	0.78			*	*	*					
ECA	Albania	Integrated Water and Ecosystems Management	2004		GEF REG	20.00	0.91	0.91	*	*	*		*	*	*			
ECA	Albania	Assessment of Capacity Building Needs and Country Specific Priorities in Biodiversity (PHASE II)	2005		GEF EA	0.39	0.39	0.32		*								
ECA	Albania	Coastal Zone Management and Clean-up	2005		IDA	38.56	4.00	0.50	*	*		*						

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
ECA	Kazakhstan	Community Based Aral Sea Fisheries Management and Sustainable	2005		TF (JSDF)	1.90	1.40	1.40		*			*	*				
ECA	Kazakhstan	Forest Protection and Reforestation	2005		GEF REG	5.00	1.44	1.44					*					
ECA	Kazakhstan	Forest Protection and Reforestation	2005		IBRD	59.00	47.70	20.50					*					
ECA	Albania	Natural Resources Development	2005		GEF REG	5.00	2.00	1.00			*		*					
ECA	Albania	Natural Resources Development	2005		IDA	14.40	5.00	3.50			*		*					
ECA	Bulgaria	Pomoriisko Lake Conservation, Restoration and Management	2005		GEF MSP	2.01	2.01	0.89	*		*				*			
ECA	Azerbaijan	Rural Environment	2005		GEF REG	5.35	5.35	5.35	*	*	*	*	*	*	*			
ECA	Azerbaijan	Rural Environment	2005		IDA	9.50	9.50	6.96		*	*							
ECA	Bosnia-Herzegovina	Forest Additional Financing	2006		IDA	4.78	0.11	0.11	*	*			*					
ECA	Hungary	Nutrient Reduction	2006		GEF REG	12.50	6.50	5.20				*	*					
ECA	Hungary	Nutrient Reduction	2006		IBRD	18.96	0.50	0.35				*	*					
ECA	Azerbaijan	Rural Environment	2006		TF (PHRD)	2.70	2.70	2.70		*								
ECA	Albania	Afforestation & Reforestation of Refused Lands	2007		CF	1.04	1.04	1.04				*	*					
ECA	Albania	Afforestation & Reforestation of Refused Lands	2007		TF (PHRD)	0.61	0.61	0.58				*	*					
ECA	Albania	Butrint Global Biodiversity and Heritage Conservation	2007		GEF REG	2.16	2.16	0.99		*		*						
ECA	Montenegro	Sustainable Tourism Development	2007		IDA	41.10	4.30	1.60	*		*	*			*			
ECA	Serbia	Transitional Agriculture Reform GEF	2007		GEF REG	5.00	5.00	5.00	*		*	*						
ECA	Serbia	Transitional Agriculture Reform GEF	2007		IBRD	25.00	7.50	7.50	*		*	*						
ECA	Poland	Rural Environmental Protection	2000	Closed	IBRD	12.80	0.33	0.33	*		*		*					
Global	Global	Assessment and Recommendations on Improving Access of Indigenous Peoples to Conservation Funding	2007		GEF MSP	0.61	0.61	0.25						*		*		

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
Global	Global	Biodiversity and Agri-cultural Commodities	2007		GEF IFC	20.36	20.36	7.00					*	*			*	
Global	Global	Coral Reef Targeted Research and Capacity Building For Management	2004		GEF REG	19.30	19.30	11.00	*	*								
Global	Global	Coral Reef Targeted Research and Capacity Building For Management	2004		IBRD	3.00	3.00	3.00	*	*								
Global	Global	Critical Ecosystem Partnership Fund 2	2008		GEF REG	100.00	100.00	20.00				*	*			*		
Global	Global	Critical Ecosystem Partnership Fund 2	2008		DGF	3.00	3.00	0.00				*	*			*		
Global	Global	Critical Ecosystems Partnership Fund	2001	Closed	GEF REG	100.00	100.00	25.00	*	*	*	*	*	*	*	*	*	
Global	Global	Critical Ecosystems Partnership Fund	2001	Closed	TF (DGF)	25.00	25.00	25.00	*	*	*	*	*	*	*	*	*	
Global	Global	Development Market-place Climate Change and Biodiversity	2003		GEF MSP	2.15	1.08	0.50						*				
Global	Global	Environmental Busi-ness Finance Program	2004		GEF IFC	100.00	5.00	5.00						*				
Global	Global	Forests and Biodiversity Window	2000		TF (BNPP)	6.60	6.60	6.60	*				*				*	
Global	Global	Forests Partnerships Program	2004		TF (DGF)	1.55	1.55	1.55		*		*	*					
Global	Global	Global Invasive Species Program	2005	Closed	TF (DGF)	1.70	1.70	1.70			*							*
Global	Global	Global Invasive Species Program	2002		TF (BNPP)	0.70	0.70	1.34			*							*
Global	Global	Local Language Field Guides	2001		TF (BNPP)	1.10	1.10	0.90		*	*							
Global	Global	Global Forest Partnership	2008		TF (DGF)	3.80	3.80	3.80	*	*								
Global	Global	Millenium Ecosystem Assessment	2004		TF (DGF)	1.00	0.50	0.50		*								
LAC	Brazil	Land Management I (Parana)	1989	Closed	IBRD	149.10	4.70	1.96	*	*		*				*		
LAC	Brazil	Land Management II (Santa Catarina)	1990	Closed	IBRD	76.30	4.30	1.98	*	*		*				*		
LAC	Brazil	National Environ mental Program	1990	Closed	IBRD	166.40	166.40	117.00	*			*	*	*		*		
LAC	St. Lucia	Water Supply	1990	Closed	IBRD	35.30	0.20	0.01		*								
LAC	St. Lucia	Water Supply	1990	Closed	IDA	5.20	0.03	0.03		*								

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
LAC	Mexico	Decentralization and Regional Development	1991	Closed	IBRD	1362.70	40.00	15.08	*		*	*	*	*	*	*		
LAC	Ecuador	Lower Guayas Flood Control	1991	Closed	IBRD	97.50	1.80	1.09								*		
LAC	Mexico	Environmental Project	1992	Closed	IBRD	60.77	13.23	4.30	*		*		*					
LAC	Brazil	Mato Grosso Natural Resource Management	1992	Closed	IBRD	285.70	48.50	44.70		*	*	*				*		
LAC	Mexico	Protected Areas Program	1992	Closed	GEF REG	10.70	10.70	8.70	*	*		*	*		*	*		
LAC	Brazil	Rondonia Natural Resource Management	1992	Closed	IBRD	228.90	38.70	35.90	*		*	*				*		
LAC	Ecuador	Rural Development	1992	Closed	IBRD	112.70	1.93	1.44	*	*	*	*					*	
LAC	Bolivia	Biodiversity Conservation	1993	Closed	GEF REG	8.39	8.39	4.54	*			*	*	*	*			
LAC	Chile	Environmental Institutions Development	1993	Closed	IBRD	32.80	16.40	5.75	*	*								
LAC	Argentina	Yacyreta Hydroelectric II	1993	Closed	IBRD	2591.10	4.50	4.50	*		*	*	*		*			
LAC	Nicaragua	Agricultural Technology and Land Management	1994	Closed	IDA	57.80	0.50	0.38		*		*						
LAC	Ecuador	Biodiversity Protection	1994	Closed	GEF REG	8.70	8.70	7.20	*	*	*	*	*		*			
LAC	Colombia	Natural Resource Management Program	1994	Closed	IBRD	65.30	11.60	6.93	*	*	*	*	*					
LAC	Paraguay	Natural Resources Management	1994	Closed	IBRD	79.10	14.83	9.38	*	*		*	*		*		*	
LAC	Mexico	Northern Border Environmental Project	1994	Closed	IBRD	762.00	15.00	7.24	*			*						
LAC	Brazil	Demonstrations	1995	Closed	TF (RFTF)	22.00	22.00	3.00	*		*		*	*	*	*		
LAC	Honduras	Environmental Development	1995	Closed	IDA	12.48	2.50	2.16	*		*		*	*				
LAC	Brazil	Extractive Reserves	1995	Closed	TF (RFTF)	9.70	9.70	3.00			*	*	*			*		
LAC	Brazil	Indigenous Lands	1995	Closed	TF (RFTF)	20.90	20.90	2.10		*		*	*			*		
LAC	Venezuela	Inparques	1995	Closed	IBRD	95.90	95.90	55.00	*	*	*	*			*			
LAC	Bolivia	National Land Administration	1995	Closed	IBRD	27.00	0.50	0.50		*								
LAC	Brazil	Natural Resources Policy	1995	Closed	TF (RFTF)	79.00	79.00	20.00	*	*								
LAC	Brazil	Science Centers and Directed Research	1995	Closed	TF (RFTF)	15.10	15.10	8.50	*	*							*	

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
LAC	Regional (Eastern Caribbean States)	Ship-Generated Waste Management	1995	Closed	GEF REG	5.50	0.20	0.20	*			*						
LAC	Costa Rica	Training Program for Sustainable Development of Indigenous People	1995	Closed	TF (IDF)	0.12	0.06	0.06	*		*					*		
LAC	Peru	Trust Fund for Parks and Protected Areas	1995	Closed	GEF REG	7.86	7.86	5.00	*		*	*	*	*				
LAC	Brazil	Brazilian Biodiversity Fund (FUNBIO)	1996	Closed	GEF REG	25.00	25.00	20.00				*	*	*	*			
LAC	Brazil	Environmental Conservation and Rehabilitation	1996	Closed	IBRD	109.00	10.90	5.00		*		*	*			*	*	
LAC	Argentina	Forestry Development	1996	Closed	IBRD	26.20	7.62	4.65	*	*			*	*			*	
LAC	Brazil	National Biodiversity (PROBIO)	1996	Closed	GEF REG	20.28	20.28	10.28	*	*		*	*		*		*	
LAC	Brazil	Rural Poverty Alleviation and Natrual Resources Management	1996	Closed	IBRD	175.00	24.80	10.00	*	*	*		*					
LAC	Colombia	Santa Fe Water Supply and Sewerage Rehabilitation I	1996	Closed	IBRD	414.20	2.40	1.58	*	*			*	*				
LAC	St. Lucia	Watershed and Environmental Management	1996	Closed	IDA	7.10	2.50	0.93	*	*								
LAC	Regional (Caribbean \States)	Planning for Adaptation to Global Climate Change	1997	Closed	GEF REG	6.49	0.325	0.31	*	*	*							
LAC	Nicaragua	Atlantic Biological Corridor	1997	Closed	GEF REG	7.10	7.10	7.10	*	*		*	*			*		
LAC	Mexico	Community Forestry	1997	Closed	IBRD	23.57	9.90	6.30	*		*		*	*		*	*	
LAC	Argentina	El Nino Emergency Flood	1997	Closed	IBRD	60.00	0.65	0.43					*					
LAC	Argentina	Flood Protection	1997	Closed	IBRD	488.00	3.60	1.48	*		*	*	*					
LAC	Haiti	Forest and Parks Protection Technical Assistance	1997	Closed	IDA	22.50	22.50	21.50	*			*	*					
LAC	Brazil	Forest Resources Management	1997		TF (RFTF)	20.00	2.00	2.00	*	*	*	*	*	*	*	*	*	
LAC	Argentina	Native Forests and Protected Areas	1997		IBRD	30.00	30.00	19.50	*	*	*	*					*	
LAC	Mexico	Proposed Restructuring of Protected Areas Program	1997	Closed	GEF REG	34.55	34.55	17.48	*			*	*	*				

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
LAC	Honduras	Rural Land Management	1997	Closed	IDA	34.00	17.25	14.03	*		*		*	*			*	
LAC	Nicaragua	Rural Municipalities	1997	Closed	IBRD	40.40	7.65	5.68	*		*		*		*	*	*	
LAC	Panama	Rural Poverty and Natural Resources	1997	Closed	IBRD	27.30	3.20	3.00	*	*			*			*		
LAC	Panama	Atlantic Mesoamerican Biodiversity Corridor	1998	Closed	GEF REG	12.80	12.80	8.40	*	*	*	*	*		*	*		
LAC	Brazil	Bahia Water Resources Management	1998	Closed	IBRD	85.00	6.87	4.10	*	*	*	*	*			*	*	
LAC	Argentina	Biodiversity Conservation	1998		GEF REG	21.90	21.90	10.10		*		*	*		*			
LAC	Honduras	Biodiversity in Priority Areas	1998	Closed	GEF REG	9.50	9.50	7.00	*	*		*	*					
LAC	Costa Rica	Biodiversity Resources Development	1998		GEF REG	11.00	11.00	7.00	*	*		*	*	*	*			
LAC	Brazil	Federal Water Resources Management (PROAGUA)	1998		IBRD	330.00	0.63	0.38			*		*					
LAC	Brazil	Gas Sector Development	1998	Closed	IBRD	2086.00	25.00	12.00	*			*			*	*		
LAC	Ecuador	Indigenous and Afro-Ecuadorian Peoples Development	1998	Closed	IBRD	50.00	6.91	3.47	*	*	*	*	*		*	*	*	
LAC	Costa Rica	Institutional Strengthening on Gender in Natural Resource Management and Agriculture	1998	Closed	TF (IDF)	0.40	0.20	0.20	*		*							
LAC	Brazil	Land Management III (Sao Paolo)	1998		IBRD	124.70	10.72	4.73			*		*	*		*	*	
LAC	Dominican Republic	National Environmental Policy Reform	1998	Closed	IBRD	3.70	1.95	1.58	*		*				*			
LAC	Dominican Republic	National Biodiversity Strategy, Action Plan and Report	1998	Closed	GEF EA	0.25	0.25	0.25	*									
LAC	Haiti	National Biodiversity Strategy, Action Plan and Report	1998	Closed	GEF EA	0.26	0.26	0.26	*									
LAC	Saint Vincent & the Grenadines	National Biodiversity Strategy, Action Plan and Report	1998	Closed	GEF EA	0.35	0.35	0.35	*									
LAC	El Salvador	Promotion of Biodiversity Conservation with Coffee Landscapes	1998	Closed	GEF MSP	3.81	3.81	0.73		*	*		*	*			*	

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	Biodiversity Activities 1	2	3	4	5	6	7	8	9	10
LAC	Regional (Latin America)	Terra Capita Fund for Biodiversity Enterprises	1998	Closed	GEF IFC	30.00	30.00	5.00					*	*	*		*	
LAC	Colombia	Cartagena Water Supply and Sewerage Environmental Management	1999		IBRD	117.00	0.41	0.41	*	*		*						
LAC	Venezuela	Conservation and Sustainable Use of Llanos Ecoregion	1999	Closed	GEF MSP	2.43	2.43	0.94	*		*		*					
LAC	Panama	Effective Protection with Community Participation of the New Protected Area of San Lorenzo	1999		GEF MSP	2.23	2.23	0.73	*		*	*	*	*	*			
LAC	Mexico	El Triunfo Biosphere Reserve: Habitat Enhancement in Productive Landscapes	1999		GEF MSP	2.12	2.12	0.73		*	*		*	*		*	*	
LAC	Brazil	Fire Prevention and Mobilization	1999		TF (RFTF)	2.00	2.00	1.00	*	*	*		*			*		
LAC	Brazil	Fire Prevention and Mobilization in the Amazon (PROARCO)	1999	Closed	IBRD	20.00	20.00	15.00	*	*	*		*			*		
LAC	Honduras	Interactive Environmental Learning and Science Promotion	1999	Closed	IDA	9.30	2.33	2.08			*	*			*			
LAC	Brazil	Monitoring and Analysis	1999		TF (RFTF)	5.80	5.80	2.00		*								
LAC	Ecuador	Monitoring System for the Galapagos Islands	1999		GEF MSP	1.59	1.59	0.94	*	*		*			*			*
LAC	Belize	Northern Belize Biological Corridors	1999	Closed	GEF MSP	3.91	3.91	0.75	*		*	*	*				*	
LAC	Nicaragua	Sustainable Forestry Investment Promotion	1999	Closed	IDA	15.00	7.50	4.50	*	*	*		*	*				
LAC	Mexico	Sustainable Hill-Side Management in Indigenous Microcatchments in Oaxaca	1999		GEF MSP	0.72	0.72	0.50					*			*	*	
LAC	Colombia	Sustainable Use of Biodiversity in Western Slope of Serrania del Baudo (Choco)	1999	Closed	GEF MSP	2.96	2.96	0.73	*	*	*	*	*		*			
LAC	Ecuador	Wetland Priorities for Conservation Action	1999		GEF MSP	0.91	0.91	0.72	*	*	*	*						

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	*Country*	*Name*	*FY*	*Status*	*Funding Source*	*Project total (US$m)*	*Total biodiv (US$m)*	*Bank Biodiv (US$m)*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
LAC	Colombia	Archipelago of San Andres: Conservation and Sustainable Use of the Marine Reserves	2000	Closed	GEF MSP	4.16	4.16	0.98	*			*	*					
LAC	Brazil	Ceara Integrated Water Resource Management (PROGERIRH)	2000		IBRD	247.20	5.90	5.90			*	*	*					
LAC	Peru	Collaborative Management for the Conservation and Sustainable Development of the Northwest Biosphere Reserve (Tumbes)	2000		GEF MSP	2.07	2.07	0.73	*	*	*	*	*		*	*	*	
LAC	Costa Rica	EcoMarkets	2000		GEF REG	8.00	8.00	8.00	*	*	*		*	*		*	*	
LAC	Costa Rica	EcoMarkets	2000		IBRD	41.20	27.47	21.53	*	*	*		*	*		*	*	
LAC	Peru	Indigenous and Afro-Peruvian Peoples Development	2000	Closed	IBRD	6.70	3.35	2.50	*	*	*		*		*	*		
LAC	Guatemala	Management and Protection of Laguna del Tigre National Park	2000	Closed	GEF MSP	1.66	1.66	0.72		*		*	*		*	*		
LAC	Peru	Participatory Conservation and Sustainable Development with Indigenous Communities in Vilcabamba	2000		GEF MSP	1.14	1.14	0.73	*	*	*	*	*			*	*	
LAC	Regional (Central America)	Public Communication and Education on the Meso-American Biological Corridor	2000		TF (IDF)	0.45	0.45	0.45			*							
LAC	Honduras	Road Reconstruction and Improvement	2000	Closed	IDA	106.80	0.30	0.20	*	*		*						
LAC	Belize	Roads and Municipal Drainage	2000	Closed	IBRD	18.38	0.18	0.18			*	*						
LAC	Mexico	Rural Development in Marginal Areas (APL II)	2000	Closed	IBRD	63.00	4.25	4.25	*				*	*			*	
LAC	Colombia	Sierra Nevada Sustainable Development	2000		IBRD	6.25	6.25	5.00	*	*	*	*	*	*	*	*		
LAC	Costa Rica	Training Program for Sustainable Development of Indigenous People	2000	Closed	TF (IDF)	0.30	0.15	0.15			*					*		

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
LAC	Colombia	Andean Region Conservation and Sustainable Use of Biodiversity	2001		GEF REG	30.00	30.00	15.00	*	*		*	*	*		*		*
LAC	Nicaragua	Barrier Removal and Forest Habitat Conservation	2001		GEF MSP	12.08	12.08	0.73	*	*	*		*				*	
LAC	Peru	Biodiversity Conservation through Sustainable Management of the Nanay River Basin (Peruvian Amazon)	2001		GEF MSP	0.95	0.95	0.75	*	*		*	*		*	*	*	
LAC	Ecuador	Choco-Andean Corridor	2001		GEF MSP	3.19	3.19	0.98	*		*	*	*			*		
LAC	Ecuador	Coastal Albarradas: Rescuing Ancient Knowledge and Sustainable Use of Biodiversity	2001		GEF MSP	3.08	3.08	0.73		*			*		*	*	*	
LAC	Colombia	Conservation and Sustainable Development of the Mataven Forest	2001	Closed	GEF MSP	1.37	1.37	0.73				*	*			*		
LAC	Regional (Central America)	Conservation and Sustainable Use of the Mesoamerican Barrier Reef System (MBRS)	2001		GEF REG	24.20	24.20	11.00	*	*	*	*	*	*	*			
LAC	Grenada	Dry Forest Biodiversity Conservation	2001		GEF MSP	1.13	1.13	0.72	*	*	*	*	*	*				
LAC	Brazil	Fire Prevention and Mobilization in the Amazon (PROTEGER II)	2001		TF (RFTF)	2.00	2.00	2.00	*	*	*							
LAC	Mexico	Indigenous and Community Biodiversity Conservation (COINBIO)	2001		GEF REG	7.50	7.50	7.50	*	*	*	*	*		*	*	*	
LAC	Mexico	Indigenous and Community Biodiversity Conservation (COINBIO)	2001		GEF REG	11.20	11.20	2.60	*				*	*	*	*		
LAC	Argentina	Indigenous Community Development	2001		IBRD	5.88	2.94	2.50					*			*		
LAC	Bolivia	Indigenous Development	2001	Closed	IBRD	5.00	1.11	1.11			*		*		*	*	*	
LAC	Peru	Indigenous Management of Protected Areas in the Peruvian Amazon	2001		GEF REG	14.61	14.61	10.00		*		*	*		*	*		

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
LAC	Peru	Indigenous Management of Protected Areas in the Peruvian Amazon	2001		IBRD	8.14	8.14	5.00			*		*	*		*	*	
LAC	Panama	Land Administration	2001		IBRD	72.36	8.92	5.90	*	*	*	*	*			*		
LAC	Mexico	Mesoamerican Biological Corridor	2001		GEF REG	26.77	26.77	14.84	*	*	*		*		*	*	*	
LAC	Mexico	Natural Disaster Management	2001	Closed	IBRD	658.30	1.28	0.78		*				*				
LAC	Argentina	Patagonia Coastal Contamination Prevention and Sustainable Fisheries Management	2001		GEF REG	18.76	13.85	6.16	*	*			*					
LAC	Ecuador	Poverty Reduction and Local Rural Development (PROLOCAL)	2001		IBRD	41.96	1.70	1.02			*		*	*		*	*	
LAC	Bolivia	Removing Obstacles to Direct Private-Sector Participation in In-Situ Biodiversity Conservation (PROMETA)	2001	Closed	GEF MSP	1.13	1.13	0.72	*	*		*	*	*	*			
LAC	Nicaragua	Second Rural Municipal Development	2001		IDA	40.70	6.58	5.35	*		*							
LAC	Bolivia	Sustainability of the National System of Protected Areas	2001	Closed	GEF REG	43.99	43.99	15.00	*	*		*	*	*	*	*		
LAC	Costa Rica	Sustainable Cacao Production in Southeastern Costa Rica	2001		GEF MSP	3.01	3.01	0.72	*	*			*	*		*	*	
LAC	Chile	Valdivian Forest Zone: Private Public Mechanisms for Biodiversity Conservation	2001		GEF MSP	0.73	0.73	0.73	*	*	*	*	*	*				
LAC	Guatemala	Western Altiplano Integrated Natural Resource Management	2001	Closed	GEF REG	8.00	8.00	8.00		*		*	*					
LAC	Guatemala	Western Altiplano Integrated Natural Resource Management	2001	Closed	IBRD	47.60	47.60	32.80	*			*	*					
LAC	Brazil	Amazon Region Protected Areas	2002		GEF REG	81.35	81.35	30.35	*	*	*	*	*	*	*	*		
LAC	Guatemala	Community Management of the Bio-Itza Reserve	2002		GEF MSP	1.48	1.48	0.75	*	*	*	*	*	*	*	*	*	

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
LAC	Chile	Conservation of the Santiago Foothills	2002		GEF MSP	4.72	4.72	0.73	*	*		*						
LAC	Mexico	Consolidation of Protected Areas (SINAP I)	2002		GEF REG	60.12	60.12	16.10	*	*	*	*	*	*	*		*	*
LAC	Brazil	Ecological Corridors	2002		TF (RFTF)	5.16	5.16	3.90	*	*	*	*	*	*		*		
LAC	Regional (Latin America)	Integrated Silvopastoral Approaches to Ecosystem Management	2002		GEF REG	8.45	8.45	4.50		*	*		*	*	*			
LAC	Nicaragua	Land Administration	2002		IDA	38.50	5.17	4.37	*	*	*	*	*			*		
LAC	Bolivia	National Land Administration (Supplemental)	2002	Closed	IBRD	6.00	0.05	0.05		*		*						
LAC	Brazil	Parana Biodiversity	2002		GEF REG	32.86	32.86	8.00	*	*	*	*	*	*	*	*	*	*
LAC	Mexico	Private Land Conservation Mechanisms	2002		GEF MSP	2.53	2.53	0.73			*	*		*				
LAC	Honduras	Rural Land Management (Supplemental Credit)	2002	Closed	IDA	9.10	0.50	0.50		*	*		*				*	
LAC	Brazil	Santa Catarina Natural Resources & Poverty	2002		IBRD	107.50	3.30	3.30	*	*	*		*					
LAC	Honduras	Sustainable Coastal Tourism	2002	Closed	IDA	6.04	1.51	1.25	*		*		*	*	*			
LAC	Ecuador	Biodiversity Conservation in Pastaza	2003	Closed	GEF MSP	1.01	1.01	0.76	*		*		*			*		
LAC	Colombia	Capacity Building in Biosafety	2003	Closed	GEF MSP	4.45	4.45	1.98	*									
LAC	Belize	Community Management Sarstoon Temash	2003	Closed	GEF MSP	1.09	1.09	0.83		*	*	*	*		*	*		
LAC	Colombia	Community-based Management for the Naya Conservation Corridor	2003	Closed	GEF MSP	2.23	2.23	0.75	*	*	*	*				*	*	
LAC	Mexico	Consolidation of Protected Areas (SINAP II)	2003		GEF REG	17.44	17.44	2.21	*	*	*	*	*	*	*		*	*
LAC	Paraguay	Mbaracayú Biodiversity	2003	Closed	GEF MSP	3.00	3.00	0.97				*	*	*				
LAC	Ecuador	National System of Protected Areas	2003		GEF REG	32.70	32.70	8.00	*	*	*	*	*	*				
LAC	Peru	Participatory Management of Protected Areas (PROFONANPE II)	2003		GEF REG	32.81	32.81	14.80	*	*	*	*	*	*	*			

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
LAC	Mexico	Programmatic Environment Structural Adjustment Loan	2003	Closed	IBRD	202.00	2.83	2.83	*	*	*		*			*		
LAC	Honduras	Regional Development in the Copan Valley	2003		IDA	13.35	1.73	1.73		*	*				*			
LAC	Brazil	Tocantins Sustainable Regional Devpt	2003		IBRD	100.00	12.70	10.10		*	*	*					*	
LAC	Colombia	Amoya River Environmental Services	2004		CF	101.40	2.00	0.00		*	*							
LAC	Regional (Latin America)	Mainstreaming Adaptation to Climate Change	2003		GEF REG	10.95	1.00	0.80	*	*								
LAC	Regional (Latin America)	Building the Inter-American Biodiversity Information Network (IABIN)	2004		GEF REG	34.93	34.93	6.00	*	*								
LAC	Regional (Latin America)	Developing Connectivity between Biological and Geospatial Information in Latin America and the Caribbean	2004		TF (DGF)	1.20	1.20	1.20	*	*								
LAC	Honduras	Forests and Rural Productivity	2004		IDA	32.70	6.78	4.20	*	*		*		*				
LAC	Peru	Inka Terra: An Innovative Partnership for Self-Financing Biodiversity Conservation & Community Development	2004		GEF MSP	12.12	12.12	0.75		*	*	*		*	*			
LAC	Regional (Latin America)	Integrated Ecosystem Management in Indigenous Communities	2004		GEF REG	11.50	11.50	4.00	*		*		*		*	*		
LAC	Regional (Eastern Caribbean States)	OECS Protected Areas and Associated Sustainable Livelihoods	2004		GEF REG	7.57	7.57	3.70	*		*	*	*		*			
LAC	Regional (Eastern Caribbean States)	OECS Protected Areas and Associated Sustainable Livelihoods	2004		GEF REG	7.57	7.57	3.70	*		*	*	*	*				
LAC	Peru	Poison Dart Frog Ranching to Protect Rainforest and Alleviate Poverty	2004		GEF MSP	1.85	1.85	0.86		*	*		*	*	*			
LAC	Brazil	Amapa Sustainable Communities	2005		IBRD	6.81	2.72	2.40	*							*		

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
LAC	Brazil	Atlantic Forest Subprogram (Phase I)	2005		TF (RFTF)	0.80	0.80	0.80	*	*								
LAC	Brazil	Ceara Multi-sector Social Inclusion Development	2005		IBRD	149.00	4.10	4.10			*	*			*			
LAC	Brazil	Conservation of Biodiversity and Ecosystem Rehabilitation in Tabuleiro State Park	2005		GEF MSP	2.35	2.35	0.99				*	*			*		
LAC	Venezuela	Dhekuana Nonoodo: Sustainable Use and Conservation of Biodiversity Resources of Dhekuana Indigenous Lands	2005		GEF MSP	1.10	1.10	0.75	*	*		*			*	*		
LAC	Brazil	Ecosystem Restoration of Riparian Forests in Sao Paulo	2005		GEF REG	19.52	19.52	7.75	*		*			*				
LAC	El Salvador	Environmental Services	2005		GEF REG	5.00	5.00	5.00	*				*	*				
LAC	Brazil	First Programmatic Reform Loan for Environmental Sustainability	2005	Closed	IBRD	505.05	42.00	42.00	*									
LAC	Uruguay	Integrated Ecosystem Management	2005		GEF REG	7.00	7.00	7.00			*		*		*			
LAC	Uruguay	Integrated Ecosystem Management	2005		IBRD	88.85	7.00	7.00			*		*		*			
LAC	Brazil	Integrated Watershed Management and Protection (Formoso River)	2005		GEF MSP	2.18	2.18	1.00	*	*	*	*	*		*	*	*	
LAC	El Salvador	Protected Areas Consolidation and Administration	2005		GEF REG	5.00	5.00	5.00				*	*					
LAC	El Salvador	Protected Areas Consolidation and Administration	2005		IBRD	5.00	13.40	5.00				*	*					
LAC	Brazil	Rio de Janeiro Sustainable Integrated Ecosystem Management in Productive Landscapes of the North-Northwestern Fluminense	2005		GEF REG	14.95	14.95	6.75			*		*	*		*	*	
LAC	Brazil	Support to Atlantic Forest NGO Network (RMA)	2005		TF (RFTF)	0.93	0.93	0.93			*							

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
LAC	Brazil	Support to Sustainable Business Practices in Rain Forests	2005	Closed	TF (RFTF)	0.48	0.12	0.12					*	*				
LAC	Colombia	Colombian National Protected Areas Conservation Trust Fund	2006		GEF REG	42.40	13.20	13.20				*	*			*		
LAC	Regional (Central America)	Corazon Transboundary Biosphere Reserve	2006		GEF REG	12.00	4.55	4.55				*	*			*		
LAC	Mexico	Environmental Services	2006		GEF REG	15.00	10.00	39.30	*	*				*		*		
LAC	Mexico	Environmental Services	2006		IBRD	156.56	143.37	39.30	*	*				*		*		
LAC	Regional (Caribbean States)	Implementation of Adaptation Measures in Coastal Zones	2006		GEF REG	5.47	1.90	1.90				*	*					
LAC	Brazil	Integrated Management of Aquatic Resources in the Amazon (AquaBio)	2006		GEF REG	17.36	17.36	7.18		*	*	*						
LAC	Colombia	Integrated National Adaptation Program	2006		GEF REG	14.90	5.40	5.40				*	*					
LAC	Costa Rica	Mainstreaming Market-Based Instruments for Environmental Management	2006		CF	2.55	0.40	7.50	*				*			*		
LAC	Costa Rica	Mainstreaming Market-Based Instruments for Environmental Management	2006		GEF REG	10.00	9.40	7.50	*				*			*		
LAC	Costa Rica	Mainstreaming Market-Based Instruments for Environmental Management	2006		IBRD	30.00	7.50	7.50	*				*			*		
LAC	Panama	Rural Productivity and Consolidation of the Atlantic Mesoamerican Biological Corridor	2006		GEF REG	6.00	6.00	6.00				*	*					
LAC	Panama	Rural Productivity and Consolidation of the Atlantic Mesoamerican Biological Corridor	2006		IBRD	18.10	18.10	10.00				*	*					
LAC	Argentina	Urban Flood Prevention and Drainage	2006		IBRD	93.51	2.77	0.25					*					

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
LAC	Argentina	Biodiversity Conservation in Productive Forestry Landscapes	2007		GEF REG	7.00	7.00	7.00				*	*					
LAC	Argentina	Biodiversity Conservation in Productive Forestry Landscapes	2007		IBRD	8.88	8.88	4.14				*	*					
LAC	Brazil	Caatinga Conservation and Management – Mata Branca	2007		GEF REG	23.06	23.06	8.34			*		*					
LAC	Colombia	Co-furatena Agro-industry Carbon Offset	2007		CF	1.75	0.75	0.75					*			*		
LAC	Argentina	Conservation of Patagonian Steppe and Southern Andes Fauna	2007		GEF MSP	1.4	1.4	1.4				*						
LAC	Mexico	Consolidation of Protected Areas (SINAP III)	2007		GEF REG	7.35	7.35	5.30	*			*		*				
LAC	Panama	Rural Productivity	2007		IBRD	46.90	11.40	10.00			*						*	
LAC	Mexico	Sacred Orchids of Chiapas: Cultural and Religious Values in Conservation	2007		GEF MSP	2.06	2.06	0.89		*	*	*		*		*		
LAC	Argentina	Upper Parana Atlantic Forest Restoration by Small-Farmers	2007		GEF MSP	0.5	0.5	0.5					*					
Global	Global	Small and Medium Scale Enterprise Program	1997		GEF IFC	40.00	20.00	2.00				*	*	*	*		*	
LAC	Brazil	National Biodiversity Mainstreaming and Institutional Consolidation	2008		GEF REG	97.00	97.00	22.00	*				*					
LAC	Argentina	Sustainable Natural Resources Management	2008		IBRD	78.80	39.80	33.38										
LAC	Mexico	Community Forestry (PROCYMAF II)	2003		IBRD	28.90	1.80	1.80	*				*	*		*		
LAC	El Salvador	Environmental Services	2005		IBRD	9.50	9.50	5.00	*				*	*				
MNA	Yemen	Land and Water Conservation	1992	Closed	IDA	47.60	0.64	0.44		*								
MNA	Algeria	Pilot Forestry and Watershed Management	1992	Closed	IBRD	37.40	0.40	0.27		*		*						
MNA	Tunisia	Forestry Development II	1993	Closed	IBRD	148.10	1.63	0.87	*			*	*					

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Investments in Projects with a Biodiversity Component									Biodiversity Activities									
Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
MNA	Iran	Irrigation Improvement	1993	Closed	IBRD	311.70	4.00	0.40	*		*		*					
MNA	Egypt	Matruh Resource Management	1993	Closed	IDA	29.50	1.70	1.27					*					
MNA	Egypt	Red Sea Coastal and Marine Resource Management	1993	Closed	GEF REG	5.73	5.73	4.75	*	*	*	*		*	*			
MNA	Algeria	El Kala National Park and Wetlands Management	1994	Closed	GEF REG	9.56	9.56	7.20	*		*	*						
MNA	Jordan	Gulf of Aqaba Environmental Action Plan	1996	Closed	GEF REG	12.67	0.95	0.65	*	*	*	*	*		*			
MNA	Tunisia	National Biodiversity Strategy, Action Plan and Report	1997	Closed	GEF EA	0.89	0.89	0.89	*									
MNA	Jordan	Tourism Development II	1998	Closed	IBRD	44.00	9.00	6.55	*		*	*	*	*	*			
MNA	Yemen	Coastal Zone Management along the Gulf of Aden	1999	Closed	GEF MSP	1.56	0.75	0.75	*	*	*	*	*		*			
MNA	Syria	Conservation of Biodiversity and Protected Areas Management	1999	Closed	GEF MSP	1.43	1.43	0.75	*		*	*						
MNA	Morocco	Lakhdar Watershed Management Pilot	1999	Closed	IBRD	5.80	0.66	0.46		*			*				*	
MNA	Yemen	Protected Areas Management	1999	Closed	GEF MSP	1.42	0.74	0.74	*	*	*	*	*				*	
MNA	Regional (Red Sea States)	Strategic Action Plan for the Red Sea	1999	Closed	GEF REG	36.60	12.95	2.11	*		*	*	*		*			
MNA	Morocco	Protected Areas Management	2000		GEF REG	15.70	15.70	10.50	*		*	*	*		*			
MNA	Tunisia	Protected Areas Management	2002		GEF REG	9.88	9.88	5.33	*	*	*	*	*					
MNA	Jordan	Conservation of Medicinal and Herbal Plants	2003		GEF REG	14.21	14.21	5.00	*	*		*	*				*	
MNA	Egypt	Matruh Resource Management II	2003		GEF REG	5.17	5.17	5.17				*	*					
MNA	Egypt	Nile Transboundary Environmental Action Plan	2003		GEF REG	43.60	2.71	2.71	*		*		*	*		*		
MNA	Tunisia	Northwest Mountain and Forestry Areas Development	2003		IBRD	44.86	6.28	4.76					*	*		*		*

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	Biodiversity Activities 1	2	3	4	5	6	7	8	9	10
		Investments in Projects with a Biodiversity Component																
MNA	Algeria	Second Rural Employment	2003		IBRD	142.89	14.34	9.54	*				*					*
MNA	Iran	Alborz Integrated Land and Water Management	2005		IBRD	200.34	4.40	2.64		*	*	*						
MNA	Tunisia	Gulf of Gabes Marine and Coastal Resources Protection	2005		GEF REG	9.81	9.81	6.31	*		*				*			
MNA	Jordan	Integrated Ecosystems in the Jordan Rift Valley	2007		GEF REG	12.70	6.15	6.15				*	*					
SAR	Sri Lanka	Forest Sector Development	1989	Closed	IDA	31.40	1.30	0.82	*	*	*	*	*					
SAR	Pakistan	Environmental Protection and Resource Conservation	1992	Closed	IDA	57.20	6.40	3.00		*	*	*	*					
SAR	Bangladesh	Forest Resources Management	1992	Closed	IDA	58.70	27.20	22.10	*	*		*	*					
SAR	India	Maharashtra Forestry	1992	Closed	IDA	142.00	31.24	27.28		*		*	*			*	*	
SAR	Bhutan	Trust Fund for Environmental Conservation	1992	Closed	GEF REG	18.58	18.58	10.00	*	*		*		*				
SAR	India	West Bengal Forestry	1992	Closed	IDA	39.00	6.50	5.67		*		*	*			*		
SAR	India	Andhra Pradesh Forestry	1994	Closed	IDA	89.10	28.80	25.02		*		*	*			*	*	
SAR	Pakistan	Balochistan Natural Resources Management	1994	Closed	IDA	17.80	4.65	3.84	*		*	*	*			*	*	
SAR	India	Forestry Research Education and Extension	1994	Closed	IDA	56.40	8.30	6.92		*		*				*		
SAR	Bangladesh	Jamuna Bridge	1994	Closed	IDA	696.00	0.25	0.07		*	*	*						
SAR	Bhutan	Third Forestry Development	1994	Closed	IDA	8.90	1.80	1.09	*		*	*	*					
SAR	India	Madhya Pradesh Forestry	1995	Closed	IDA	67.30	31.10	26.80	*	*		*	*		*	*		*
SAR	Pakistan	Punjab Forest Sector Development	1995	Closed	IDA	33.75	2.29	1.69		*			*			*	*	
SAR	India	Orissa Water Resources Consolidation	1996	Closed	IDA	345.50	1.80	1.52	*				*			*		
SAR	India	Ecodevelopment	1997	Closed	GEF REG	20.00	20.00	20.00		*	*	*			*	*		*
SAR	India	Ecodevelopment	1997	Closed	IDA	47.00	47.00	28.00	*		*	*	*		*	*		*
SAR	India	Environmental Management Capacity Building and Technical Assistance	1997	Closed	IDA	65.29	5.34	4.09	*	*			*					

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Region	Country	Name	FY	Status	Funding Source	Project total (US$m)	Total biodiv (US$m)	Bank Biodiv (US$m)	1	2	3	4	5	6	7	8	9	10
SAR	Sri Lanka	Conservation and Sustainable Use of Medicinal Plants	1998	Closed	GEF REG	5.21	5.21	4.60	*	*	*	*	*			*	*	
SAR	India	Kerala Forestry	1998	Closed	IDA	47.00	19.70	16.35	*	*	*	*	*			*	*	
SAR	India	Uttar Pradesh Forestry	1998	Closed	IDA	65.01	19.93	16.23	*	*	*	*	*			*	*	*
SAR	Bangladesh	Fourth Fisheries	1999	Closed	IDA	55.80	32.20	15.60	*	*			*				*	*
SAR	Bangladesh	Fourth Fisheries-Aquatic Biodiversity Conservation	1999	Closed	GEF REG	5.00	5.00	5.00	*	*			*					
SAR	India	Gujarat State Highway	2000	Closed	IBRD	533.00	0.50	0.20		*								
SAR	Sri Lanka	Land Administration and Management	2001		IDA	6.93	0.25	0.18		*		*	*	*				
SAR	Sri Lanka	Protected Area Management and Wildlife Conservation	2001	Closed	GEF REG	33.50	33.50	9.00	*			*		*	*			
SAR	Pakistan	Protected Areas Management	2001		GEF REG	10.75	10.75	10.08	*	*	*	*				*		
SAR	India	Capacity Building for Implementation of Cartagena Protocol on Biosafety	2003		GEF EA	3.07	0.60	0.20	*	*								*
SAR	Bhutan	Sustainable Land Management	2006		GEF REG	15.89	7.64	7.64				*	*					
SAR	India	Himachal Pradesh State Roads	2007		IBRD	303.43	0.50	0.20		*								

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