Investing in Natural Capital for a Sustainable Future in the Greater Mekong Subregion

September 2015

ADB

GREATER MEKONG SUBREGION
CORE ENVIRONMENT PROGRAM

Investing in Natural Capital for a Sustainable Future in the Greater Mekong Subregion

September 2015

GREATER MEKONG
SUBREGION
CORE ENVIRONMENT
PROGRAM

6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines
Tel +63 2 632 4444; Fax +63 2 636 2444
www.adb.org; openaccess.adb.org

Printed in Thailand.

ISBN 978-92-9257-145-0 (Print), 978-92-9257-146-7 (e-ISBN)
Publication Stock No. RPT157686-2

Cataloging-In-Publication Data

Asian Development Bank.
Investing in natural capital for a sustainable future in the Greater Mekong Subregion.
Mandaluyong City, Philippines: Asian Development Bank, 2015.

1. Natural capital 2. Greater Mekong Subregion 3. Sustainable development I. Environment Operations Center.

Note: In this publication, "$" refers to US dollars.
Front cover photo by Steve Griffiths, ADB.
Back cover photo by Hermione McCosh.

GMS Environment Operations Center
23rd Floor, The Offices at Central World
999/9 Rama 1 Road, Pathumwan
Bangkok 10330
Tel +66 2 207 4444; Fax +66 2 207 4400
E-mail: info@gms-eoc.org
Website: www.gms-eoc.org

Contents

Acknowledgments

This report was prepared under the guidance of the Greater Mekong Subregion (GMS) Working Group on Environment, together with staff and consultants of the Asian Development Bank (ADB). ADB staff Sanath Ranawana, Javed Mir, Suchin Teoh, Ancha Srinivasan, Bruce Dunn, Pavit Ramachandran, Uzma Hoque, and Raza Farrukh, provided strategic guidance or technical inputs. Consultants under ADB's GMS Environment Operations Center (EOC) coordinated the compilation and production of the report and conducted much of the research. EOC inputs were led by Sumit Pokhrel, Shannon Wang, Ornsaran Maunamorn, and Duncan McLeod, with support from Bopha Seng, Eric Wikramanayake, Iain Watson, Jerry Chen, Jiao Xi, Lothar Linde, Michael Green, Sebastian Philipps, Quyen Hanh Nguyen, Somphavanh Nakhavong, Teo Dang Do, Tin Win Win Ei, and Vong Sok. Consultants from ADB's GMS Core Agricultural Support Program also provided inputs, namely Janis Tebecis, Thamrongsak Moenjak, Apichai Thirathon, and Thamana Lekprichakul.

The following external organizations contributed technical inputs: Conservation International; the Consortium of International Agricultural Research Centers (Joost Vervoort, Rathana Peou); GIST Advisory (Kaavya Varma); the Global Footprint Network (Mathis Wackernagel and Phillip Fullon); the Institute for Global Environment Strategies (Puja Sawhney); the Institute for Social and Environmental Transition (Richard Friend); the International Food Policy Research Institute (Daniel Mason-D'Croz); the International Institute for Applied Systems Analysis (Amanda Palazzo); the International Water Management Institute (Matthew McCartney); the Mekong Adaptation and Resilience to Climate Change Project of the US Agency for International Development (Paul Hartman and Shelley Gustafson); the Mekong Futures Institute (Alex Smajgl); the Mekong River Commission (Basin Development Plan, Environment Programme); Southeast Asia START (Suppokorn Chinvanno); the Stockholm Environment Institute (Albert Salamanca, Chayanis Krittasudthacheewa, Wathanyu Amatakakul, Charles Rodgers, Eric Kemp-Benedict); the United Nations Convention on Combating Desertification (Christina Wollesen, Siv Oystese, Simone Quatrini, Elisabeth Barsk); the United Nations Development Programme (Gan Pek Chuan and Midori Paxton); the United Nations Economic and Social Commission for Asia and the Pacific (Hitomi Rankine); the United Nations Environment Programme (UNEP) (Makiko Yashiro, Keiko Nomura, Aaron Vuola, Pushpam Kumar, Ersin Esen, Nicolas Bertrand); the UNEP's World Conservation Monitoring Centre (Charlotte Hicks, Ralph Blaney, Marieke Sassen, Val Kapos); and the World Wild Fund for Nature (Aaron Vermeulen, Chloe Hill, Hanna Helsingen, Louise Gallagher, Alasdair Forman). The contributions of Kewal Thapar, Luke Brander, Peter Cutter, Raji Dhital, and Camille Bann are also gratefully acknowledged.

Duncan McLeod saw this report through production. It went through peer review by Pavan Sukhdev and Robert Costanza, technical editing by Alastair Sarre, and manuscript editing by Mary Ann Asico. Scand-Media designed and executed the page layout and the cover artwork.

Finally, the report could not have been compiled without the funding support to the GMS Core Environment Program provided by ADB, the governments of Finland and Sweden, the Global Environment Facility, the People's Republic of China Regional Cooperation and Poverty Reduction Fund, and the Nordic Development Fund.

Abbreviations

ADB	Asian Development Bank
ASEAN	Association of Southeast Asian Nations
PRC	People's Republic of China
CBD	Convention on Biological Diversity
CEP	GMS Core Environment Program
D	Vietnamese dong
EMM4	4th GMS Environment Ministers' Meeting
EOC	Environment Operations Center
FDI	foreign direct investment
GDP	gross domestic product
GHG	greenhouse gas
GMS	Greater Mekong Subregion
ha	hectare
I-GEM	Indonesia Green Economy Model
IMBM	incentive- and market-based mechanism
IWRM	integrated water resources management
Lao PDR	Lao People's Democratic Republic
LEAP	Long-range Energy Alternatives Planning system
LMB	Lower Mekong Basin
m^3	cubic meter
MCA	multi-criteria analysis
NBSAP	national biodiversity strategy and action plan
ODA	official development assistance
PA	protected area
PES	payments for ecosystem services
PFES	Payments for Forest Environmental Services (Viet Nam)
REDD	Reducing Emissions from Deforestation and Forest Degradation
REDD+	Reducing Emissions from Deforestation and Forest Degradation, as well as conserving and enhancing forest carbon stocks and practicing sustainable forest management in developing countries
RIF	GMS Regional Investment Framework
SEA	strategic environmental assessment
SEEA	United Nations System of Environmental–Economic Accounting
SMEs	small and medium-sized enterprises
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WEAP	Water Evaluation and Planning system

Duncan McLeod, EOC

Executive Summary

Natural capital has been a key contributor to the subregion's rapid economic growth over the past 3 decades or so. However, the subregion's key natural capital stocks are in a state of decline. This is evident by the degradation of arable land; considerable losses in forests, wetlands, and mangroves; and many species of fauna and flora becoming endangered or even extinct.

The Greater Mekong Subregion (GMS) is poised to continue developing at a significant pace. The subregion is well placed to benefit from the emerging Association of Southeast Asian Nations Economic Community due to its strategic geographic positioning, extensive subregional connectivity, and strong sense of community established through 2 decades of subregional cooperation.

The GMS Regional Investment Framework Implementation Plan (2014–2018), comprising a pipeline of prioritized investment projects worth over $30 billion and approved by GMS leaders at the 5th GMS Summit in Bangkok in December 2014, is indicative of the subregion's development potential.

However, the sustainability of the subregion's future prosperity could be undermined unless the GMS invests significantly more in safeguarding and enhancing its natural capital. Indeed, in the context of the subregion's vulnerability to climate change, natural disasters, and human-induced shocks, investments in natural capital present some of the most economically viable and socially inclusive adaptation and resilience strategies. Investing in natural capital will greatly help the GMS realize inclusive and sustainable development.

Below are key messages from this report on natural capital in the GMS.

Natural capital underpins the socioeconomic development of GMS countries and the achievement of inclusive and sustainable growth in the subregion

Natural capital, which accounts for 20%–55% of the total wealth of GMS countries, has been a key contributor to the rapid economic growth achieved in the subregion in the past 3 decades. Agriculture (including forestry) makes up about 30% of gross domestic product (GDP) in Cambodia, the Lao People's Democratic Republic (Lao PDR), and Myanmar, and is the main source of employment in the GMS, engaging between 38% (in Thailand) and 74% (in the Lao PDR) of the labor force. The Mekong River supports the world's largest inland fishery, with annual turnover of $1.4 billion–$3.9 billion. Natural capital also sustains the manufacturing and service sectors—such as the thriving furniture industry in Viet Nam, the world's sixth-largest exporter of furniture, and tourism, which contributes about 17% of GDP in Yunnan Province, the People's Republic of China (PRC).

Natural capital is critical for maintaining the resilience of GMS countries to natural and human-induced shocks

The GMS is highly vulnerable to climate change, particularly in its extensive low-lying coastal areas, which are also among the world's most productive agricultural lands and fisheries. Projections of temperature and rainfall under climate-change scenarios suggest that critical thresholds for many crops in the Lower Mekong Basin (LMB) will be exceeded by 2050. Ecosystems, such as watersheds, wetlands, mangroves, and coastal dunes, provide invaluable regulatory services that buffer the effects of extreme weather events, such as storms and droughts. Historically, rural communities have depended on nature (e.g., forests and wetlands) for subsistence as part of strategies for coping with and recovering from natural and human-induced shocks.

Natural capital ensures the security of energy, food, and water in the GMS and is, therefore, especially important for the poor

Natural capital is a crucial component of rural livelihoods. More than 60 million rural people rely directly on it for their daily energy, food, water, and income needs. Fisheries provide 47%–80% of animal protein consumed in the GMS, and more than 80% of Cambodian and the Lao PDR households depend on biomass for cooking and lighting. A significant decline in ecosystem services would directly affect the energy, food, and water security of these populations. Land, water, and soil degradation, and the associated reduction in agricultural yield, could drastically lower the earning capacity of vulnerable groups, such as the rural poor and women.

Current development approaches in the GMS have led to large-scale degradation of natural capital

Many nations including the GMS countries have pursued economic development strategies that rely on the intensive use of natural capital. Such development strategies typically undervalue the contributions of natural capital to human well-being and treat ecosystem services as economically invisible. This approach has led to the overexploitation of natural capital and the degradation and destruction of arable land, forests, and water resources.

For example, the overuse of pesticides and chemical fertilizers in agricultural production has severely degraded groundwater and reduced soil fertility and crop diversity. In the PRC's Yunnan Province, about 47% of available grazing land is classified as moderately to severely damaged. Wetlands—among the most diverse and productive ecosystems in the GMS—are also severely threatened by land conversion, water withdrawal, and dam construction. Less than 2% of the original area of natural inland wetlands in the Mekong Delta is intact. Between 1990 and 2010, the GMS (excluding Viet Nam) lost more than 12.5 million hectares (ha) of forest, or almost half of the total area of the Lao PDR. Natural-capital losses in the GMS are valued at 10%–12% of GDP per year. If current trends in ecosystem loss continue, forgone services in the next 25 years could cost the subregion an estimated $55 billion.

Pressures on natural capital in the GMS are likely to increase under business as usual approaches, causing continued losses that threaten future prosperity

Several key drivers are exerting further pressure on natural capital in the GMS. *First*, economic growth is expected to continue, thus increasing the demand for food, energy, and water, and could hasten the depletion of natural capital. For example, the GMS Regional Investment Framework (RIF) Implementation Plan (2014–2018) represents a pipeline of priority investment projects worth $30.1 billion. Compared with the $16.7 billion invested during the first 20 years of the GMS Economic Cooperation Program (1992–2012), this is double the investment in one-fourth of the time. While aiming to create new economic opportunities, this level of investment also carries environmental and social costs that have yet to be fully understood, and its potential impact on natural capital in the subregion has yet to be accounted for.

Second, consumption patterns in the subregion are shifting as a result of a more affluent society as well as a rapidly increasing urban population, creating additional pressure on natural capital. For example, diets are changing from predominantly cereal-based to increasingly protein-rich, which intensifies pressure on farmlands. Urbanization increases the demand for key ecosystem services such as energy, water, and construction materials.

Third, climate change will place added pressure on natural capital in the GMS. Agricultural assets, including land and water, are highly sensitive to a changing climate. Agriculture yields in the subregion could decline because of extreme temperatures, the intrusion of saline water into croplands due to rising sea levels, increased drought and flooding, and the effects of wind and soil erosion.

Current efforts to reverse the trend of natural-capital degradation are insufficient; the GMS must urgently scale up investments to protect and restore its natural capital

Policies and programs to support the protection and management of natural capital must be more cohesive and complementary to be effective and efficient. Natural-asset policies currently mainly focus on establishing and managing protected areas (PAs). Only limited actions have been taken to minimize the impact of economic activities on natural capital, such as the use of strategic environmental assessments. Natural-capital related policies often lack robust legal underpinning, and their implementation is not always mandatory. Legal systems and monitoring and evaluation processes must be put in place or improved for policy implementation to succeed. Similarly, there is a need for greater coordination among international, regional, and national actors to achieve policy objectives under related global agreements. These include the Aichi Biodiversity Targets, the United Nation's climate-change targets, and the proposed post-2015 Sustainable Development Goals.

Some GMS countries have begun institutional reforms to give greater authority to environmental agencies, consolidate their functions, and improve coordination with other sectors. Other countries have yet to do so, however.

Official development assistance and conservation projects traditionally funded by governments are the main sources of investment in natural capital. GMS countries are also exploring innovative fiscal instruments, such as environmental taxes and incentives, and market-based mechanisms, such as payments for ecosystem services (PES). Greater uptake of such approaches will ensure sustainable investment in natural capital.

To achieve the required financial, institutional, legal, and policy reforms, the value of natural capital must receive greater recognition at the political level. There is a large and growing body of information about the value of natural capital in the GMS, but national-level frameworks, such as natural-capital accounting, are only starting to be applied.

Lack of technical and institutional capacity presents another challenge to scaling up investments in natural capital in the GMS.

A natural-capital approach to decision making will stimulate investment in natural capital in the GMS

A natural-capital approach is the economic reflection of the value that natural assets and services contribute to human economies. It represents a fundamental shift away from traditional approaches to natural resource management and counters the widespread perception that natural resources are either valueless or unlimited merely because they are available for "free" (without market prices).

Properly assessing and valuing natural capital (both stocks and ecosystem services) and capturing that value in a natural-capital accounting framework can provide decision makers with essential information about the trade-offs involved in development decisions. They will thus become more aware of the socioeconomic implications of their countries' use (or potential use) of natural capital, and better able to make informed decisions on that use—by whom, where, and to what extent.

Actions to increase investments in natural capital should seek to maximize socioeconomic co-benefits

If properly designed and implemented, strategic investments in natural capital can be a means of tackling pressing environmental and social issues, such as climate change and energy, food, and water security. Such investments can encourage inclusive and sustainable growth, thereby supporting the livelihoods of the rural poor and increasing their access to economic opportunities. For example, PES schemes can encourage the rural poor to practice conservation by offering them incentives to do so. Land tenure reforms, especially those targeting marginalized groups, can stimulate local investment in courses of action that increase both productivity and resilience to climate change.

A guiding framework can help high-level policy makers provide enabling conditions for natural-capital investment

A holistic framework can help policy makers develop policies to promote investments in protecting and enhancing natural assets, improving the efficiency of resource use, and mitigating the impact of economic activities on natural capital.

Increasing investment in natural capital requires four enabling conditions:

- political support for natural capital and recognition among policy makers, organizations, and individuals that natural capital is an essential part of long-term prosperity;
- the inclusion of natural-capital accounting in regulations, incentives, and market instruments to provide economic signals for the sustainable management of natural capital;
- public and private financing for programs to increase natural capital; and
- tools to support decisions on natural capital–friendly policies and investments.

Governments, the private sector, development cooperation agencies, and other stakeholders can take action to put the GMS natural-capital investment framework into operation

The following measures are recommended:

- Identify key policy and planning processes at the regional and national levels that could significantly increase investment in natural capital.
- Support the development of the underlying legal and institutional systems.
- Tailor messages on natural-capital investment to decision makers so as to establish the relevance of such investment to dealing with the major development challenges facing the GMS.
- Build technical capacity to develop and deploy valuation and mainstreaming tools and approaches, such as natural-capital accounting, valuation, and strategic environmental assessment.
- Foster science–policy links to increase the relevance of assessment and research.
- Confirm the benefits of natural capital through frameworks that address, among other things, the links between energy, food, and water security and ecosystem-based approaches to climate-change adaptation and mitigation.
- Mobilize public sector and private sector investment by strengthening fiscal and economic instruments targeting high-priority landscapes with rich natural capital and the supply chains for key commodities.

Introduction

This report, *Investing in Natural Capital for a Sustainable Future in the Greater Mekong Subregion* was originally produced by the Environment Operations Center (EOC) as a meeting document for the of 4th Greater Mekong Subregion Environment Ministers' Meeting (EMM4), 27–29 January 2015 in Nay Pyi Taw, Myanmar. The report aims to demonstrate the compelling need to increase investments in natural capital in the Greater Mekong Subregion (GMS). It describes the importance and status of natural capital in the GMS and identifies actions now being taken at the regional and country levels to manage natural capital. It also proposes a guiding framework for investment promotion and for actions by GMS countries to secure natural capital and thus ensure sustainable and inclusive growth in the GMS.

The target audiences of this report are policy makers in GMS countries, who can create the enabling conditions for increasing investments in natural capital. These include public sector and private sector decision makers, who can harness such investments; development partners, who can provide technical and financial assistance to GMS countries; the academic and research communities, which can address the need for further analysis; and civil society groups, which can mobilize investments, especially at the grassroots level.

The report is based on data and text generously contributed by international and regional development partners. GMS countries also provided valuable information for the report through their responses to country questionnaires about the status of their efforts to manage natural capital.

Steve Griffiths, ADB

Chapter 1. Natural Capital: What It Is and Why It Is Important in the Greater Mekong Subregion

Key Messages

Natural capital underpins the socioeconomic development of the GMS countries and the achievement of inclusive and sustainable growth in the subregion

Natural capital, which accounts for 20%–55% of the total wealth of the countries in the Greater Mekong Subregion (GMS), has been a key contributor to the rapid economic growth achieved in the subregion in the past 3 decades. Agriculture (including forestry) accounts for about 30% of gross domestic product (GDP) in Cambodia, the Lao People's Democratic Republic (Lao PDR), and Myanmar and is the main source of employment in the GMS, engaging between 38% of the labor force (in Thailand) and 74% (in the Lao PDR). The Mekong River supports the world's largest inland fishery, with an annual turnover of $1.4 billion–$3.9 billion. Natural capital also supports the manufacturing and service sectors—such as the thriving furniture industry in Viet Nam, the world's sixth-largest exporter of furniture, and tourism, which contributes about 17% of GDP in Yunnan Province, the People's Republic of China (PRC). Natural capital contributes even more substantially to the GDP of the poor in the region: more than 60 million people (mostly rural poor) depend directly on natural capital for their daily energy, food, water, and income needs.

Natural capital is critical for maintaining the resilience of GMS countries to natural and human-induced shocks and for ensuring energy, food, and water security in the subregion

The GMS is highly vulnerable to climate change, particularly in its extensive low-lying coastal areas, which are also among the world's most productive agricultural lands and fisheries. Projections of temperature and rainfall under climate-change scenarios suggest that critical thresholds for many crops in the Lower Mekong Basin will be exceeded by 2050. Ecosystems, such as watersheds, wetlands, mangroves, and coastal dunes, provide invaluable regulatory services that buffer the impact of extreme weather events, such as storms and droughts. Natural capital is crucial, therefore, for energy, food, and water security in the GMS. Historically, rural communities have depended on nature (e.g., forests and wetlands) for subsistence as part of strategies for coping with and recovering from both natural and human-induced shocks.

The existing development approach is unsustainable, causing losses in natural capital that threaten future prosperity

Development in the GMS continues to undervalue the contributions of natural capital to human well-being and treats ecosystem services as economically "invisible." Natural capital has been overexploited as a result, and arable lands, forests, and water resources have been degraded or destroyed. Natural-capital losses in the GMS are valued at 10%–12% of GDP per year.

Adopting a natural-capital approach to decision making will promote increased investment in natural capital in the GMS

A natural-capital approach is the economic reflection of the value that natural assets and services contribute to human economies. Recognizing and valuing natural capital (both stocks and ecosystem services) for its economically valuable flows of ecosystem services represents a fundamental shift away from conventional approaches to natural resource management. Countries come to appreciate better the socioeconomic implications of their use of natural capital and can thus make more balanced and effective decisions on such use—by whom, where, and to what extent.

The GMS urgently needs to scale up investments to protect and restore its natural capital

GMS governments need to prioritize the scaling up of investments in natural capital—and provide enabling conditions for these—to fully harness the gains of future development and to mitigate threats to economic and social well-being. With impressive economic growth rates set to continue, the demand for natural capital will increase, as will the attendant pressures. Conservation efforts must receive more investment support. At the same time, much greater emphasis must be placed on tempering the negative effects of economic growth.

Actions to increase investments in natural capital should seek to maximize socioeconomic co-benefits

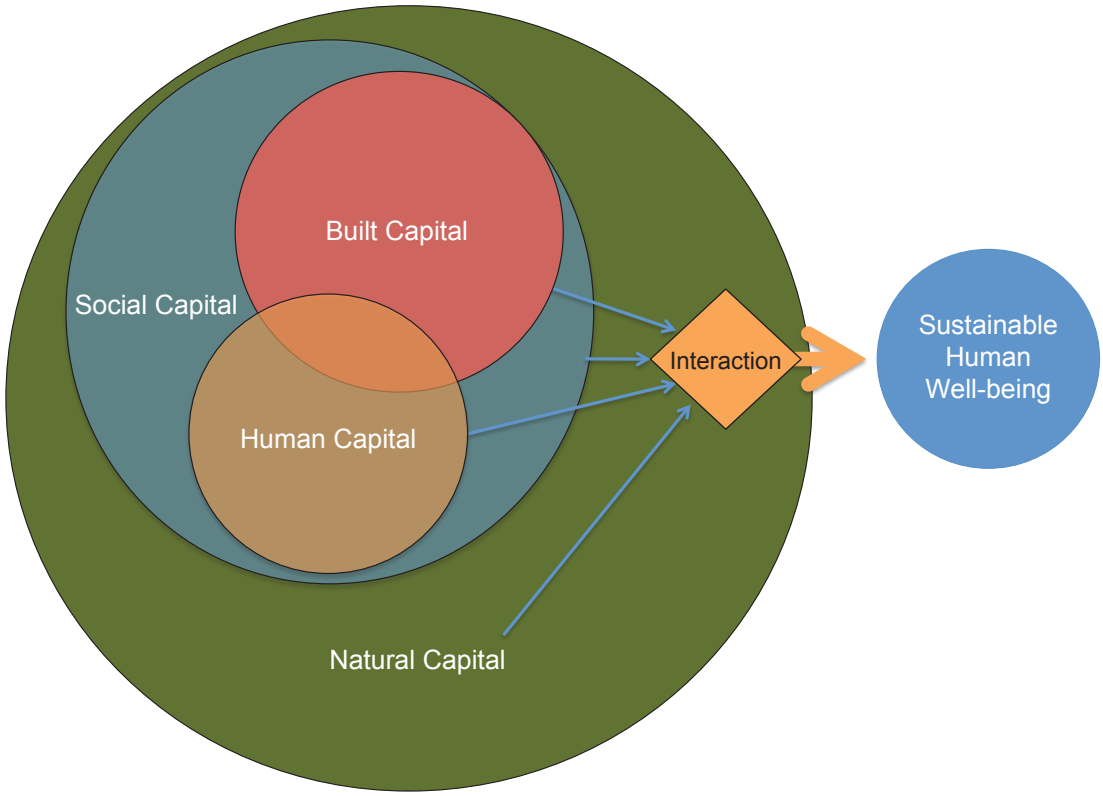
If properly designed and implemented, strategic investments in natural capital can be a means of tackling pressing environmental and social issues, such as climate change and energy, food, and water security. Such investments can encourage inclusive and sustainable growth, thereby supporting the livelihoods of the rural poor and increasing their access to economic opportunities. Schemes involving payments for ecosystem services, for example, offer incentives to the rural poor to practice conservation, and land tenure reforms, especially those targeting marginalized groups, can boost local investment in productivity and resilience to climate change.

1.1 What is Natural Capital?

Natural capital is the collection of ecosystem assets that, in combination with built, human, and social capital,[1] generates a flow of services essential for sustaining socioeconomic development and supporting human well-being (Costanza and Daly 1992) (Figure 1.1). Natural capital includes both living plants and animals, and nonliving components of nature, such as water and minerals. The flow of ecosystem services from ecosystem assets generates streams of benefits (Costanza et al. 1997; Millennium Ecosystem Assessment 2005), such as food, water, recreational and cultural benefits, pollination, climate regulation, air quality regulation, and disease control (a more complete list can be found in Figure 1.2). To ensure that these ecosystem services continue to sustain human well-being and life on earth, the underlying natural-capital asset base must be preserved.

[1] An example of *built capital* is economic infrastructure, such as highways and water irrigation systems. *Human capital* refers to an individual's knowledge, talent, and ability, which enables him or her to attain economic and social well-being. *Social capital* refers to relationships between individuals, such as trust, sense of community, and solidarity.

Figure 1.1: Built, Social, Human, and Natural Capital Interacting to Produce Human Well-being



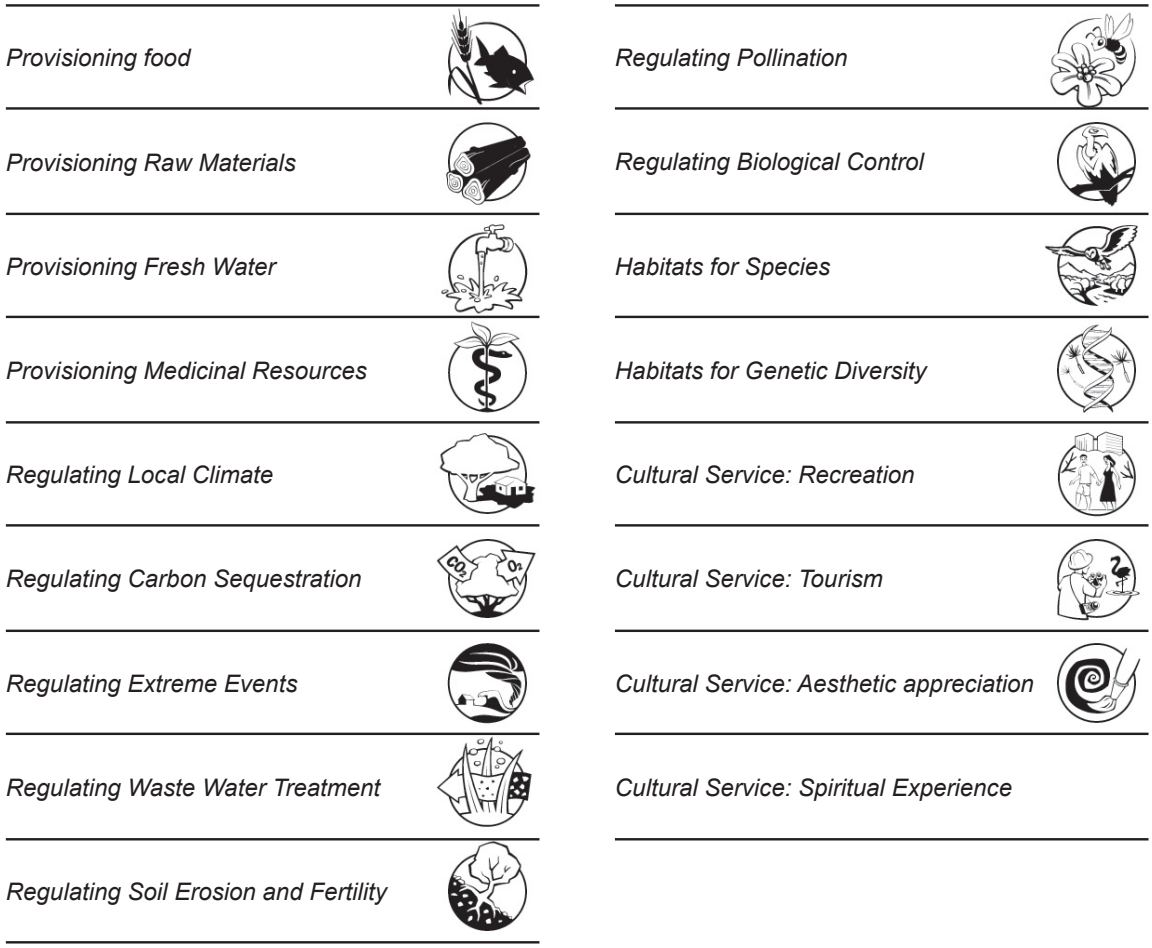
Source: Costanza et al. (2014).

The integral role of natural capital in the overall wealth of a nation has gained wider currency since the publication of the World Bank report "Where Is the Wealth of Nations?" not long after the Millennium Ecosystem Assessment in the middle of the last decade. That report contained a "millennium capital assessment" and advocated the inclusion of natural resource investment and management in the economic development strategy of every country as a fundamental element. Economic development, according to the report, is a process of managing a portfolio of asset classes, including natural capital. Finance ministries must therefore "[develop] a comprehensive agenda that looks at natural resources as an integral part of their policy domain" (World Bank 2006).

Until recently, the value of ecosystem services produced by natural assets was largely invisible in economic and financial decisions, and nature's services were often viewed as "free" or "public goods." Now there is growing recognition in both the public and private sectors that natural-capital assets give rise to economically valuable goods and services. Natural capital has been equated with other forms of capital (built, social, and human) and a strong case has been made for maintaining and investing in natural capital to sustain inclusive growth and enhance human well-being.

Natural capital undergoes valuation to recognize, assess, and, if appropriate, capture its economic value and thus improve understanding of the socioeconomic significance of its use. More balanced and effective decisions can then be made about which natural capital can be used and how much of it, for what purposes, and by whom. Economic valuation can also help determine appropriate rewards for the custodians of natural capital and the costs to be imposed on users. But its primary purpose is to enable comparisons and make the trade-offs more explicit (Costanza et al. 2014). It is not the same as monetization, commodification, or privatization and does not suggest that natural capital can be fully priced or that it should be traded.

Figure 1.2: What Are Ecosystem Services?



Source: TEEB (2010a).

1.2 Global Importance of Natural Capital

1.2.1 Natural capital is a fundamental asset for survival and development

Natural capital and its ecosystem services provide significant economic benefits. For example, the total economic value of pollination worldwide was estimated at €153 billion per year in 2005, or 9.5% of total agricultural output that year (Gallai et al. 2009). An estimated 25%–50% of the value of the pharmaceutical market in 2000 ($640 billion) was derived from genetic resources. Also in 2000, ecosystem services contributed $400 billion to the timber industry, $80 billion to marine fisheries, and $57 billion to marine aquaculture (Millennium Ecosystem Assessment 2005). The total contribution of ecosystem services to human well-being—believed to be at least $124 trillion per year—far exceeds the global gross domestic product (GDP), which was $84 trillion in 2012 (Costanza et al. 2014). However, the interlinkages between natural capital and economic development are typically undervalued or invisible in traditional indicators of economic growth, such as GDP (TEEB 2010b). GDP growth tends to rely on the depletion of natural capital or its replacement with other forms of capital (TEEB 2011).

1.2.2 Natural capital underpins energy, food, and water security

Various analyses have demonstrated the importance of natural capital in ensuring energy, food, and water security and reducing poverty (TEEB 2011). Most rural households depend on access to land, water, and forests for farming, fishing, bioenergy production, and the collection of non-timber forest products.

Renewable energy worldwide has the potential to provide low-cost electricity to 1.6 billion people who lack electricity (UNEP 2011), thereby reducing their dependence on conventional fuels (such as kerosene) that are damaging to both human health and the environment. Women are disproportionately affected by a lack of electricity in rural areas because they bear most of the responsibility for household activities that can be done faster with electricity. Women, as well as children, are also much more likely to endure the effects of indoor pollution from inefficient biomass and coal stoves. Such pollution is projected to contribute to more than 1.5 million premature deaths per year by 2030 (UNEP 2011).

Another global challenge is ensuring food security in the face of climate change for a population projected to reach 9 billion people by 2050, while minimizing and mitigating damage to ecosystems (UNEP 2011). Today, the food security of 2.5 billion people, almost 40% of the world's grain production, and almost one-quarter of the global economy are at risk because of unsustainable water use (Veolia Water North America and IFPRI 2013). More than 70% of the freshwater consumed throughout the world is used in farming, which contributes more than 13% of greenhouse-gas (GHG) emissions worldwide and leads to 3–5 million cases of pesticide poisoning and 40,000 related deaths each year (Veolia Water North America and IFPRI 2013). The use of pesticides is increasing. In Cambodia, 1.3 million liters of pesticides were applied in and around the Tonle Sap Lake in 2000, and this volume is likely to have grown considerably since then (Ek 2013). The widespread use of chemical fertilizers, while increasing yields in the short term, is expected to decrease agricultural productivity in the long term because of severe groundwater degradation, soil infertility, and diminished crop diversity (GIST 2013). Unsustainable farming has major long-term implications for water supplies, soil health and productivity, and the ability of countries to grow enough safe food.

A drop in agricultural productivity could have major implications for women, who are often responsible for food production and overall household food security and nutrition. In Cambodia, women compose 65% of the farming population (ADB 2012a); in Myanmar,

the agriculture sector is the biggest employer and provides half of all employment for women in the workforce (UNDP 2011). Significantly reduced ecosystem services and agricultural yields would decrease the earning capacity of women and their ability to feed their families.

1.2.3 Poor people rely mainly on natural capital for their living

A measure known as "GDP of the poor," an indicator of household income in rural and natural asset–dependent communities, illustrates the critical dependence of rural households—especially the poor—on natural capital (TEEB 2011). The contribution of ecosystem services to "classical" GDP is generally relatively low. Such services account for 21% of GDP in Indonesia, 16% in India, and 10% in Brazil. But their contribution to the GDP of the poor is much higher: 75% in Indonesia, 47% in India, and 89% in Brazil (TEEB 2011). The GDP of the poor in the GMS, however, has not yet been assessed.

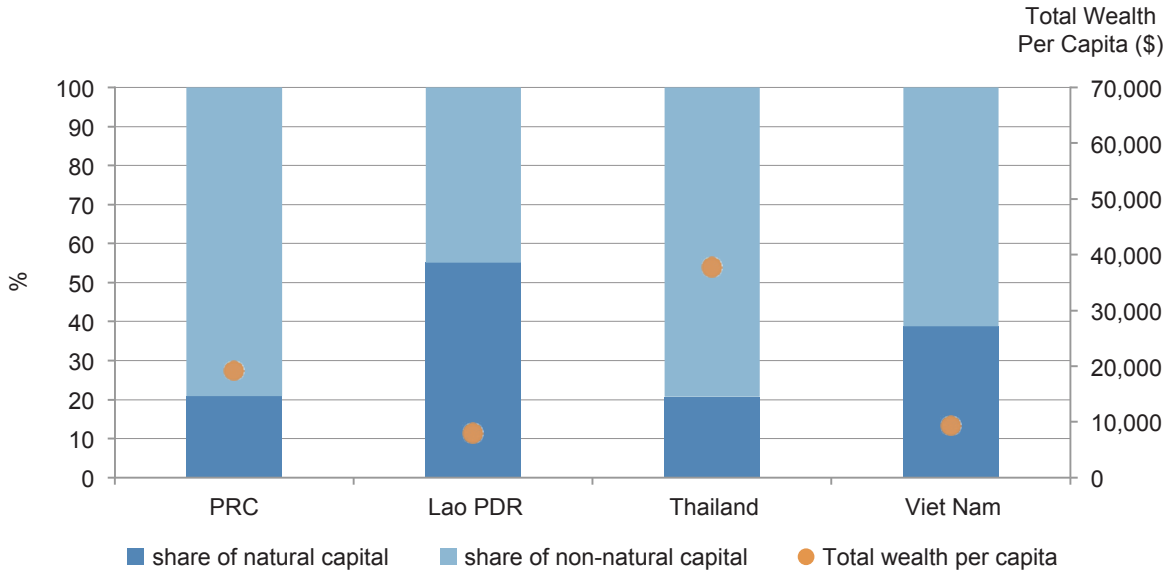
Policies to reduce poverty, improve health and education services, and raise the status of women are likely to be most effective if the income sources of the poor are protected. Policy makers must therefore be mindful of the heavy reliance of rural households on ecosystem services.

1.3 Importance of Natural Capital in the Greater Mekong Subregion

The GMS comprises Cambodia, the People's Republic of China (PRC) (specifically Yunnan Province and Guangxi Zhuang Autonomous Region), the Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand, and Viet Nam. The Mekong River—the world's twelfth-longest river and second only to the Amazon River in fish biodiversity—is the defining feature of the GMS, which is rich in various forms of natural capital, such as biodiversity, coal, forests, land, natural gas, oil, subsoil minerals, and water. Maintaining and, where possible, increasing natural capital is critical for all GMS countries and their citizens. Some of the reasons for this are discussed below.

Natural capital contributes a significant proportion of the total economic wealth of GMS countries (Figure 1.3), ranging from about 20% in the PRC (entire country) and Thailand to 55% in the Lao PDR (World Bank n.d.[a]).

Figure 1.3: The Contribution of Natural Capital to the Total Wealth of GMS Countries (2005)



GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Notes: No available data on Cambodia and Myanmar. Natural capital is calculated as the sum of the value of crop and pasture land, timber and non-timber forest products, protected areas, oil, natural gas, coal, and minerals. Non-natural capital is the sum of the value of net foreign assets, produced capital, and intangible capital.
Source: World Bank (n.d.[a]).

1.3.1 Natural capital underpins energy, food, and water security and rural livelihoods

Natural capital is crucial for energy, food, and water security in the GMS and for the livelihoods of millions of people in the countryside. Of the total population of 333 million people in the subregion, more than 60 million (mostly rural poor) depend directly on natural capital for their daily energy, food, water, and income needs (ADB and WWF 2012).

About 54–60 million people in the Lower Mekong Basin (LMB)[2] grow rice for income and consumption; worldwide, 100 million people consume rice grown in the GMS (FAO 2012a). Fisheries provide 47%–80% of the subregion's animal protein intake (the Mekong River is the world's most productive freshwater natural-capture fishery).

While more than 80% of Cambodian and the Lao PDR households depend on biomass for cooking and lighting (ADB 2012b), the Mekong River and its tributaries have enormous potential for hydroelectricity generation, estimated at 229 gigawatts annually (ADB 2012b). But the competing demands on water resources (from agricultural, energy, industrial, and urban uses) pose significant challenges to water security in the subregion. Agriculture, as might be expected, is the largest water user in all GMS countries, accounting for 68%–98% of total withdrawals (IWMI and WorldFish Center 2010).

Many low-income groups derive significant income from forests. Between 40% and 90% of incomes in the Lao PDR come from non-timber forest products (UNDP 2001, Foppes and Phommasane 2005).

[2] The LMB countries are Cambodia, the Lao PDR, Thailand, and Viet Nam.

1.3.2 Natural capital supports key economic sectors

Natural capital supports primary sectors, such as agriculture, fisheries, forestry, and mining. Agriculture is a major employer in all GMS countries, hiring between 38% (in Thailand) and 74% (in the Lao PDR) of the labor force (ADB 2011a). It contributes 30% of GDP in Cambodia, the Lao PDR, and Myanmar, and employs 65%–70% of the workforce in Cambodia and the Lao PDR (ADB 2011a). The Mekong River sustains the world's largest inland fishery, with annual turnover of $1.4 billion–$3.9 billion (WWF 2013a).

Natural capital also supports many fast-growing manufacturing and service sectors. Using timber grown locally and in nearby countries, Viet Nam has become the world's sixth-largest furniture exporter and Southeast Asia's second largest (Vietnam Trade Promotion Agency, n.d.). The tourism sector, based largely on the subregion's natural scenic beauty, contributes almost 17% of Yunnan Province's GDP (Yunnan Statistical Bureau 2013).

1.3.3 Natural capital is vitally important for climate resilience

Natural capital provides critical ecosystem services that have traditionally enabled local communities to cope with crises, including those related to climate change. In addition to flood management, drought control, and related courses of action, communities have crafted subsistence and crisis survival strategies around forests and wetlands.

Studies have shown that ecosystem-based approaches—such as the conservation and restoration of forests, wetlands, and peatlands; marine conservation; improved grassland management; and environmentally sound agricultural practices—are cost-effective responses to climate change. A comparative analysis of flood protection measures for a flood-prone area of Viet Nam, in anticipation of a 12-centimeter rise in sea level by 2020, found that building a system of sea dikes would cost about D138.8 million per person, compared with only D1.7 million per person for a reforestation and conservation program (WWF and World Bank 2013).

Box 1.1: Link Between the Loss of Natural Capital, Environmental Hazards, and the Economy: The 2011 Thailand Floods

The 2011 floods in Thailand had devastating impact. The collapse of the supply chains for automobiles and computers, with estimated total economic damage and losses amounting to $48 billion, has been well documented (World Bank 2011). The floods also interrupted the flow of remittances from migrant workers, largely from Cambodia and Myanmar, to their home countries.

The 2011 floods occurred because of heavy rainfall in the northern parts of the Chao Praya Basin in Thailand and the failure of various water and flood management systems—including reservoirs and flood protection. However, the underlying causes have historical and ecological roots related to the loss of forest cover in upper watersheds and the conversion of land in the lower parts of the floodplain into residential housing and industrial estates. Thailand's experience attests to the long-term consequences of investment decisions that inadequately consider risks related to climate and the depletion of natural capital. Given that such shocks and crises are likely to occur with greater intensity and regularity in the future, the costs of poor investment decisions will rise unless greater attention is paid to climate-related risks and the restoration of natural-capital assets.

Source: World Bank (2011).

1.4 Status of Natural Capital in the Greater Mekong Subregion

Natural capital in the GMS is under increasing pressure from rapid and often poorly planned development, continued high population growth, the changing consumption patterns of an emerging middle class, and increased market linkages beyond the subregion. Climate change presents an unprecedented challenge for GMS countries and especially their large rural populations. The subregion's long coastline, low-lying coastal areas, and large river deltas are vulnerable to higher sea levels and more frequent and severe storms (Box 1.1). This section gives an overview of the status of the three most important renewable natural-capital asset classes in the GMS—agricultural land, forests, and water.

1.4.1 Agricultural land in the Greater Mekong Subregion

Status and drivers of change

Agriculture takes up a significant part of the land area of GMS countries, ranging from about 11% in the Lao PDR to 56% in the PRC. The proportion of land under agriculture increased in all GMS countries except the PRC from 2000 to 2012 (Table 1.1). Agriculture generates 34% of GDP in Cambodia, 31% in Myanmar, 28% in the Lao PDR, 18% in Viet Nam, and 11.1% in Thailand. The main agricultural commodities produced in the GMS are cassava, fruit, maize, rice, sugarcane, and vegetables.

Agriculture in the GMS has shifted away from traditional subsistence toward modern commercial farming to meet growing regional and global demand. Agricultural production increased significantly in all GMS countries (and in Guangxi and Yunnan provinces in the PRC) from 2000 to 2010 (Figure 1.4). The production of commodities such as rice, oil crops (groundnut, sesame, soybean, and sunflower), and coarse grains (maize, millet, and sorghum) more than doubled from 1990 to 2010, outpacing consumption growth in the subregion (FAO 2012b).

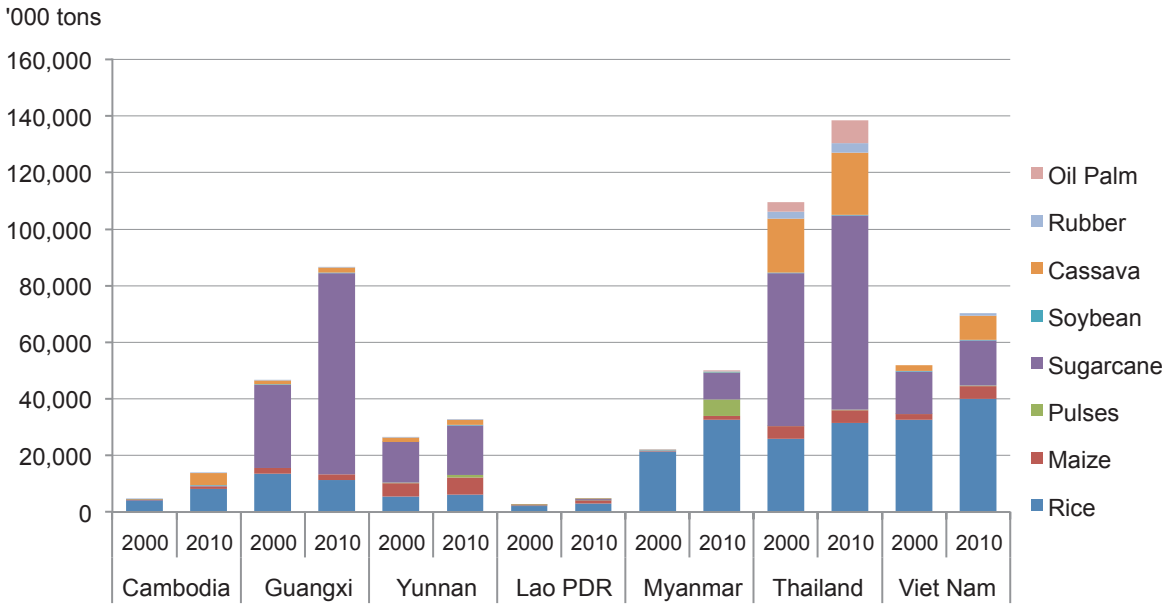
Increasing demand for protein-rich food is also driving the expansion of agricultural land in the GMS. In Guangxi and Yunnan provinces in the PRC, rising meat consumption is heightening pressure on natural capital (PRC Ministry of Environmental Protection 2013).

Table 1.1: Agricultural Land as a Proportion of Total Land Area and Its Contribution to GDP in GMS countries, 2000–2012

	% of total land area					% of GDP
Country	2000	2005	2010	2011	2012	2012
Cambodia	27.0	30.3	32.0	32.0	32.6	34
PRC (entire country)	55.6	56.1	55.6	55.7	54.8	10
Lao PDR	8.02	8.70	10.3	10.3	10.7	28
Myanmar	16.5	17.2	19.2	19.2	19.3	31
Thailand	38.8	38.4	41.2	41.2	42.8	11
Viet Nam	28.2	32.4	34.7	35.0	35.0	18

GDP = gross domestic product, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Source: World Bank (n.d.[b]).

Figure 1.4: Production of Major Crops in the GMS, 2000 and 2010

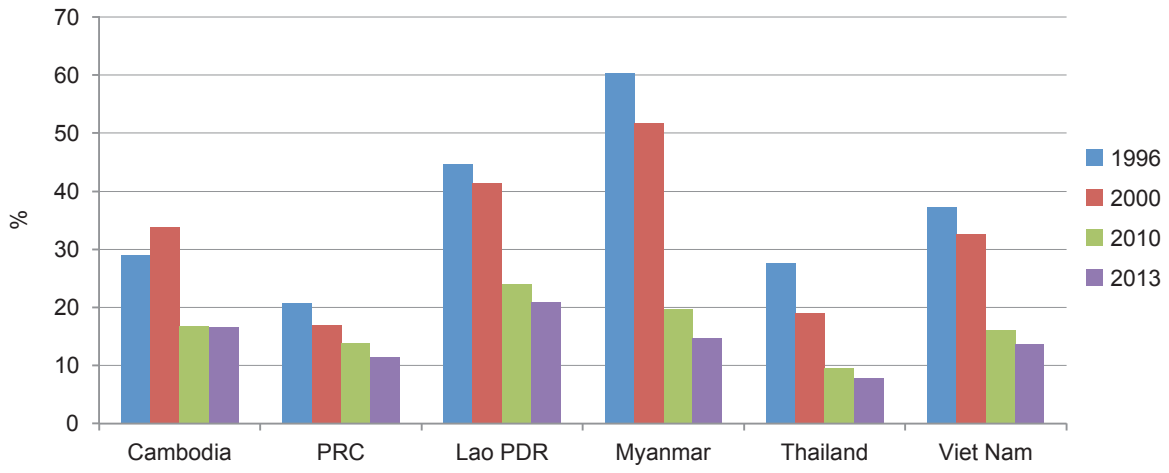


GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic.
Notes: Unavailable data on pulse production in 2000 for Guangxi (in the PRC) and Myanmar; on pulse production in 2010 for Guangxi; on sugarcane production in 2000 for Myanmar; on rubber production in 2000 for the Lao PDR and Viet Nam; and on rubber production in 2010 for the Lao PDR.
Source: FAO (n.d.[a]).

Besides increasing the land area under cultivation, rising demand for food in the GMS has encouraged agricultural intensification, large-scale monoculture farming, and the extensive use of agrochemicals. Such practices have caused significant damage to soil quality, shrunk productive farmland, and increased health risks to farmers and consumers. An estimated 10%–40% of arable land in the GMS is degraded (ADB 2013a). In Yunnan, 7.22 million ha—about 47%—of available grazing land is classed as moderately to severely degraded (UNEP and TEI 2007). Farming has become more costly, and poor farmers earn and benefit less.

Food security strategies in the GMS tend to focus on the quantity of the food supply and to disregard nutrition and food safety. Despite an increase in overall crop production due to the use of high-yielding varieties and the intensified application of agrochemicals and other input, agriculture feeds only 60% of the GMS population. About 20% of the people in the GMS live below the poverty line and 15% are undernourished (Mekong River Commission n.d.), indicating a need to make nutritious food more accessible to communities. Although the proportion of undernourished people has decreased since 1996 (Figure 1.5), in 2013, it was still above 10% in all GMS countries except Thailand; in the Lao PDR it was above 20%.

Figure 1.5: Undernourished Population in the GMS, 1996–2013



GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Sources: FAO (n.d.[b]); ADB (2014b).

Food safety in parts of the GMS is at risk. Heavy metals, such as cadmium released from mines and factories, have polluted rice fields in key rice-growing regions in the PRC and in some provinces of Thailand. In the PRC, investigations have found moderate to severe pollution caused by heavy metals, pesticides, and other toxins on 3.3 million ha of agricultural land (PRC Ministry of Environmental Protection 2013).

Impact of climate change on agricultural land

Agriculture is highly sensitive to climate change. Some of the risks facing the sector are lower yields due to heat stress, saltwater intrusion into cropland caused by rising sea levels, and increased drought, flooding, wind and soil erosion, and incidence of pests and diseases. Climate change may marginalize some crops in certain areas, while widening the range of other crops and raising their productivity.

A recent thorough assessment of climate change in the LMB projected higher temperatures and reduced rainfall beyond suitability thresholds for many crops by 2050, under several climate-change scenarios. The flowers of traditional rain-fed rice, for example, become sterile at temperatures higher than 35°C. By 2050, maximum temperatures in many areas of the LMB—such as Gia Lai in Viet Nam's Central Highlands—are projected to exceed this threshold during the growing season, significantly lowering rice yield if proper adaptation measures are not taken (USAID 2013). Modeling indicates that climate change will make land in the LMB less suitable for rubber and coffee, to the likely detriment of large rubber plantations in eastern Cambodia, southern Lao PDR, and Viet Nam's Central Highlands.

1.4.2 Forests in the Greater Mekong Subregion

Current status and drivers of change

Rapid development of infrastructure, such as trans-boundary economic corridors and large hydroelectric power plants, has cut wide swaths through the forests of the GMS. Remaining natural forests and their globally important biodiversity, and many endangered species, are under pressure. Dependence on primary industries, especially agricultural plantations, for economic growth is high, and there is a large transnational commercial market for wildlife hunting.

A leading driver of forest conversion in the GMS is the expanded cultivation of cacao, cashew, coconut, coffee, rubber, tea, and other cash crops. The area of rubber plantations doubled between 1990 and 2005, and large tracts of forest in the Lao PDR, Cambodia, and Thailand and in Viet Nam's Central Highlands were cleared to make way for the expansion. Oil-palm plantations in southern Myanmar and southern Thailand have contributed to extensive forest conversion (FAO 2011). In upland areas of northern and central Myanmar, northern Lao PDR, and Thailand, shifting cultivation has created sprawling mosaics of secondary forest on steep slopes. In Cambodia and Viet Nam, the conversion of a significant area of mangroves into shrimp ponds has exposed coastal areas to increased flooding, storm surges, and erosion.

Unclear land tenure and weak governance make forest conversion difficult to control. The GMS (excluding the two PRC provinces) lost just under one-third of its forest cover from 1973 to 2009 (WWF 2013a). From 1990 to 2010, the GMS (excluding Viet Nam, where forest cover expanded during the period) lost more than 12.5 million ha of forest—an area almost half the size of the Lao PDR (FAO 2011).

Myanmar has the largest forest area among the GMS countries (including Guangxi and Yunnan in the PRC), but the Lao PDR has the highest percentage of forest cover (Table 1.2). From 1990 to 2012, Cambodia experienced the highest percentage of forest loss, followed by Myanmar and the Lao PDR (Box 1.2). Throughout the subregion, primary forest—rich in biodiversity and providing important ecosystem services—continues to be lost at high rates and has almost completely disappeared (FAO 2011). Viet Nam had a 13% increase in forest area as a percentage of total land area from 1990 to 2012, largely as a result of the reforestation of 4.6 million ha of degraded hilly land, but the country is still losing its primary forests at a high rate. The area of primary forest has fallen to 322,000 ha in Cambodia and a mere 80,000 ha in Viet Nam (FAO 2011).

Table 1.2: Total Forest Cover in the GMS, 1990–2012

Country	Forest area ('000 ha)					Forest cover, 2012 (%)	Change, 1990–2012 ('000 ha)
	1990	2000	2005	2010	2012		
Cambodia	12,944	11,546	10,731	10,094	9,967	57	–2,977
Lao PDR	17,314	16,532	16,142	15,751	15,672	68	–1,642
Myanmar	39,218	34,868	33,321	31,773	31,463	48	–7,755
Thailand	19,549	19,004	18,898	18,972	18,987	37	–562
Viet Nam	9,363	11,725	13,077	13,797	13,941	42	4,578
PRC Guangxi	n/a	9,819	12,525	13,427	12,525	53	n/a
PRC, Yunnan	n/a	12,873	15,600	18,177	18,177	46	n/a
Total GMS (excluding Guangxi and Yunnan)	98,388	93,675	92,169	90,387	90,030		–8,358
Total	**98,388**	**116,367**	**120,294**	**121,991**	**120,732**		**22,344**

n/a = data not available, GMS = Greater Mekong Subregion, ha = hectare, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Source: FAO (2012b).

Box 1.2: Forest Conversion Hotspots in the Greater Mekong Subregion

Studies published in 2006 and 2007 identified major hotspots (areas of intensive activity) of forest conversion and canopy cover loss in Myanmar and smaller hotspots in Cambodia, the Lao People's Democratic Republic (Lao PDR), and Viet Nam. In a large area in northern Thailand, many small patches of land-use change, including encroachment into protected areas, were observed (Stibig et al. 2007, Lakanavichian 2006). Most forest-conversion hotspots in Cambodia, the Lao PDR, Myanmar, and Viet Nam, were in evergreen and semi-evergreen forests in hilly zones and mountain ranges, but deforestation was also observed in evergreen and deciduous lowland forests in Cambodia, central and southern Lao PDR, central Myanmar, and central Viet Nam. Forest-conversion hotspots were common in border areas, such as the border between Myanmar and the People's Republic of China (Yunnan); between Cambodia, the Lao PDR, and Viet Nam; and between Cambodia and Thailand (Stibig et al. 2007).

Source: Authors.

The GMS is rich in plant and animal species (Table 1.3), many of which are endemic to the subregion. More than 430 terrestrial mammal species (16% endemic), 1,200 bird species (10%), and 500 species of reptiles (38%), are known in the GMS, but recent discoveries of new species indicate that biodiversity may be even richer (Critical Ecosystem Partnership Fund 2011). The subregion is also home to 16 of the world's 200 ecoregions, whose huge biodiversity is indicated by the discovery of more than 1,000 species in 1997–2007 (Wikramanayake et al. 2011).

Despite this diversity, many forests in the GMS are "empty" because of intense and widespread wildlife hunting and ongoing habitat loss. Protected wildlife species are poached for the international market, where demand is strong. Globally important populations of endangered and endemic species have been decimated. Tigers and elephants, two of Asia's most iconic species, have been poached to near-extinction in the GMS. In southern PRC and Viet Nam and in the Eastern Plains Landscape of Cambodia and Viet Nam, the tiger may now be extinct. A third iconic species, the Javan rhinoceros, is thought to be extinct in the subregion;[3] poachers shot the last known individual of the species in Cat Tien National Park, Viet Nam, in 2010.[4]

Table 1.3: Number of Plant, Mammal, and Bird Species in GMS Countries and Number of Threatened Species

Country	Higher plant species		Mammal species		Bird species	
	Total	Threatened	Total	Threatened	Total	Threatened
Cambodia	2,308	30	123	37	545	24
Guangxi, PRC	8,562	Unknown	131	Unknown	543	Unknown
Yunnan, PRC	17,000	151	259	Unknown	793	Unknown
Lao PDR	412	23	282	45	700	23
Myanmar	7,000	44	251	45	1,056	43
Thailand	12,000	96	302	57	928	46
Viet Nam	11,494	147	310	54	840	43

GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Sources: Cambodia Ministry of Environment (2010), the Lao PDR Government (2010), Myanmar Ministry of Forestry (2009), Thailand Ministry of Natural Resources and Environment (2009), Viet Nam Ministry of Natural Resources and Environment (2008), Yunnan Bureau of Statistics (2011), and Guangxi Forestry Department (2011).

Impacts of forest loss

Forest loss, fragmentation, and degradation threaten many forest-dwelling and forest-dependent wildlife species in the GMS. If current trends continue, by 2030, it is estimated that only 14% of forests in the GMS will be large enough to support viable populations of large animal species, such as the tiger and the Asian elephant (WWF 2013a). Many smaller forest-dwelling species endemic to the GMS also require immediate conservation attention.

[3] http://www.iucnredlist.org/details/19495/0 (accessed 5 December 2014).
[4] http://wwf.panda.org/what_we_do/endangered_species/rhinoceros/asian_rhinos/javan_rhinoceros/ (accessed 6 December 2014).

Recent research in Thailand showed that the loss of birds and mammals from a forest due to excessive hunting compromises the regeneration of certain tree species that depend on these animal species to spread their seeds and fruits (Caughlin et al. 2014). Other research has shown that the loss of even one pollinator species can compromise forest health and function (Brosia and Briggs 2013).

The value of forest ecosystem services in the LMB, such as soil erosion control and carbon storage, is estimated at $64.19 billion per year (WWF 2013b). The total value of three biodiversity conservation corridors[5] in the GMS countries and the ecosystem services they provide has been estimated at more than $9 billion per year (ADB GMS-EOC, 2011; Table 1.4). Forests in the GMS generate a significant proportion of the subregion's GDP, as shown in Figure 1.6 for the timber component of forest production. Non-timber forest products are estimated to provide about half the annual incomes (of about $600) of rural households in or near protected areas (PAs) in Viet Nam's Central Annamite mountains.

Table 1.4: Value of Ecosystem Services in GMS Biodiversity Corridors

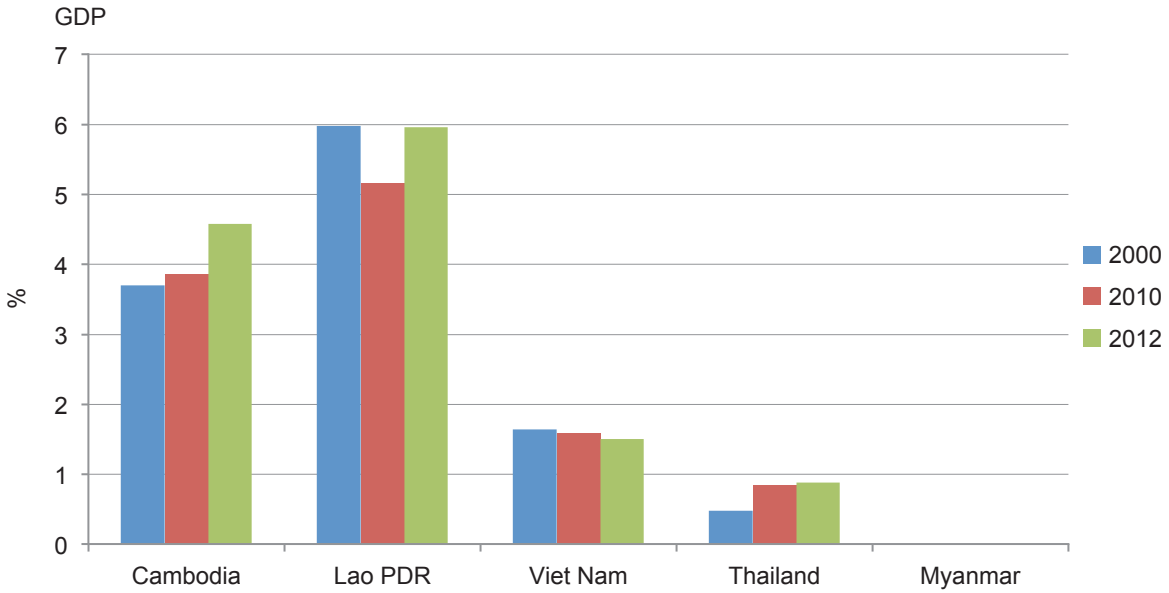
Ecosystem service	**1,560,236 ha Cardamom Mountains and Eastern Plains Dry Forest, Cambodia** ($'000)	**417,660 ha Tri-border Forest, Lao PDR** ($'000)	**360,748 ha Central Annamites, Viet Nam** ($'000)	**Total value of ecosystem services on 2,338,644 ha total area** ($'000)	**Unit value** ($/ha)
Non-timber forest products	4,200	2,958	1,694	8,852	3.79
Carbon storage	2,720,110	770,815	751,714	4,242,639	1,814.14
Watershed production	1,016,843	284,222	510,934	1,811,998	774.81
Water quality regulation	1,588,817	299,765	407,725	2,296,307	981.90
Soil erosion control	622,730	158,673	143,984	925,386	395.69
Total value	**5,952,700**	**1,516,433**	**1,816,050**	**9,285,183**	**3,970**

GMS = Greater Mekong Subregion, ha = hectare, Lao PDR = Lao People's Democratic Republic.
Source: ADB GMS-EOC (2011).

Population pressure is a major determinant of deforestation in the GMS, especially in Cambodia, the Lao PDR, and Viet Nam (Dasgupta et al. 2005), but the situation is complex. A study in Viet Nam showed that shifting cultivators—often blamed for deforestation—were forced into new forest areas by the expansion of perennial commodity crops, such as coffee, which in turn was in response to increased market demand (Meyfroidt, Phuong, and Anh 2013).

[5] The Biodiversity Conservation Corridors Project, administered by ADB, focuses on biodiversity-rich forest landscapes in the Cardamom Mountains and Eastern Plains Dry Forest in Cambodia, the Tri-border Forest in southern Lao PDR, and the Central Annamites in Viet Nam. http://www.gms-eoc.org/resources/biodiversity-conservation-corridors-project-2012-onwards-#sthash.RZCOosEh.dpuf

Figure 1.6: Contribution of Forestry to GDP in GMS Countries, 2000–2012



GDP = gross domestic product, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic.
Notes: The bars show forest rent—the difference between the forest to be sold in the market and its respective logging cost—computed as the product of roundwood harvest time average prices and a region-specific rental rate.
Source: World Bank (n.d.[b]).

Shifting cultivation is generally practiced by local ethnic minorities and poor migrants, who have few economic alternatives. Continuing forest loss will deprive them of this livelihood option and is likely to deepen their poverty. In the Lao PDR, for example, most villagers rely on non-timber forest products to meet their needs, but the availability of some forest products, such as leaves, fruit, and wildlife, has declined (FAO 2011).

The projected increase in energy demand in the Lao PDR, Thailand, and Viet Nam will be met partly through the construction of hydroelectric power schemes on rivers flowing from the Annamite and Tennaserim mountain ranges. Forest loss in these watersheds is likely to lead to soil erosion, however, compromising the sustainability of such schemes. Thus, conserving upland watersheds is essential for this development and for energy security.

Forest degradation and loss are major contributors to GHG emissions. Land-use change and forestry contributed 32% of GHG emissions in Myanmar in 2011, 46% in Cambodia, and 55% in the Lao PDR (Table 1.5). On the other hand, reforestation projects and other sustainable land management practices led to reductions in GHG emissions associated with land-use change in Thailand and Viet Nam.

Table 1.5: GMS Greenhouse Gas Emissions from Land-use Change and Forestry, 2011

Country	Total GHG emissions ($MtCO_2$)	GHG emissions from land-use change and forestry ($MtCO_2$)	Land-use change and forestry share of total emissions (%)
Cambodia	49	23	46
Lao PDR	43	23	55
Myanmar	239	78	33
Thailand	368	–2	0
Viet Nam	264	–14	–5

GHG = greenhouse gas, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, $MtCO_2$ = megatons of carbon dioxide equivalent.
Source: World Resources Institute (n.d.).

Impact of climate change on forests and biodiversity

Worldwide, climate change and increased climate variability are expected to have substantial impact on forests and related ecosystem services. Forest ecosystems are predicted to shift poleward or to higher altitudes. Such shifts will be dynamic and, in some places, forests may die back or disappear (Mendelsohn 2011). Climate change could have the following impact on forest ecosystem services in the LMB: (i) reduced plant and animal productivity; (ii) the decline and loss of a range of non-timber forest products; (iii) reduced regulation of erosion and sedimentation; (iv) reduced regulation of flash flooding and landslides; and (v) reduced nutrient cycling (USAID 2013).

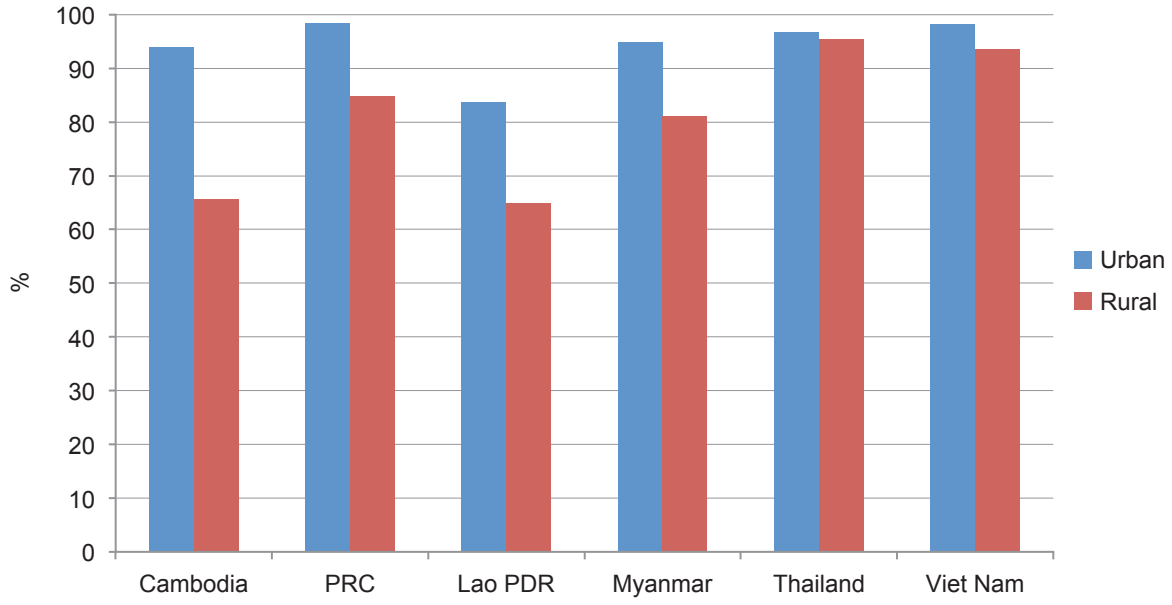
Knowledge of the effects of climate change on global biodiversity is limited. But climate change is expected to place additional pressure on already stressed habitats and species in the GMS. For example, it may lead to the spread of hardy, aggressive native and exotic plant species that thrive on degraded lands, such as bamboo and other grasses (USAID 2013). There are also concerns about the effects of climate change on coral reefs and other aquatic life in the GMS because of increasing oceanic acidity, greater storm intensity, rising sea levels, and increased sea surface temperatures, with potential impact on the supply of seafood and ingredients for pharmaceutical production, among other things.

1.4.3 Water in the GMS

Status and drivers of change

More than 90% of the people in urban areas in all GMS countries except the Lao PDR, and more than 80% of those in the rural areas in all GMS countries except Cambodia and the Lao PDR, had access to good-quality drinking water in 2012 (Figure 1.6). But development, because of its nature and the rate at which it is proceeding, is jeopardizing water quality and water-dependent resources, such as fisheries.

Figure 1.7: Access to Improved Drinking Water in the GMS, 2012



GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Source: WHO–UNICEF (n.d.).

Monitoring by the Mekong River Commission since 1985 shows that water quality in the GMS is relatively stable, generally meeting water-quality standards that are adequate for the protection of human health, aquatic life, and agricultural use. Localized surface water pollution is nonetheless becoming more evident in urban areas, such as Phnom Penh in Cambodia, Vientiane in the Lao PDR, and Can Tho in Viet Nam (MRC 2011). The Mekong Delta is the ultimate destination of waste products from human activities across the entire basin. The continued intensification of agriculture, combined with rapid urban growth and industrial development, is likely to worsen surface-water quality unless steps are taken to mitigate impact.

An important consequence of dam construction and sand mining for various purposes in the GMS has been a major reduction in river sediment loads. The changes this causes in downstream hydrology and natural patterns of erosion and silt deposition are expected to increasingly affect floodplain agriculture and fisheries. The reduced sediment supply to the Mekong Delta in Viet Nam is also likely to have major implications for coastal erosion.

Wetlands in the GMS are among the world's most diverse and productive ecosystems, featuring more than 1,000 bird species, of which 220 are dependent on river and wetland habitats. There are also more than 900 species of fish (one of the highest species counts among all river systems worldwide)—or more than 1,100 species, if estuarine and deltaic species are included. Wetlands play vital roles in the livelihoods and socioeconomic development of local people, for example, by supporting rice cultivation and freshwater fisheries and by providing flood-regulation services.

However, there has been widespread loss of wetlands in the GMS. Less than 2% of the original area of natural inland wetlands in the Mekong Delta remains. The overall loss of wetlands is estimated at 45% in Cambodia, 30% in the Lao PDR, and 96% in Thailand (MRC 2010). The Ha Tien Plain is the last remaining large wetland area of seasonally inundated grassland in the Mekong Delta, supporting a high diversity of plants and birds. And since the mid-1990s, this valuable wetland ecosystem has been threatened by conversion for use in agriculture, aquaculture, and tree plantation, as well as by physical alteration due to the construction of dams and canals, water withdrawals, overharvesting, pollution, the introduction of exotic species, hunting, and illegal wildlife trade.

The loss and degradation of wetlands is a significant threat to wetland-dependent mammal, bird, reptile, amphibian, and fish species. The IUCN Red List indicates a steady increase in the number of critically endangered and vulnerable wetland species in the GMS. Of four flagship species in the Mekong River, three—the Mekong River population of the Irrawaddy dolphin, the giant catfish, and the Siamese crocodile—are critically endangered, and the fourth, the Eastern Sarus crane, is listed as vulnerable.

The annual yield of natural-capture fisheries in the LMB ranged from 0.9 million to 2.1 million tons in the decade up to 2010, with an approximate value of $1.6 billion–$3.8 billion per year. This vital resource is threatened by overfishing, the use of destructive fishing equipment, habitat fragmentation, and the loss of riverine connectivity. Although the fish catch is still high, its quality is declining as the percentage of small fish increases. Infrastructure developments such as dams that alter the natural flows of rivers and block fish migration routes escalate the threat. Annual aquaculture production, estimated at 2.6 million tons and valued at up to $4.7 billion, has been growing steadily and is now larger in volume than the annual yield of natural-capture fisheries in three of the four LMB countries—Cambodia, Thailand, and Viet Nam (ICEM 2010).

Impact of climate change on water

The GMS coastline is at risk from rising sea levels and more frequent and severe extreme weather events. Except for the Lao PDR and the PRC's Yunnan Province (both of which are landlocked), all GMS countries have coastlines that are likely to be adversely affected by climate change. All GMS countries also have uplands that are susceptible to projected increases in rainfall and extreme weather events, which are likely to increase the risk of erosion and landslides. Average annual flood damage in the LMB is estimated at $60 million–$70 million; two-thirds of this damage occurs in Cambodia and Viet Nam.

Under certain climate-change scenarios, annual flooding on the Viet Nam floodplain could extend over 2.5 million ha by 2060, compared with 1.5 million ha in 2000 (USAID 2014). Projected modest increases in temperature in upland areas could increase the yields of existing crops and make such areas suitable for the cultivation of certain other crops, although thin soils and steep slopes at higher elevations will remain limiting factors.

Climate change is likely to affect rainfall patterns and therefore runoff, lake levels, groundwater, floods, droughts, and water quality. The Intergovernmental Panel on Climate Change (IPCC 2007a, 2007b) indicated that higher temperatures could reduce runoff and thus reduce the water supply; combined with increased water demand in the subregion, this implies future water scarcity. Four river valleys in the GMS—those of the Chao Phraya, Mekong, Red, and Salween rivers—are susceptible to increased flooding due to changes in rainfall patterns and the frequency of extreme weather events (IPCC 2007b).

Climate change is likely to affect the productivity and sustainability of marine and freshwater fisheries and aquaculture. Reduced rainfall and higher temperatures in the dry season, projected for southeastern areas of the Mekong River Basin, are likely to create conditions that are sufficiently harsh to cause the extinction of some fish species (USAID 2013). It has been estimated that 500 freshwater species in Cambodia will cope with projected climate change but 350 species may die out (WorldFish Center 2009).

Changes in habitat temperatures will influence metabolism, growth rates, production, reproduction, recruitment, and susceptibility to toxins and diseases. Vulnerability analyses in five hotspot provinces (Mondulkiri in Cambodia, Khammouan in the Lao PDR, Chiang Rai in Thailand, and Gia Lai and Kien Giang in Viet Nam) suggest that upland fish species and migratory white fish species will be most vulnerable to climate change in Mondulkiri, Chiang Rai, and Gia Lai; migratory white fish will also be highly vulnerable in Khammouan. Aquaculture could be more vulnerable to climate change than natural-capture fisheries, with flash floods causing sudden drops in salinity in the delta and encouraging disease in coastal shrimp ponds. Higher temperatures in the LMB are expected to increase the risk of eutrophication in aquaculture ponds and have associated negative effects on water quality in adjacent streams and river systems.

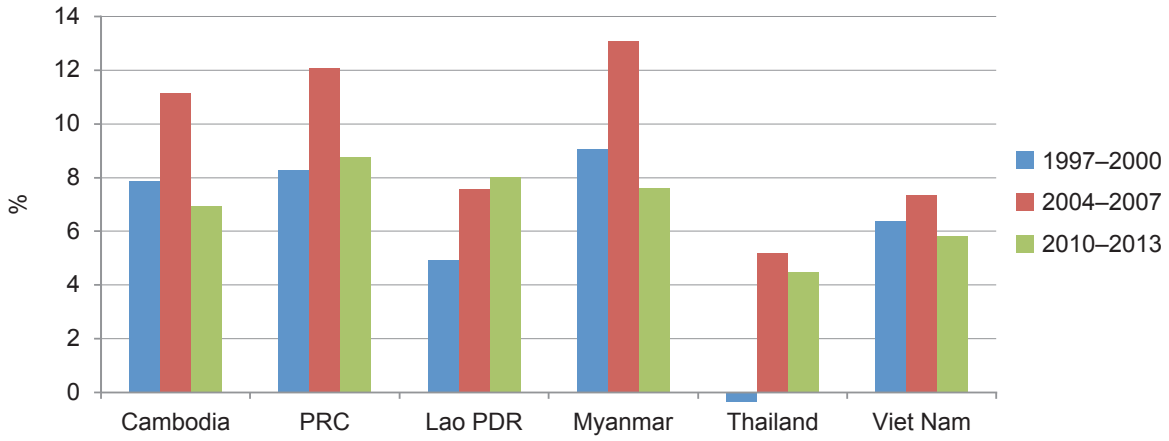
1.5 Investing in Natural Capital

1.5.1 Why is investing in natural capital necessary?

As shown in section 1.3, natural capital constitutes a significant proportion of the wealth of GMS countries and contributes substantially to the subregion's socioeconomic development. Section 1.4, which presented the status of key natural-capital asset classes, and the main drivers of change, showed that natural capital is declining in the subregion at a rate that threatens to undermine economic development and human well-being. It is estimated that the GMS loses about 10%–12% of GDP each year because of pollution and the overexploitation of forests, soils, and fisheries.

Pressure on natural capital is likely to increase in the GMS, for several reasons. The GMS economy is expected to continue to grow, in line with the trend in recent decades (Figure 1.8). Continued economic growth is expected to increase the competition for energy, land, and water and has considerable potential to hasten the depletion of the subregion's natural capital.

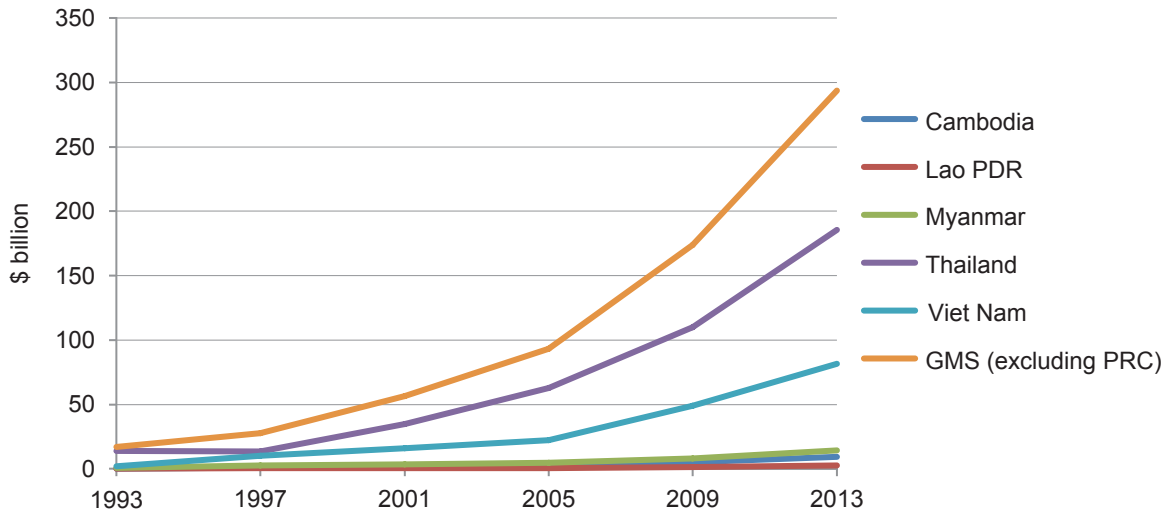
Figure 1.8: Average GDP Growth in the GMS Countries, 1997–2013



GDP = gross domestic product, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Notes: No 1997 data available for the Lao PDR and no 2013 data for Myanmar.
Source: ADB (2014a).

The GMS has been a favorable destination for foreign direct investment (FDI) in recent years, with FDI increasing tenfold between 1993 and 2010 (Figure 1.9). The pipeline of investments, loans, and technical assistance projects in the GMS Regional Investment Framework (RIF, a key initiative of the subregion's Economic Cooperation Program) for the period 2013–2022 is valued at $51.5 billion. This amount is triple the investment of $16.7 billion made in the first 20 years (1992–2012) of the GMS Economic Cooperation Program (ADB 2014a).

Figure 1.9: Foreign Direct Investment in the GMS Countries, 1993–2013



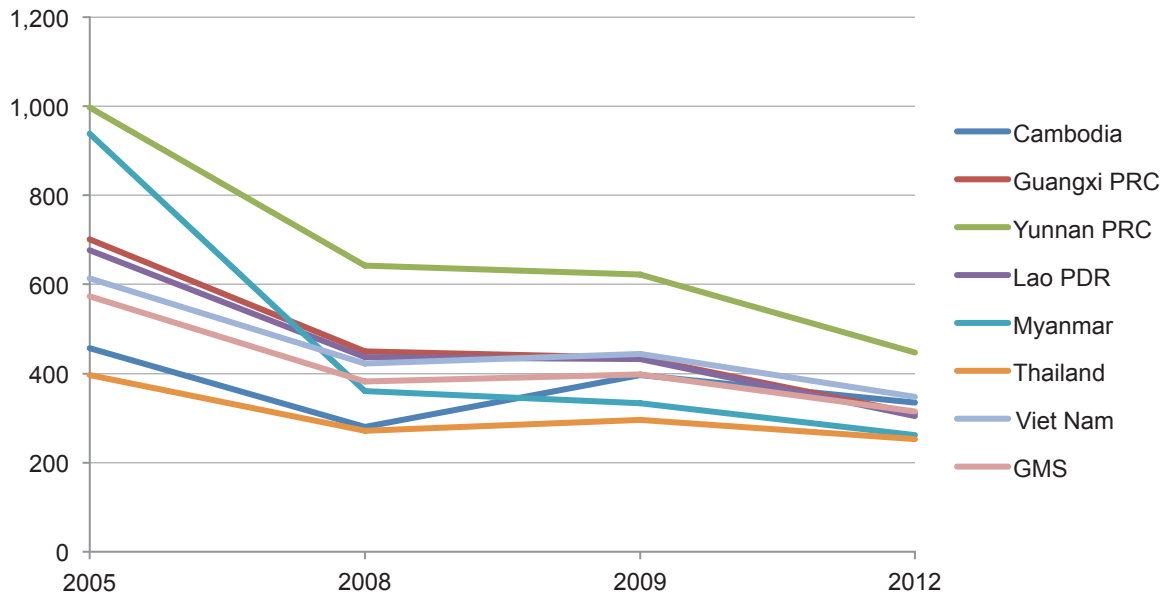
GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Source: UNCTAD (n.d.).

Investments in the subregion are spurring energy, industrial, logistical, transport, and urban infrastructure development and creating new opportunities for trade and commerce. While these investments are catalyzing the creation of new wealth, however, ensuring the equitable distribution of their benefits and minimizing their impact on the environment remain huge challenges that, if unmet, will risk the sustainability of development efforts.

Figure 1.10 shows the energy intensity per unit of GDP in the GMS; although the trend is decreasing over time, the rate is still significantly higher than the global average, and this is indicative of a resource-intensive development model. Figure 1.11 shows that most GMS countries' ecological capacity to accommodate their domestic demand for natural capital has been decreasing over time, and the PRC and Thailand have already reached their net biocapacity deficit state. If continued, this development approach will ultimately lead to resource depletion. The scarcity of resources will, in turn, lead to price shocks, which will be detrimental to livelihoods, businesses, and economic growth.

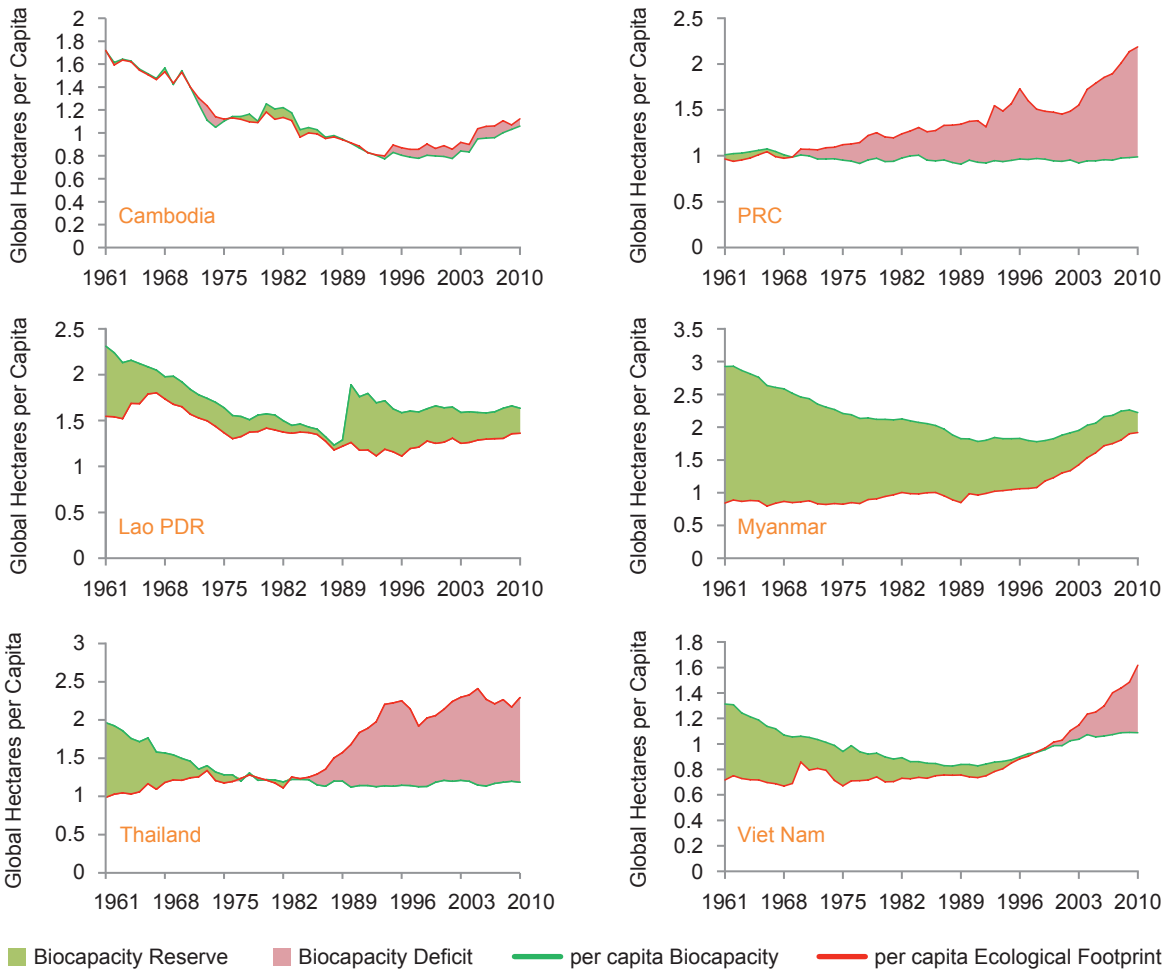
A recent analysis comparing "business as usual" and a scenario in which a green economy is pursued suggests that failing to take action to conserve ecosystems could cost the LMB countries almost $55 billion in the next 25 years (WWF 2013b). Investing in natural capital is therefore critical for meeting green-economy and growth objectives.

Figure 1.10: Energy Intensity in the GMS Countries, 2005–2012
(tons of oil equivalent per $ million of GDP)



GDP = gross domestic product, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Sources: IEA (2013); IMF (2012); Lao PDR Ministry of Energy and Mines; PRC: Guangxi Statistical Yearbooks, Yunnan Statistical Yearbooks.

Figure 1.11: National Ecological Footprint in the GMS Countries, 1961–2010



GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
Notes: In general terms, the *ecological footprint* is a measure of the demand for natural capital versus the capacity of the planet (or a country, subregion, or region) to regenerate the natural capital that is depleted in meeting demand. The *national ecological footprint* is a measure of the biocapacity needed to provide for national per capita consumption, where biocapacity is the productive area available nationally. Pink shading in the figure indicates a biocapacity deficit and green shading indicates a biocapacity reserve. A net biocapacity deficit may be compensated for in three ways: (i) by overusing local biocapacity (using domestic resources faster than they regenerate); (ii) by importing biocapacity from abroad; or (iii) by using the global commons (e.g., by causing net carbon emissions to the atmosphere or fishing in international waters). Note that the apparent spike in biocapacity in the Lao PDR in 1989 (shown in the figure) may be due to data anomalies.
Source: www.footprintnetwork.org

If natural capital is to continue providing ecosystem services, investments must be made in maintaining and increasing the natural-capital base, and such investments must be accorded the same priority (if not higher) as investments in other forms of capital (built, human, and social). Global experience suggests that the aspirations of GMS countries to graduate from "developing" to "developed" status can be fulfilled only if their economies move swiftly from a dependence on primary and secondary sectors toward innovation-driven tertiary sectors. To maximize and maintain the potential benefits of their rich natural-capital endowments, GMS countries should invest more in the uptake of natural capital–friendly service industries and clean technologies, such as ecotourism and low-carbon urban development.

1.5.2 What does investing in natural capital mean?

Investing in natural capital is largely about actions to protect, restore, and enhance natural assets while also ensuring the sustainable use of the ecosystem services they provide. Investments in natural capital can be cheaper than technological "fixes" to environmental problems and can stimulate economies. UNEP (2011) estimated that "green" investments (investments in natural-capital management and resource-use efficiency) of 2% of global GDP in the period 2011–2050 would deliver economic growth that is at least as high as an optimistic business-as-usual case, while avoiding considerable environmental risk. Substituting artificial fixes for natural functions (e.g., water purification) may be feasible in isolated cases but becomes unjustifiable at the scale of replacing the full bundle of ecosystem services provided by wetlands, forests, mangroves, and other ecosystems and the livelihoods that depend on them (TEEB 2011).

There are two broad categories of investment in natural capital. One category is investment to directly protect and enhance natural assets, such as by protecting or restoring forests, wetlands, soil, and water; Boxes 1.3 and 1.4 illustrate this category. The other category is investment in improvements in resource-use efficiency and in actions to reduce or mitigate the negative impact on natural capital of economic development in sectors that depend on the flow of ecosystem services. This form of investment may include water- and energy-efficiency measures for the agriculture, manufacturing, and urban sectors, and effective planning processes to avoid, reduce, or offset negative impact in areas of high natural-capital value. Both forms of investment are of equal importance in the GMS, and both need to be implemented on the basis of an understanding of, and accounting for, the full economic value of natural capital. This section describes options for investment in natural capital in the energy, manufacturing, waste management, construction, transport, tourism, and urban development sectors.

Box 1.3: Examples of Investments in Natural Assets

Restoring and protecting mangroves

The damage caused by storms, coastal and inland flooding, and landslides can be reduced by a combination of judicious land-use planning and investments in natural capital to boost buffering capacity. In Viet Nam, planting and protecting 12,000 hectares of mangroves cost $1.1 million but is saving $7.3 million per year in dike maintenance (TEEB 2011). The average value of storm damage protection provided by coastal wetlands has been estimated at $8,240 per hectare per year (Costanza et al. 2008).

Protecting Ream National Park

The protection of Cambodia's Ream National Park is estimated to generate benefits from sustainable resource use, recreation, and research worth 20% more than the benefits of destructive use. Local villagers earn three times more under a scenario of effective protection than in its absence (TEEB 2011).

Investing in natural assets for livelihoods in India

Under the National Rural Employment Generation Act 2006, which focuses on restoring natural capital, each household that works on environmental conservation is guaranteed at least 100 days of paid labor. Since its inception, the act has created 3 billion workdays and benefited 59 million households in rural India (UNEP 2011).

Source: Authors.

Box 1.4: Benefits and Costs of Natural Capital Investments

According to Balmford et al. (2002), a conservative estimate of the benefit–cost ratio of investing in natural capital globally is 100:1. This is based on a scenario involving the expansion of the global protected-area network to 15% of the terrestrial biosphere and 30% of the marine biosphere. It would cost an estimated $4 billion per year to build and maintain such a network, but the net benefits—that is, the difference between the total value of ecosystem services provided by the intact ecosystems, minus the value of the most likely alternative land uses—were estimated at $4 trillion per year. The conclusion to be drawn is that the continued degradation and conversion of natural habitats is eroding overall human welfare for short-term private gain. Retaining as much as possible of remaining natural ecosystems through a judicious combination of sustainable use, conservation, and, where necessary, compensation for resultant opportunity costs makes overwhelming economic sense.

It is possible to use estimates of the value of natural capital and its associated ecosystem services to evaluate a wide range of projects, scenarios, and policies. For example, a benefit–cost analysis of certain Basin Development Plan scenarios in which more appropriate discount rates were applied and the cost of lost natural-capture fisheries, aquaculture production, and wetland ecosystem services were accounted for resulted in a change in net present value of the development scenarios from a benefit of $33 billion to a cost of $274 billion (Kubiszewski et al. 2013).

Sound economic analysis of interventions requires assessment of the full range of costs and benefits, including those associated with changes in natural capital. Investing in natural capital may often make economic sense for society.

Source: Authors.

Energy

By 2035, Asia is expected to account for 40% of global energy demand (IEA 2013). About 134 million people in Southeast Asia (22% of the total population) do not have access to electricity, and about 280 million people (50% of the total population) do not have access to clean cooking fuel (IEA 2013). To ensure that rural people have adequate access to energy and to keep up with rising demand, investments are needed in clean, locally available forms of energy. Regulatory reforms could encourage reductions in pollutant emissions (including GHGs), through such means as penalizing industries that do not take measures to reduce emissions. Significant renewable-energy production capacity is needed, and governments should work closely with the manufacturing sector to help lower the cost of adoption.

Manufacturing

Manufacturing composed 22% of global GDP in 2009 and is predicted to become increasingly important in the economies of developing countries (UNEP 2011). Generally, natural-capital scarcities lead to higher commodity prices and ultimately to more expensive manufactured products. A life-cycle approach to value chains would encourage producer responsibility for entire product life cycles. Investments in clean technologies could be encouraged, and large-scale recycling and remanufacturing initiatives offer scope for job creation. Efficiency in the use of raw materials and energy should be encouraged; this may involve investments in closed-cycle manufacturing, advanced climate-change mitigation strategies (especially in countries with heavy industries), subsidies and loans available to natural capital–friendly activities, eco-industrial parks, education and training in cleaner technologies, and support for small and medium-sized enterprises (SMEs) (UNEP 2011).

Waste management

The reduction and prevention of waste is particularly important in developing countries because of their relatively high rates of population growth and intensifying consumption of materials. Governments in the GMS could encourage improved waste management by, among other things, increasing their budgetary allocations to the sector, improving transparency in the awarding of contracts for waste services, providing localized waste treatment solutions, and formally recognizing and adequately compensating informal waste collectors (UNEP 2011).

Tourism

Southeast Asia attracted 261 million visitors in 2000–2005. Given an attractive investment climate, a sustainable tourism industry is a viable option in the GMS. Sustainable tourism can be a driver of investment in climate-change mitigation, renewable energy, waste management, the conservation of biodiversity and water, cultural heritage, and local economies (UNEP 2011).

Urban development

Urban areas are home to 50% of the world's population and account for 60%–80% of energy consumption (UNEP 2011). Cities in Southeast Asia are growing twice as fast as those in the rest of the world: it is expected that 70% of people in Southeast Asia will be living in cities by 2030 (World Bank 2013). Cities can be centers of innovation and knowledge, and there is enormous potential for greatly improving the energy efficiency of traffic flows, public transport, and housing and other buildings. Investments in urban natural capital can create jobs, reduce urban poverty, and improve the well-being of residents. Cities with long traditions of land-use planning, effective public transport strategies, and green spaces are the healthiest in the world (UNEP 2011).

1.6 Using Natural Capital to Tackle Environmental and Social Issues

Strategic investments in natural capital can be a means of tackling pressing environmental and social issues, such as climate change and energy, food, and water security, as described below.

1.6.1 Climate change

The impact of climate change on natural capital and associated livelihoods in the GMS is expected to be wide ranging, significant, and mostly negative. On the other hand, natural capital, if managed sustainably, can help to mitigate climate change as well as to safeguard livelihoods. In the GMS, the sustainable management of forests, agriculture, and water assets can help capture climate co-benefits by incorporating approaches such as ecosystem-based mitigation and adaptation in broader policy making (Box 1.5).

Box 1.5: Ecosystem-based Approaches to Climate Change Mitigation and Adaptation

Ecosystem-based approaches constitute a strategy for the integrated management of land, water, and living resources to promote equitable conservation and sustainable use.[a] An ecosystem-based approach involves applying appropriate methodologies focused on the essential structure, processes, and functions of ecosystems and the interactions among organisms.

Ecosystem-based climate-change mitigation is the use of ecosystems for their carbon storage and sequestration services, in which emission reductions are achieved through the creation, restoration, and management of ecosystems (Doswald and Osti 2011). Ecosystem-based mitigation approaches include forest, wetland, and peatland conservation and restoration, the protection of the oceanic carbon sink, improved grassland management, and environmentally sound agricultural practices (Trumper et al. 2009, Cowen et al. 2009). Reducing Emissions from Deforestation and Forest Degradation (REDD+) is an ecosystem-based climate-change mitigation measure in developing countries, especially tropical countries, because it aims (among other things) to protect carbon stocks in natural forests (more on this in Chapter 2). Biomass energy production is another climate-change mitigation measure that could employ an ecosystem-based approach (Mendelsohn 2011). Ecosystem-based climate-change mitigation can be cost-effective. For example, land-use opportunity costs are often low compared with the value of carbon and especially compared with the cost of cutting industrial emissions (Richards and Jenkins 2007).

Ecosystem-based climate-change adaptation is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change (CBD 2009). Despite evidence showing that the investments required for ecosystem-based climate-change adaptation are small compared with the long-term benefits it generates, the implementation of this approach has been limited so far, often because of a lack of information and sometimes because of institutional resistance (Mensah et al. 2012). But interest in ecosystem-based climate-change adaptation is growing in the GMS, especially in Viet Nam. Compared with hard infrastructure, ecosystem-based approaches can be less expensive because ecosystems are often self-adaptive (e.g., mangroves shift in distribution in response to rising sea levels) and self-maintaining (e.g., forests re-grow after storms).

[a] Definition from the Convention on Biological Diversity, Article 2.
Source: Authors.

Forests are a clear example of natural capital that can provide services important for tackling climate change. Stern (2006) proposed that avoided deforestation should be one of the key global climate-change mitigation strategies, arguing that it would be a “highly cost-effective way of reducing GHG emissions” (Richards and Jenkins 2007). The sustainable management and restoration of major carbon-storage assets, such as peatlands, should also be prioritized.

Forests could play a key role in climate-change adaptation in the GMS. For many rural people in the subregion, forests provide access to wild food in times of food insecurity, a carbon-neutral fuel source, and (through the sale of timber and non-timber forest products) income-earning opportunities in times of crisis, such as those brought about by climate-related shocks.

Forests are part of the region's "ecological infrastructure," which can complement, and in some cases replace, physical infrastructure in helping countries cope with climate-related shocks. For example, relative to partly deforested catchments, intact forests produce 35% less peak runoff (Ogden et al. 2013), and thus helps limit soil erosion (Zheng 2006) and protects hydroelectric dams. According to an analysis of flood data by Bradshaw et al. (2007), a 10% reduction in forest cover increases flood frequency by 4%–28%. Assuming a midpoint value of 16% and applying it to GMS countries for which data on flood damage are available (Cambodia, Thailand, and Viet Nam), a 10% increase in forest cover would reduce flood losses by $600 million per decade. In coastal areas, mangrove ecosystems provide services such as storm protection and wave energy attenuation that can reduce the vulnerability of communities to climate change. In Viet Nam, a coastal protection project involving the establishment, restoration, and protection of mangroves estimated that the ratio of benefits to costs ranged from 19:1 to 69:1, not counting the ecological benefits (IFRC 2011). According to TEEB (2009), a compelling case can be made for public investment in ecological infrastructure (especially the conservation and restoration of forests, mangroves, and wetlands) as a means of climate-change adaptation, on the basis of benefits versus costs.

The adoption of sustainable land management practices can increase the resilience of agricultural natural assets in the face of climate change and the pressures likely to be exerted by population growth. Given predicted increases in rainfall intensity and flood risk, sustainably managed wetland assets (e.g., marshes) will be needed for their water-regulation and flood-protection services (Kubiszewski et al. 2013), helping to lessen the costs associated with property damage, community displacement, and health risks.

The integrated management of agricultural, forestry, and water assets for climate-change mitigation and adaptation requires two fundamental changes. *First*, it requires a paradigm shift in planning processes—in the GMS and elsewhere. On the one hand, planning horizons need to be extended beyond those of conventional planning frameworks to a decadal timescale that takes possible future climate and socioeconomic regimes into consideration. On the other hand, development planners need to move away from "predict-then-act" to "no-regrets" approaches, which manage climate-related risks by allowing for multiple possible futures. A "no-regrets" approach requires adaptation investments that are justifiable under a wide range of climate scenarios and even in the absence of climate change. *Second*, managing natural capital to capture climate-change mitigation and adaptation co-benefits requires integrated planning across sectors. Landscape approaches, such as integrated water resources management (IWRM), will be required to ensure that natural capital is managed effectively in the GMS to provide energy, food, and water security and to reduce the impact of climate-related events on natural-capital assets. Land tenure reforms, especially targeting marginalized groups, could encourage more local investment in climate-change resilience.

1.6.2 Energy security

By 2025, electricity demand in the GMS is expected to reach 237,000 megawatts, a threefold increase over demand in 2010 (77,000 megawatts). Building the capacity to meet this demand while ensuring inclusive access to energy is essential for energy security in the GMS (ADB 2012b).

The concept of a regional electricity market has emerged in the GMS as a way of ensuring an undisrupted electricity supply and reducing dependence on supply from outside the subregion. This initiative has been boosted by an increased investment capacity in GMS countries, especially the PRC, Thailand, and Viet Nam.

Energy security should be viewed holistically so that it does not compromise the security of other resources, such as food and water (Box 1.6). Energy planning, water management, food production, and water and land conservation are connected. For example, the construction and operation of hydroelectric dams on the Mekong River and its tributaries could result in a diminution of fish stocks, with a consequent reduction in downstream food security and a loss of livelihoods. Osborne (2010) estimated that the livelihoods of 29.6 million people in Cambodia, the Lao PDR, and Thailand, and 14 million people in Viet Nam, could be affected if all dams planned for the Mekong mainstream were built.

Nevertheless, while environmentalists increasingly apply pressure on governments to halt the construction of hydroelectric dams in the GMS, data on the high environmental costs of other power options, such as coal, are emerging. A strategic environmental assessment (SEA) of Viet Nam's Power Development Plan VII showed that thermal power, the largest component of electricity supply, has a very large negative environmental and social impact in Viet Nam. It is estimated, for example, that the resultant atmospheric pollution, including GHGs, will cost Viet Nam nearly $9 billion per year by 2030 unless action is taken.

Environmental and social considerations related to energy security are not yet fully embedded in the subregion's energy planning, although a promising start has been made. Strategic planning tools, such as SEA, have been applied at the regional level and in some countries, such as Viet Nam, with a degree of success. Participatory processes and more analytical capacity are needed, however, to ensure holistic energy security planning and management in the subregion.

Box 1.6: Tools for Integrated Water and Energy Planning

To facilitate coherence in policy and planning, initiatives have been launched to develop and deploy decision-support tools. For example, the Stockholm Environment Institute has been working to connect the functionality of its Water Evaluation and Planning (WEAP) system and Long-range Energy Alternatives Planning (LEAP) system tools as a first step toward capturing the complexity of an energy–food–water nexus analytical framework. Making such a tool available will allow users to

- project energy and water demand and shortfall scenarios for a region,
- assess trade-offs between alternative energy futures to meet energy demand,
- assess trade-offs between alternative water allocation schemes,
- analyze the economic and policy consequences of alternative scenarios, and
- recommend optimum energy mixes and water resource allocations.

The current version of the nexus toolkit allows LEAP to receive information from WEAP on the water available for hydroelectric power generation, and for WEAP to receive information from LEAP on how the energy requirements of various water management actions will be met. There is a need to develop these tools further to take into account the many other energy–food–water interlinkages and to formulate, test, and refine their use in planning and decision making to improve the outcomes of sectoral analyses.

Source: Text contribution by the Stockholm Environment Institute.

1.6.3 Food security

Agricultural intensification, large-scale monoculture cropping, and the inappropriate use of agrochemicals have incurred a high environmental cost—especially land degradation—in the GMS without significantly reducing rural poverty. Agricultural production also contributes to climate change and is directly affected by it, through higher temperatures, seasonal shifts in rainfall, and rising sea levels, among other things. Given the growing population of the GMS and the associated increased demand for land for urban development, the subregion faces a high risk of increased food insecurity. Future agricultural systems will need to be flexible and diverse to withstand and respond to climate change and to other environmental and social drivers. To ensure food security, GMS countries should focus their efforts on

- securing and increasing food production systems under changing climatic and market conditions and in light of a looming water crisis;
- protecting and enhancing natural capital in agricultural landscapes; and
- reducing the vulnerability of communities to climate change and other global changes by improving the adaptive capacity of small-scale producers (IWMI and WorldFish Center 2010).

GMS countries can make their food production systems more resilient to climate change and other external shocks, and more productive, by (i) investing in measures to improve soil health and increase soil carbon and the efficiency of rain harvesting and irrigation; (ii) preventing crop losses through flood protection and drainage; and (iii) improving postharvest storage and processing facilities (Box 1.7). Providing rural finance and support for the adoption of efficient technologies will help farmers to adopt climate-friendly agricultural practices and thus help increase the resilience of farming systems, reduce GHG emissions, increase national food security, and achieve development goals.

Box 1.7: Addressing Food Loss By Improving Storage

A preliminary economic analysis showed that more than 30% of rice harvests may be lost in the Greater Mekong Subregion, largely because of inadequate storage practices. On the other hand, grain stored in metal silos can be kept safe for 6 months without major losses. The estimated annual cost of a silo with a storage capacity of 900 kilograms is $4.50, and the benefits are estimated at $20 per year, meaning a net profit of $15.5 per year per silo. In addition to the monetary benefits, farmers are also able to obtain higher market prices by storing grain in periods when prices are low.

Source: Swiss Agency for Development and Cooperation (2011).

Improving the management of natural capital, especially forests and water, will increase and sustain agricultural and fishery production; reduce soil erosion and nutrient deficiencies; and help ensure the sustainability of biodiversity and wildlife. The challenge is to create productive agroecosystems that deliver valuable regulating services while sustainably producing food. Many traditional agricultural systems are valuable agroecosystems that mimic the ecosystem functions of natural systems. For example, paddy fields emulate the water retention function of natural wetlands, producing rice and fish while absorbing floods, recharging groundwater supplies, controlling soil erosion, and purifying water (IWMI and WorldFish Center 2010).

Integrating producers, agribusinesses, and consumers into national, regional, and global food systems is essential for ensuring adequate food supplies, and therefore food security. Greater market connectivity in rural and remote areas—where dependence on natural capital is highest—is likely to increase the prices that communities in those areas are able to obtain

for their goods. Greater market connectivity is also essential if producers who conserve and increase natural capital are to be rewarded in the marketplace for such management.

Food security is also about the availability of safe and nutritious food. Increasing food safety and quality involves, for example, establishing and enforcing regulatory requirements; adopting compliance approaches; providing training, education, and community outreach; and involving farmers, industries, consumers, and governments in such measures. Participatory guarantee systems are being developed to certify the quality of organic produce in the GMS, with the aim of providing consumers with safer food, smallholder farmers with access to new markets and premiums for their products, and governments with the benefits of increased regional and global trade. Awareness of and interest in natural and organic foods is increasing in the GMS, as indicated by the emergence of certification standards, such as those of Organic Agriculture Certification Thailand.

1.6.4 Water security

The rich water-resource endowment of the GMS is central to the subregion's socioeconomic development. For example, inland fisheries support 2.8–3.2 million households in the Mekong River Basin and many other households in the Ayeyarwady, Salween, and Red river basins. The value of freshwater ecosystem services in the LMB has been estimated at $4.57 billion per year (WWF 2013b). GMS countries see further potential for the development of water resources for irrigated agriculture, aquaculture, hydroelectricity, and water transportation, but such development must ensure the continued availability of clean water, equitable access, and sustainable demand management in light of projected climate change.

All GMS countries have water resources above the estimated threshold for water stress of 1,700 cubic meters (m^3) per capita, but population growth, rapid urbanization, and industrialization are increasing water demand. While agriculture is the largest water user, demand in nonagriculture sectors is rising and is expected to account for 15% of total water demand by 2050 (Rosegrant et al. 2012). Projections indicate that domestic and industrial water demand in the Mekong River Basin will more than double between 2000 and 2020, from 899 million m^3 to 1,994 million m^3.

The health of water resources depends on the capacity of water bodies to maintain their natural functions and associated goods and services. Capacity can be impaired by inappropriately developed or managed irrigation systems, inadequately regulated point sources of pollution (from municipalities and industry), and uncontrolled nonpoint

source pollution (generally agricultural chemicals), among other things. Watershed disturbances, such as deforestation, road construction, and the destruction of natural wetlands, can also affect water-resource health. The Environmental Water Security Index (ADB 2013b) comprises four indicators: water disturbance; pollution; water resource development (increased storage and diversions that alter natural flows); and biotic factors (e.g., fish-catch pressure). Table 1.6 shows that, according to this index, many rivers in the GMS are already in poor condition.

Table 1.6: Environmental Water Security in the GMS, according to ADB's Environmental Water Security Index

Country	Index[a]
Cambodia	2
PRC	2
Lao PDR	3
Myanmar	3
Thailand	1
Viet Nam	2

ADB = Asian Development Bank, GMS = Greater Mekong Subregion, Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.
[a] Rankings range from 1 to 5, with lower scores denoting a poorer condition.
Source: ADB (2013b).

An increase in extreme weather events due to climate change and the increasing development and urbanization of the Mekong River Basin's floodplains is predicted to worsen flood damage in densely populated parts of the basin. Given the large variation in mainstream water flows, the basin's current and planned water storage capacity is inadequate. Increasing and managing this capacity as part of a climate-change mitigation strategy will require coordinated basin-level planning and operation.

In the next decade, GMS countries will need to make decisions on water resource development and water security that will have far-reaching consequences. Water security poses complex and interrelated challenges, and traditional approaches to water management that focus on water supply will no longer be viable. The GMS needs a holistic approach to water management at the basin level that integrates, among other things, water-use efficiency, demand-side management, pollution control, and preparedness for extreme weather events. IWRM is increasingly recognized globally as a way of achieving the efficient, equitable, and sustainable development of water resources. It promotes the coordinated development and management of water, land, and related resources, taking into account multiple viewpoints and development objectives (Box 1.8).

Box 1.8: Integrated Water Resource Management in the Greater Mekong Subregion

The Basin Development Strategy, which is facilitated by the Mekong River Commission and updated every 5 years, has adopted an integrated water resources management (IWRM) approach. The strategy is based on an assessment of basin-wide development scenarios in terms of the benefits, impact, and risks of water management. It involves extensive stakeholder engagement aimed at finding a middle ground among all key players and stakeholders and agreement on the actions to be taken.

At the national level, the implementation of the Basin Development Strategy for 2011–2015 involves communication and information sharing among sectors and subbasins, as well as initial steps toward bringing regional and national planning processes on water management closer together. The basin-wide perspective of the Basin Development Strategy enables the assessment of future investments in the Greater Mekong Subregion and the identification of suitable locations for development. Project developers that align with the strategy may find it easier to attract funding by providing lenders with a level of assurance that IWRM will be applied in project execution.

Source: Text contribution by the International Water Management Institute.

Steve Griffiths, ADB

Chapter 2. Current Efforts to Promote Natural Capital Investments in the Greater Mekong Subregion

Key Message

Current efforts to reverse the trend of natural-capital degradation are insufficient; the GMS urgently needs to scale up investments to protect and restore its natural capital

The Greater Mekong Subregion (GMS) countries should improve the cohesiveness and complementarity of policies regarding natural assets to ensure their effectiveness and efficiency. Similarly, there is a need for greater coordination among international, regional, and national actors to achieve policy objectives under related global agreements such as the Aichi Biodiversity Targets, United Nations climate-change targets, and the proposed Sustainable Development Goals for the post-2015 period.

Natural-asset policies focus largely on the establishment and management of protected areas. Actions aimed at minimizing the impact of economic activities on natural capital, such as the use of strategic environmental assessments, have been undertaken to a limited extent.

Natural capital–related policies often lack robust legal underpinning, and their implementation is not always mandatory. Legal systems and monitoring and evaluation processes need to be put in place or improved to ensure successful policy implementation.

Some GMS countries have initiated institutional reform to give greater authority to environmental agencies, consolidate their functions, and improve coordination with other sectors. Other countries are yet to do so, however.

Official development assistance and traditional publicly funded conservation projects are the predominant sources of investment in natural capital. GMS countries are exploring innovative fiscal instruments, such as environmental taxes and incentives, and market-based mechanisms, such as payments for ecosystem services. Greater uptake of such approaches will ensure sustainable investment in natural capital.

Achieving the required financial, institutional, legal, and policy reforms will be possible only if there is greater recognition of the value of natural capital at the political level. There is a large and growing body of information on the value of natural capital in the GMS, but national-level frameworks, such as natural-capital accounting, are only beginning to be applied.

An additional challenge to scaling up investments in natural capital in the GMS is a lack of technical and institutional capacity.

During “The Watershed”—the People’s Republic of China’s (PRC) first national conference on environmental protection, which was held in Beijing in August 1973—Premier Zhou outlined a comprehensive list of policy principles. His policy statement, “plan comprehensively, distribute rationally, use synthetically, turn harm to benefit, depend on the masses,” resonates with the vision of all GMS countries and their aim to transition to “green growth.”[6] In recent decades, the advent of important global agreements has provided GMS countries with impetus to strengthen regional and national environmental policy frameworks and to catalyze investment in natural capital. These policy frameworks operate at various scales, such as through international agreements, cooperation with international

[6] “Green growth” or “green economy” is an approach or model widely used by various international organizations and countries to promote economic growth while reducing pollution and greenhouse gas (GHG) emissions, minimizing waste and inefficient use of natural assets, and maintaining biodiversity and human well-being.

development partners, regional and subregional initiatives, national policies and strategies, or subnational or locally implemented projects.

This chapter gives an overview of regional and national initiatives for promoting investments in natural capital in the GMS. It is intended to show the state of institutions, legislation, and policies in each GMS country on the basis of the results of a desk review and responses by countries to a questionnaire.

2.1 Policies and Programs

2.1.1 Country implementation

All GMS countries are signatories to the 1992 Rio Declaration on Environment and Development, and they are all parties to the Convention on Biological Diversity (CBD) and to several other multilateral environmental agreements that address the management of natural capital (Table 2.1).

Table 2.1: Major Multilateral Environment Agreements in the Greater Mekong Subregion

Agreement	Function
United Nations Convention on Biological Diversity, 1992	Conservation of biological diversity, sustainable use of the components of biological diversity, and fair and equitable sharing of the benefits arising from the use of genetic resources
United Nations Framework Convention on Climate Change, 1992	Stabilization of greenhouse-gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system
United Nations Convention to Combat Desertification, 1994	Reversal and prevention of desertification and land degradation, and mitigation of the effects of drought in affected areas, to support poverty reduction and environmental sustainability efforts
Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973	Agreement to ensure that international trade in wild animal and plant species does not threaten the survival of those species
Ramsar Convention (Convention on Wetlands), 1971	Maintenance of the ecological character of wetlands of international importance and planning for the “wise” and sustainable use of wetlands
Rotterdam Convention (on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade), 1998	Protection of human health and the environment from potential harm from pesticides and industrial chemicals

Source: Authors.

All GMS countries have strategies for facilitating investments in natural capital and for integrating the consideration of natural capital in development processes. With the adoption of national biodiversity strategies and action plans (NBSAPs) to fulfill requirements under the CBD, all GMS countries have moved toward target-driven, action-oriented frameworks for investing in natural capital, particularly biodiversity assets, in line with the

Aichi Biodiversity Targets (Box 2.1). A recent review of the implementation of NBSAPs in GMS countries by the Asian Centre for Biodiversity, the UNEP, and the Association of Southeast Asian Nations (ASEAN)7–China Center concluded that all NBSAPs clearly identify biodiversity threats and priority spatial and thematic intervention areas, the importance of natural capital to societal and human well-being, the intrinsic value of natural capital, and investment needs, but they are yet to develop clear mainstreaming strategies, investment plans, and benefit distribution mechanisms.

Box 2.1: The Aichi Biodiversity Targets

The 10th meeting of the Conference of the Parties to the Convention on Biological Diversity, which took place in Aichi, Japan, in 2010, adopted a revised and updated strategic plan for biodiversity for the period 2011–2020, which included the Aichi Biodiversity Targets. The Aichi Biodiversity Targets have the following strategic goals:

- Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society.
- Reduce the direct pressures on biodiversity and promote sustainable use.
- Improve the status of biodiversity by safeguarding ecosystems, species, and genetic diversity.
- Enhance the benefits to all from biodiversity and ecosystem services.
- Enhance implementation through participatory planning, knowledge management, and capacity building.

Among the Aichi Biodiversity Targets are the following:

- At least halve and, where feasible, bring close to zero the rate of loss of natural habitats, including forests.
- Establish a conservation target of 17% of terrestrial and inland water areas and 10% of marine and coastal areas.
- Restore at least 15% of degraded areas through conservation and restoration activities.
- Make special efforts to reduce the pressures faced by coral reefs.

Source: Convention on Biological Diversity website, more information available at https://www.cbd.int/sp/targets/

Policy priorities for forest asset management in the GMS have shifted in the last decade or so from timber extraction toward multipurpose management and devolution to ensure greater ownership and rights for local communities. Greater emphasis on sustainable forest management is characterized by reduced harvesting in primary forests, an increase in plantation establishment, and the greater inclusion of community groups and the private sector in forest management. Other measures taken by GMS countries include more stringent management of PAs and an increase in their extent. All GMS countries have clearly articulated policy targets, although these are unmet in some instances (Table 2.2).

[7] Four GMS countries—Cambodia, Myanmar, Thailand, and Viet Nam—are members of ASEAN.

Table 2.2: Extent of Forest and Protected Areas in the GMS Countries, 2012, and Forest Cover Targets

Country	Land area ('000 ha)	Forest area, 2012 ('000 ha)	Forest cover as % of land area, 2012	Forest cover target, 2015 or 2020	Area of PAs ('000 ha)	Area of PAs as % of land area
Cambodia	17,652	9,967	57	60% by 2015	4,976.9	28.2
Lao PDR	23,080	15,672	68	70% by 2020	3,451.9	15.0
Myanmar	65,329	31,463	48	50% (35% closed forest, 15% open forest) by 2030	3,153.3	4.8
Thailand	51,089	18,987	37	40% (25% conservation forest, 15% economic forest) by 2016	11,077.4	21.7
Viet Nam	33,096	13,941	42	47% by 2020 (15.6 million ha)	3,907.5	11.8
PRC (Guangxi)	23,525	12,525	53	n/a	1,742.4	7.4
PRC (Yunnan)	39,232	18,177	46	n/a	3,322.9	8.5

n/a = data not available, GMS = Greater Mekong Subregion, ha = hectare, Lao PDR = Lao People's Democratic Republic, PA = protected area, PRC = People's Republic of China.
Source: FAO (2011).

Recently, there has been a marked shift in water asset management policies. Such policies traditionally focused on the allocation of water endowments for household and sectoral use, and on the construction of dams for hydroelectric power, but today they increasingly emphasize integrated management and sustainable use. All GMS countries have at least a "national framework" or a "water policy and strategy" that is based on IWRM principles and that covers priority economic, environmental, and social issues and policies related to water (MRC 2011).

GMS countries are expanding their policy focus to include the sustainable management of natural capital through the formulation of green-growth strategies. In the PRC, all major national plans and poverty-reduction strategy papers address natural capital and biodiversity. In its Third Rectangular Strategy, the Government of Cambodia has placed a high priority on the sustainable management and use of environmental and natural assets, and it has established the Secretariat for Green Growth under the Ministry of Environment. Myanmar has been convening a "green economy, green growth" forum annually since 2011. In 2012, Viet Nam developed its National Strategy for Green Growth, which has a strong focus on the restoration and development of natural capital and encourages all economic sectors to invest in "ecological services" infrastructure. Viet Nam has also adopted national strategies for sustainable development, environmental protection, climate change, and forest protection and development (Box 2.2).

All GMS countries have developed climate-change strategies, such as "national adaptation programs of action" and "nationally appropriate mitigation actions." While there is a comprehensive list of policies on biodiversity, green growth, and climate change in the

subregion, however, these policies are often formulated in isolation of each other, and there is considerable scope for greater complementarity. The implementation of these policies is not always mandatory, and they often lack monitoring and evaluation processes, making it difficult to assess their performance and effectiveness.

Box 2.2: Viet Nam's National Green Growth Strategy

Viet Nam's National Green Growth Strategy for 2011–2020 includes: promoting restoration and the development of natural-capital programs; implementing economic and financial policies for restoring and developing natural-capital resources; mobilizing and encouraging all economic sectors to invest in "ecological services" infrastructure, conservation areas, and the restoration of degraded ecological systems; and developing a green-accounting system involving natural-capital valuation. The National Strategy for Environmental Protection to 2020, with a vision to 2030, comprises activities and measures for achieving the objectives of rehabilitating and regenerating degraded natural ecosystems, especially coastal mangroves.

Source: Authors.

2.1.2 Regional collaboration

Regional collaboration to address trans-boundary environmental issues is increasingly a policy priority in GMS countries. The four GMS countries that are members of ASEAN (Cambodia, Myanmar, Thailand, and Viet Nam) participate in the ASEAN Heritage Parks Programme, which is aimed at reducing the rate of loss of natural habitats and effectively and equitably managing ecologically representative and well-connected PA networks. The ASEAN Centre for Biodiversity has been established as a regional center of excellence for promoting biodiversity conservation and management. Regional collaboration on the environment among ASEAN countries expanded to include the PRC with the formulation of the China–ASEAN Strategy on International Environmental Protection Cooperation and the establishment of the China–ASEAN Environmental Protection Center.

Lower Mekong countries are collaborating through the Mekong River Commission to manage the rich water resource endowment embodied by the Mekong River. This collaboration is underpinned by the Mekong Agreement of 1995, which is based on the principles of IWRM with the aim of guiding water development in the basin. The Basin Development Plan, which was developed under the Mekong Agreement, seeks to achieve a balance between the development and protection of the water resource.

The GMS Core Environment Program (CEP), which is administered by the Asian Development Bank (ADB) and overseen by the environment ministries of the six countries that form the Working Group on Environment, is striving to integrate environmental considerations in the GMS Economic Cooperation Program. The CEP is an integral part of the GMS Strategic Framework and serves to promote investment in natural capital within the GMS Regional Investment Framework (RIF). The CEP introduces environmental approaches, tools, and processes; builds capacity to use these; and leverages their uptake in economic development. The focus is on environmental assessments, planning, pilot-testing of innovation, and monitoring. Several other multilateral and bilateral initiatives in the GMS are supported by various official development assistance (ODA) programs.

There is a continuing need to strengthen coordination and collaboration among international, regional, and national initiatives to achieve natural-capital policy objectives and targets under global frameworks such as the Aichi Biodiversity Targets, United Nations climate-change targets, and the Sustainable Development Goals for the post-2015 period.

2.2 Legislation and Institutions

While significant progress has been made in strengthening policy frameworks in GMS countries, the desired outcomes will be achieved only if these frameworks are underpinned by robust laws and sufficient institutional capacity. In the past several decades, GMS countries have established a wide range of environmental laws, regulations, and standards to improve the management of natural capital. Even countries with relatively weak environmental legislative and institutional systems have undergone major reforms. Myanmar passed its Environmental Conservation Law in 2012, and the Cabinet approved the Environmental Conservation Rules in 2013. The Lao PDR revised its Environmental Protection Law, creating several new provisions to strengthen its regulatory framework and give greater prominence to the sustainable management of land and water resources.

The implementation of these laws, regulations, and standards remains a challenge, however. While all GMS countries have laws or regulations for the use of environmental impact assessment, their implementation, monitoring, and compliance are weak in some countries. Cumbersome governance structures make cross-ministerial collaboration difficult, watering down the implementation of environmental laws, and the technical capacity to undertake environmental measures in line ministries remains limited. In most cases, different agencies have separate mandates for related natural assets such as biodiversity, forests, land, and water, resulting in overlapping responsibilities and authority, institutional fragmentation, and reduced operational efficiency.

Strategic environmental assessment (SEA) is gaining recognition as a powerful legal tool for integrating environmental externalities into development policies, plans, and programs. The PRC and Viet Nam have legislated requirements for SEA, the Lao PDR is in the early stages of drafting legislation on SEA, and Cambodia, Myanmar, and Thailand have all shown strong interest in institutionalizing SEA in their legal systems.

On the institutional front, the PRC established the Ministry of Environment Protection in 2008 as a “super” ministry with a “vote” in the decision making of the State Council. This ministry performs a comprehensive management and coordination role, avoiding overlapping responsibilities and authority and consolidating institutional fragmentation. In the Lao PDR, the Water Resources and Environment Administration was restructured in

2011 into the Ministry of Natural Resources and Environment. This legal and institutional reform brought key natural assets, such as biodiversity, forests, and water, under the purview of one ministry. In Myanmar, the Ministry of Forestry was restructured and strengthened in 2012 to become the Ministry of Environmental Conservation and Forestry.

2.3 Financing

The ODA and national budgets continue to provide the main sources of environmental and natural-capital investment in GMS countries. Up to 35% of total ODA commitments in 2011 and 2012 were aimed at increasing environmental sustainability (OECD 2014). In Thailand and Viet Nam, the proportion of the national budget designated for environmental purposes has been close to 1% for the last 8–10 years. Private sector investments in natural capital are low in the GMS.

No systematic assessment has been made regarding the gap between the total financial cost of maintaining the quantity and quality of natural capital in the GMS and the funds available to do so. But several sectoral and thematic exercises, such as a subregional analysis of the financial gap in the management of PAs, have been conducted (Box 2.3).

Box 2.3: Multicountry Analysis of Southeast Asia's Protected Areas: Fiscal and Resource Gaps

A study involving the People's Republic of China and seven countries in Southeast Asia (Cambodia, Indonesia, the Lao People's Democratic Republic, Malaysia, the Philippines, Thailand, and Viet Nam) was conducted to assess resource and financing gaps for protected areas (PAs). The assessment included comprehensive descriptions and analyses of the internal and external pressures on the various PAs, their management responses (resource allocations), existing fiscal and fee structures, and the options for addressing resource gaps. The key findings of the Viet Nam country study, based on an assessment of 53 of the country's 164 PAs, are summarized below.

- The existing full-time staff in PAs was estimated at 65%–67% below the required level. An estimated 2,500–2,600 more staff would be required, therefore, for the effective management of all PAs in the country.
- The gap in operating expenses was estimated at 118%–132% of existing expenses. Extrapolating this estimate to the national level resulted in a total funding gap of about $34.8 million–$38.9 million for the 164 PAs combined.
- PAs in Viet Nam vary greatly in size and infrastructure, and investments should consider this variation. Almost 89% of the 53 surveyed PAs had residents living nearby, indicating that conservation measures must consider the livelihood needs of local communities.

Source: Pham (2011).

2.4 Fiscal and Economic Instruments

Fiscal instruments are needed for the effective and efficient development and implementation of environmental and natural-capital policies. Some GMS countries have already introduced, or are considering, comprehensive environmental tax reforms. For example, Thailand is considering a law to promote green growth that would involve fiscal instruments, including elements of environmental tax reform. The draft Environmental Management Act considers a range of fiscal instruments, such as environmental taxes, user fees, charges for pollution management, and product surcharges. The Pollution Management Plan (2012–2016) also proposes to apply the "polluter pays" principle (Nuntapotidech 2012). Most of the laws and regulations needed to implement these instruments are yet to be passed, however (OECD 2014).

Water pricing is widely used in the subregion, with water charges increasing in both the PRC and Viet Nam. The Lao PDR is exploring the possibility of a water consumption tax and an environmental tax. In forestry, there has been a shift away from granting forestry concessions toward the use of logging royalties. In Cambodia, all forms of forest concessions have been banned, and some economic land concessions have been suspended. In 2012, the Ministry of Planning and Investment in the Lao PDR announced a 4-year suspension of new land concessions for rubber plantations and new mining licenses.

There is growing interest in the use of economic instruments and innovative financing mechanisms to encourage private actors to invest in natural capital. Examples of these "incentive and market-based mechanisms" (IMBMs) are payments for ecosystem services (PES), REDD and REDD+,[8] and the certification and labeling of sustainably produced goods and services (discussed further in Section 3.5.3). A number of schemes that include elements of IMBMs have been implemented in the GMS to promote investments in natural capital. The use of IMBMs is still at a relatively small scale, however, and there has been only limited replication of pilot schemes.

Viet Nam was one of the first countries in Southeast Asia to implement a national policy on PES; it has built considerable experience in its Payments for Forest Environmental Services (PFES) scheme since 2011 and has successfully implemented provincial-level pilot schemes in Quang Nam, Lam Dong, and Son La (see Box 3.6 in Section 3.5.3). In the PRC's Yunnan Province, a PES scheme for protecting water and biodiversity has been explored but not applied at a large scale. Cambodia has hosted small-scale pilot PES schemes for wildlife conservation, water services, and ecotourism (Box 2.4) but is yet to scale up these initiatives. REDD and REDD+ initiatives have been undertaken in GMS countries, but only limited sales of carbon credits have taken place.

A possible reason for the limited replication of successful IMBM schemes is their high transaction costs. For example, the PES schemes that have been implemented successfully in the subregion have required intensive development and tailoring to suit their specific contexts. International development partners pay the transaction costs in many pilot schemes—an arrangement that is unlikely to be sustainable when the schemes are scaled up.

Box 2.4: Economic Instruments to Promote Sustainable Use of Natural Capital in Cambodia

A number of incentive and market-based mechanisms (IMBMs) have been implemented in Cambodia to promote sustainable land management, including PES, REDD/REDD+, and the eco-labeling and certification of sustainably produced products. A recently published inventory identified 17 past, ongoing, and concept IMBM schemes in the country (UNCCD 2014), comprising 12 PES schemes, 4 REDD/REDD+ projects, and 1 product-labeling scheme. The Cardamom Mountains ecosystem has been a particular focus of PES and REDD/REDD+ pilot schemes.

PES = payments for ecosystem services; REDD = Reducing Emissions from Deforestation and Forest Degradation; REDD+ = Reducing Emissions from Deforestation and Forest Degradation, as well as conserving and enhancing forest carbon stocks and practicing sustainable forest management, in developing countries.
Source: UNCCD (2014).

[8] REDD = Reducing Emissions from Deforestation and Forest Degradation. REDD+ = Reducing Emissions from Deforestation and Forest Degradation, as well as conserving and enhancing forest carbon stocks and practicing sustainable forest management, in developing countries.

2.5 Natural Capital Valuation

Although there is a large and growing body of information about the value of natural capital in the GMS, increasing investments in natural capital will require greater recognition of its economic value. Recent reviews (Brander and Eppink 2012, Emerton 2013) have synthesized information from more than 70 studies that estimate values for various ecosystems (e.g., forests, wetlands, and rivers) and ecosystem services (e.g., provisioning, regulation, and cultural), at several scales (local, subnational, national, and regional). Nevertheless, estimates of the economic value of natural capital in GMS countries are mostly ad hoc and far from comprehensive.

None of the GMS countries has a national-level framework for natural-capital accounting, but pilot activities exist. In Viet Nam, for example, the World Bank is supporting natural-capital accounting in the forest sector, and UNEP is supporting an assessment of the benefits of ecosystem services through its Project for Ecosystem Services (ProEcoServ) initiative (Box 2.5). In the PRC's Yunnan Province, natural-capital accounting is relatively mature in the valuation of water, minerals, and forests. In the Lao PDR, an economic assessment of biodiversity was conducted in Champasak Province. In Cambodia, the World Wide Fund for Nature (WWF), Conservation International, and Fauna and Flora International have initiated several natural-capital valuation projects.

Box 2.5: The Value of Ecosystem Services in Viet Nam From a Pro-poor Perspective

In Viet Nam, the United Nations Environment Programme's ProEcoServ initiative supported a review of pro-poor markets relating to ecosystem services and their potential benefits. Three types of market opportunities were examined to assess their applicability in Viet Nam: (i) forest carbon sequestration, (ii) PES, and (iii) biodiversity offsets. The study analyzed several markets related to forest carbon sequestration—the Clean Development Mechanism, the voluntary carbon market, REDD/REDD+, and the Forest Carbon Partnership Facility. The study also assessed various types of PES markets, payment methods, and scales, and the basic components of PES for various ecosystem services. The study reviewed the main elements of biodiversity offset schemes and analyzed existing schemes in Asia.

The study found that Viet Nam was well placed to take advantage of all three types of market opportunities. In particular, PES could be applied to maintain and conserve wetland ecosystem services while generating additional income for poor households living in wetland and forest communities.

PES = payments for ecosystem services; REDD = Reducing Emissions from Deforestation and Forest Degradation; REDD+ = Reducing Emissions from Deforestation and Forest Degradation, as well as conserving and enhancing forest carbon stocks and practicing sustainable forest management, in developing countries.
Source: Text contribution by the United Nations Development Programme.

Although considerable, current efforts by GMS countries to address the degradation of natural capital are insufficient to ensure the maintenance and improvement of ecosystem services in the subregion. GMS countries need a cohesive approach to guide the scaling up of investments in natural capital, as introduced in Chapter 3.

Bopha Seng, EOC

Chapter 3. Enabling Future Investments in Natural Capital

Key Messages

A guiding framework can help high-level policy makers provide enabling conditions for natural-capital investment

A holistic framework and the identification of critical enabling conditions can help policy makers develop policies that promote investments in the direct protection and enhancement of natural assets and in the improvement of resource-use efficiency and the mitigation of the impact of economic activities on natural assets. This chapter presents such a framework.

The range and scale of investment needed will be achieved only if the value of natural capital is accounted for in development decision making

Increasing investment in natural capital requires the following four enabling conditions:

- political support for natural capital and new perception of natural capital among policy makers, organizations, and individuals as an essential part of long-term prosperity;
- accounting for the value of natural capital in regulations, incentives, and market instruments to provide economic signals for the sustainable management of natural capital;
- the availability of public and private financing for programs to develop natural capital; and
- provision of tools to support decisions on natural capital–friendly policies and investments.

This chapter presents a framework for promoting investments in natural capital. It identifies the key enabling conditions for natural-capital investments and provides examples of actions that can be taken to strengthen these.

3.1 A Framework for Investing in Natural Capital

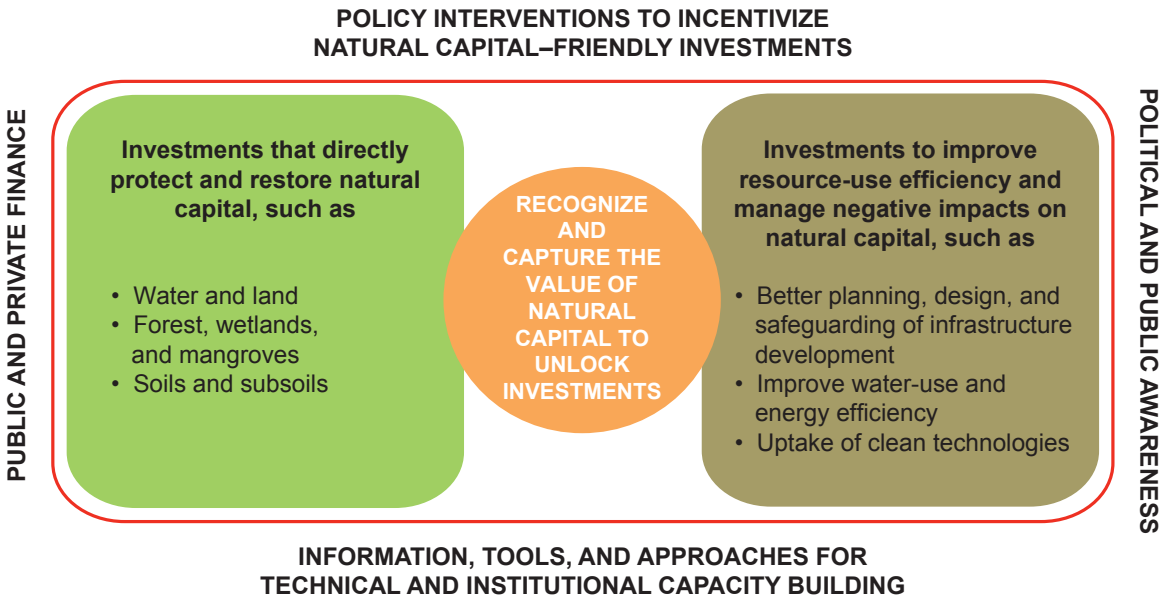
Investments in natural capital are largely about promoting actions to protect, restore, and enhance natural assets and the associated flow of ecosystem services they provide by accounting for their value in the economy and to society. Broadly, natural-capital investments can be categorized as those aimed at protecting and increasing natural-capital stocks, and those aimed at improving resource-use efficiency and thereby reducing the ecological footprint of economic sectors that rely heavily on natural assets. These two categories of investment may overlap and complement each other.

The range and scale of investment needed to maintain and increase natural capital in the Greater Mekong Subregion (GMS) will be achieved only if the value of natural capital is accounted for in development decision making. Four enabling conditions are essential for this:

- political support for natural capital and new perception of natural capital among policy makers, organizations, and individuals as an essential part of long-term prosperity;
- accounting for the value of natural capital in regulations, incentives, and market instruments to provide economic signals for the sustainable management of natural capital;
- the availability of public and private financing for programs to develop natural capital; and
- provision of tools to support decisions on natural capital–friendly policies and investments.

Figure 3.1 provides a framework for promoting investment in natural capital that illustrates the relationship between the two categories of natural-capital investment, the recognition of the value of natural capital, and the four enabling conditions. The following sections discuss the valuation of natural capital and each of the four enabling conditions for ensuring that the value of natural capital is taken into account in decision making.

Figure 3.1: A Framework for Promoting Investments in Natural Capital



Source: Authors.

3.2 Assessing, Valuing, and Accounting to Unlock Investments in Natural Capital

Assessing and valuing natural capital and presenting the assessed value through natural-capital accounts (Box 3.1 elaborates on the differences between these terms) is a powerful way of making natural capital visible and increasing efforts toward its sustainable use. The valuation of the ecosystem services generated by natural capital is at the heart of the proposed framework for promoting investment in natural capital.

All decisions that affect the way in which the natural environment functions implicitly put a value on natural capital (Costanza et al. 1997). For example, a decision to clear a forest to expand agriculture involves a trade-off between the value of ecosystem services provided by the forest and the value of increased agricultural production (in which the former is assumed to be lower than the latter). Problems arise, however, because the decision maker is unlikely to know the full value to the economy and society of the services provided by the forest. While some of those services, such as the provision of timber, have market values and can be assessed, other services, such as carbon storage, biodiversity conservation, and climate regulation, have little or no market value and therefore are unlikely to have been properly valued. It is possible that a decision to clear forest will make society worse off—but, in the absence of a proper valuation, the decision maker cannot know this.

Reliable information about the value of natural capital facilitates the objective and transparent consideration of trade-offs between investment choices and therefore helps policy makers and investors make informed decisions. The choice of valuation method depends on the context, the characteristics of the natural asset, and the availability of data. As explained in Chapter 2, estimates of the economic value of natural capital in GMS countries have mostly been ad hoc and done without clear integration with policy-making processes. Although no GMS country has a national-level framework for natural-capital accounting, pilot activities at the provincial, municipal, and sectoral levels are laying the foundation for future national natural-capital accounting systems.

Box 3.1: Natural Capital Assessment, Valuation, and Accounting

Natural-capital assessment is a review of the state or condition of natural capital. Such assessments can be conducted at various scales: (i) in geopolitical units such as countries or provinces; (ii) in individual ecosystems, such as watersheds; (iii) in individual natural-capital asset classes (e.g., forests, fish stocks, surface water, or mineral deposits); and (iv) in multiple asset classes (e.g., all ecosystems). Natural-capital assessment usually includes a valuation of the natural capital present in that unit.

Natural-capital valuation is the measurement of the contribution to well-being of stocks of natural capital or the flow of services produced by natural capital. Such valuations are expressed in social or economic terms and conducted by a relevant stakeholder, in a clearly stated ecological, economic, and social context, and with a clearly stated purpose.

Natural-capital accounting is the statement of economically expressed natural-capital valuations in formal financial reports of any kind—both internal reports (e.g., management accounts and management information systems) and external reports (e.g., national accounts, corporate statutory accounts, and corporate sustainability reports). At the national level, natural-capital accounts are typically denoted as "green GDP" accounts, "inclusive wealth" accounts, or "comprehensive wealth" accounts. An important distinction between natural-capital accounts and many natural-capital valuation studies is that accounts generally focus on measuring *total* stocks and flows, whereas valuation studies tend to measure *marginal* changes in stocks and flows under alternative policy scenarios. Examples of global natural-capital accounting initiatives are the System of Environmental–Economic Accounting (SEEA, Box 3.2), the World Bank's Wealth Accounting and Ecosystem Services (WAVES), and the International Human Dimension Programme's Inclusive Wealth Index.

Source: Authors.

Monetary valuations of natural capital should be treated with caution because they are unlikely to fully capture the multiple values of ecosystems, such as their intrinsic, aesthetic, cultural, and spiritual values. Nevertheless, if applied within a broader understanding of "value," monetary valuation can be a useful aid to decision makers in mainstreaming and capturing natural capital in plans and policies and ultimately in instigating positive changes in behavior.

Information about the monetary value of natural capital can be used to

- raise awareness of the value of natural capital among decision makers and the general public;
- reveal the distribution of costs and benefits of policies, programs, and projects among social groups;
- design appropriate fees for the use of natural capital;
- calculate potential returns on investment for projects that enhance, use, or cause a deterioration in natural capital;
- compare the costs and benefits of alternative uses of natural capital;
- compile national natural-capital accounts or green-business accounts (Box 3.2);
- calculate environmental damage and set compensation;
- provide incentives for the private sector to sustainably use natural capital;
- invest in cost-effective ecological infrastructure to mitigate the impact of climate change; and
- increase the capacity of local governments to develop municipal development plans that take natural capital into account.

Box 3.2: The System of Environmental–Economic Accounting

The System of Environmental–Economic Accounting (SEEA), a United Nations initiative, provides detailed methodological guidance for the production of internationally comparable statistics on the environment and its relationship with economies. It comprises three volumes: Central Framework, Experimental Ecosystem Accounts, and Applications and Extensions.

- The Central Framework provides a consistent accounting framework that can be integrated with the structure, classifications, definitions, and accounting rules of the System of National Accounts (the framework used by most countries to measure economic progress), thereby enabling the analysis of changes in natural capital, its contributions to economies, and the impact of economic activities on it.
- Experimental Ecosystem Accounts provide guidance on measuring ecosystem conditions (with a particular focus on carbon and biodiversity) and the flows of ecosystem services into economies and other human activities. This volume offers a synthesis of knowledge on ecosystem accounting and serves as a platform for the development of ecosystem accounting systems at the national and subnational levels.
- The Applications and Extensions volume is still under development. When finalized, it will provide users of SEEA-based environmental–economic accounts with examples of the ways in which collected information can be used in decision making.

In Southeast Asia, SEEA is being implemented at two pilot sites in the Philippines, with support from the World Bank's Wealth Accounting and Ecosystem Services (WAVES) initiative. Environmental–economic data on mineral resource exploitation and mangroves at the pilot sites will be used to develop accounts that will assist in sharing the benefits of mineral extraction with local communities and in supporting action to protect coastal areas from storms.

Source: SEEA Initiative website, more information is available at http://unstats.un.org/unsd/envaccounting/seea.asp

A substantial number of economic valuations of natural capital have been carried out in the GMS. Forests are by far the most frequently assessed ecosystem type, with more than 300 economic valuations at the subregional, national, and local levels (see Box 3.3 for an example from Cambodia), followed by coastal ecosystems (130 valuations), wetlands (100), and mangroves (80). Of the ecosystem services provided by these natural assets,[9] provisioning services, particularly those related to food and raw materials, have been valued most commonly (over 320 valuations), followed by cultural services (170), particularly those associated with recreation and tourism. Regulating services, such as flood and storm protection, have received relatively little attention, although these are likely to increase in importance if extreme weather events become more frequent, as projected under climate change (Brander and Eppink 2012). Most of these valuation studies have been small in scale, with varying methodologies, and they do not provide compelling evidence of the macroeconomic role of natural capital. Systematic, large-scale, and compatible assessment and valuation exercises are needed in the GMS.

[9] See Figure 1.2 for a list of ecosystem services provided by natural assets.

Box 3.3: Economic Valuation of the Change in Forest Ecosystem Services in Cambodia

A recent study estimated the change in the provision and value of forest ecosystem services that will occur in Cambodia in the period 2010–2030 if current deforestation trends continue. The analysis estimated the cost (forgone benefits) of ongoing forest conversion.

Extrapolated from current provincial-level trends in land-use change, the projected reduction in forest area in Cambodia in the period 2010–2030 is 1.2 million hectares (12% of the current forest area). The present value of ecosystem services that would be lost because of forest loss is estimated at $4.8 billion, about 10% of the country's projected gross domestic product in 2030 (IMF 2012).

The study showed that, globally, carbon storage in Cambodia is a highly valuable forest ecosystem service, although the benefits currently do not accrue to Cambodian land users or owners. Existing markets for carbon storage are weak and prices are low; these may provide incentives for maintaining forest carbon stocks, but not to the extent warranted by their global value.

Estimated values of non-carbon ecosystem services are also substantial and accrue directly to Cambodia. The present value of losses in these in the period 2010–2030, should deforestation continue, is estimated at $1.6 billion.

Source: UNCCD (2014).

Bopha Seng, EOC

The extent to which natural-capital valuation exercises have contributed to policy reforms and decision making on natural-capital investment is unclear, although Viet Nam provides a positive example. In 2003, the Chair of the Dong Nai Provincial People's Committee cited the role of forests in recreation and in the maintenance of the well-being of the growing urban population as a reason for reconstituting three state forest enterprises as forest protection management boards tasked with promoting sustainable forest management. As a first step toward increasing investment in natural capital, key natural resource–dependent sectors, such as agriculture, energy, fisheries, forestry, nature-based tourism, and water, could begin accounting for their use of natural capital, channeling the value of such use into investments that seek to maintain and increase natural capital. Valuation at landscape or spatial level is also essential to understand the linkages and interdependency of different natural-capital assets and to promote an integrated planning approach.

3.3 Raising Awareness of, and Mobilizing Support for, Natural Capital

Putting investment in natural capital on the political agenda requires concerted and coordinated effort. Cambodia's National Council for Green Growth, for example, was established to coordinate the efforts of various sectors and government departments in pursuing green development. Three factors are critical to the success of such a body. The *first* is high-level leadership. "Champions" often play key roles in pushing policy agendas and ensuring their relevance and impact. Strong political leadership can also ensure that sectors and government departments genuinely collaborate in national planning, sectoral development, job creation, and the fulfillment of other social and economic policy objectives. Such leadership is crucial when policy objectives conflict, near-term trade-offs are required, or financial resources need to be redirected toward "green" approaches. The *second* critical factor is coordination bodies with clear roles and functions, especially in relation to existing agencies. The *third* factor is effective communication, or the ability to tailor explanations of the issues, solutions, and challenges of natural-capital investment to specific target audiences. The role of natural capital must be understood well beyond environment ministries—such as in ministries of finance and planning, line ministries, and subnational and local decision-making bodies. "Selling" the natural-capital investment agenda to these actors requires the use of the right language and the right indicators (Box 3.4).

Activities to raise awareness of, and develop capacity in, natural-capital investment are required to help countries

- track trends in natural capital to enable priority setting and planning;
- improve regulations and create incentives to encourage the sustainable use of natural capital, especially in the private sector;
- reform environmental fiscal systems to encourage optimal resource consumption, raise revenues, and free up government resources for other priorities;
- implement international environment-related agreements, which often require specialized monitoring and reporting systems; and
- integrate natural capital into planning and decision-making processes at the national, sectoral, and local levels (OECD 2012).

Businesses must be made more aware of the role of natural capital in their activities if they are to account for it and incorporate it in their business plans and investment decisions. An understanding of natural capital also enables businesses to compute realistic returns

Box 3.4: Communicating the Role of Natural Capital in the Language of Finance and Planning Ministries

Investments in natural capital bring at least three benefits to a nation's economy: they create decent green jobs, they increase green GDP, and they increase the GDP of the poor.

The International Labour Organization defines *decent green jobs* as direct employment created in different sectors of the economy and through related activities that reduces the environmental impact of those sectors and activities to sustainable levels. Robust analyses of the potential for job creation through investments in natural capital would encourage local officials to increase investments in jobs that are sustainable, based on regional capacities, and socially defensible.

Green GDP incorporates estimates of the otherwise invisible economic benefits of ecosystem services and accounts for the depreciation of natural capital (the degradation and depletion of ecosystems and their services over time). To determine green GDP, data are collected on the value of ecosystem products and services such as timber, soil conservation, water augmentation, flood prevention, species diversity, bio-prospecting, agricultural land, freshwater, subsoil assets, and human capital (education and health). The measurement of green GDP follows the principles of the System of Environmental–Economic Accounting (SEEA) (Box 3.2). The green GDP of countries in which there is net ecological and environmental degradation will be less than the conventional GDP.

The process of calculating green GDP enables governments to create panel data for their natural capital and provides information about the importance of ecosystems and their services for continued development. The process also allows policy makers to target investments in selected ecosystem services that would provide economic gains.

GDP of the poor (as discussed in Chapter 1) measures the value of the incomes of rural and forest-dependent communities, including the contributions of ecosystem services. Modeling the ways in which the aggregate and per-household GDP of the poor can be improved—such as through interventions to improve ecosystem management, equitable access to markets, better public health and education, and additional employment opportunities—is a useful way of evaluating policy impact on communities.

An example of the benefits of investment in natural capital in Indonesia

Indonesia has developed the Indonesia Green Economy Model (I-GEM), which enables provincial governments to estimate the value of ecosystem services to rural economies, livelihoods, and health. I-GEM is helping national and local officials determine the scope for investment in green sectors that will generate economic growth and additional revenue.

Pilot-tested in Central Kalimantan, I-GEM has helped the provincial planning agency there to understand the dependence of rural households on natural capital. Among the surveyed rural households, ecosystem-based cash and noncash income constituted, on average, 76% of total income. This estimate enabled simulations of how future policy interventions might affect the well-being of rural households if natural-capital degradation continued under a business-as-usual scenario. It showed that incomes in villages that rely heavily on rattan, forests, and fisheries will decline almost immediately if practices do not change; on the other hand, investments in natural capital on a green-economy pathway would improve the incomes of all households that rely heavily on ecosystem services.

Assessments of GDP of the poor increase understanding of the integral role that women play in generating ecosystem-services-based income, which could be used in developing policy interventions to improve the well-being of women.

GDP = gross domestic product.
Source: Sukhdev, Varma, and Bassi (2014).

on investment that take into account the use of natural capital. Businesses that fail to assess their impact and dependence on natural capital carry unknown risks and may neglect profitable opportunities (TEEB 2012). For example, a recent study found that no industry in the top 20 sectors would be profitable if environmental impact were accounted for in monetary terms. According to the study, agriculture contributed more than logging to deforestation (commercial agriculture was responsible for 32%, and subsistence farming, for 42%) and did not generate sufficient revenue to compensate for or mitigate the risks posed by forest degradation (TEEB 2013). The incorporation of natural capital in the cost of production would cause volatility in agricultural commodity prices and would need to be approached in a manner that allowed industries and producers to adapt. More and better-targeted awareness raising among businesses—including the development of realistic alternative approaches and practices and the provision of examples of good business practice in the use and conservation of natural capital—will assist companies in remaining competitive, increasing resilience, and reducing costs while also protecting vulnerable natural-capital resources (TEEB 2013).

The full integration of natural capital in decision making means going beyond public policy making and private investment decisions to influence the decisions and actions of all individuals in a society. Almost all citizens in GMS countries have been affected by the increasing frequency of natural disasters; consequently, awareness of climate change and the need to conserve natural capital is growing in the subregion. Educational campaigns targeted at households can complement such awareness by building understanding of the concept of green growth and its relevance to daily lives. Information campaigns could also be used to encourage consumers to reward sustainable practices through their buying preferences.

3.4 Capturing the Value of Natural Capital in Regulations, Fiscal Incentives, and Market-based Instruments

A range of policy interventions has been developed to promote investments in natural capital, including IMBMs (see Chapter 2). Governments could consider four categories of IMBM in the GMS (Scherr et al. 2004):

- public payments (charges and reduction in levies) to private resource users for the enhancement (or degradation) of natural capital (e.g., subsidies, taxes, public payments for ecosystem services, and conservation easements);
- open trading between private resource users under a regulatory cap or floor for the level of use or investment in natural capital (e.g., habitat banking, water pollution permits, carbon trading, and development rights);
- self-organized private deals between the off-site beneficiaries of natural capital and the resource owners (e.g., payments by private water users to upstream farmers for their catchment protection efforts); and
- the eco-labeling and certification of sustainably produced products for which consumers are willing to pay a price premium.

Table 3.1 elaborates on these categories. Some mechanisms will be better suited to some contexts than others. Considerations include institutional capacity, governance, the regulatory framework, the system of property rights and land tenure, technical capacity, awareness of natural capital, and the existence of a culture of payment for public goods. The Global Mechanism of the United Nations Convention to Combat Desertification (UNCCD) has developed a screening tool to help in choosing IMBMs to suit a given context (UNCCD 2014).

Table 3.1: Fiscal Incentives and Market-based Mechanisms

Mechanism	Description
Public payments	
Permanent conservation easements	This is a guarantee that a tract of land will not be used or farmed. It usually involves an annotation in the property title or at the land registry office.
Contract farmland set-asides	Landowners give up the right to use part or all of their farmland in exchange for payments.
Cofinanced investments	Government pays part of the investment needed to achieve a certain land use or to promote production practices (e.g., afforestation, sustainable forest management, or sustainable land management).
Payments for proven investments in land conservation	Government provides a payment based on the investments made, per unit of area. The wastelands policy of the People's Republic of China is a variation of this kind of mechanism, in which the government makes in-kind payments of land rights to those who commit to conserving soil resources.
Subsidies	Government provides direct subsidies to those who implement sustainable land management practices or other environmental technologies (e.g., water treatment plants, energy-efficient light bulbs, or soil conservation equipment). These subsidies could be in the form of nonmonetary arrangements, such as providing technical assistance, seeds, and plants.

continued on next page

Table 3.1: continued

Mechanism	Description
Taxes, tax breaks, environmental fees	Environmental or green taxes may be levied on unsustainable practices, and the revenues can be used to correct or modify existing land-use practices. Tax incentives or breaks are provided for rain harvesting, brownfield redevelopment and decontamination, energy-efficiency measures, etc.
Open trading under regulation	
Conservation banks	Permanently protected private or public land is managed with conservation objectives. Parcels used for conservation purposes are managed by the bank, which sells credits to projects that will have an impact on the environment. Banks use the money to protect natural resources such as water, endangered species, farmlands, natural beauty, forestlands, and historical or archaeological sites.
Tradable development rights	The development of a certain amount of land is allowed on the condition that land of a similar type and quality is restored as a compensation measure.
Trading of emission reductions or removals (or other environmental benefits)	This mechanism sets a total pollution goal or allowance (or reduction) and distributes pollution permits to the amount of the total allowance. Parties can use, give, buy, or sell their allowances. The Clean Development Mechanism and REDD/REDD+ are examples of this kind of mechanism.
Self-organized private deals	
Purchase of development rights	An interested party buys the development rights for a given area of land to be dedicated to a particular use, such as forest management or conservation. For example, a hydroelectricity generator could purchase the development rights to an area that protects water quality.
Direct payments for ecosystem services	The users of ecosystem services pay the providers directly. For example, a hydroelectricity generator interested in minimizing erosion and siltation pays upstream farmers who employ sustainable land management practices.
Conservation concessions	One party provides another with a concession to use a tract of land for conservation purposes. Conservation concessions work in the same way as forestry or mining concessions, guaranteeing that the land will be protected, at least during the period considered.
Eco-labeling and certification of products and services	
Marketing labels	Payments for ecosystem services are embedded in a product or service, or a market develops for products produced sustainably. Products are sold to those consumers or retailers wanting to support suppliers who are good environmental managers.
Certification schemes	In certification schemes, a third party provides written assurance that a product, process, or service complies with certain standards. Compliance with the standards is certified by verification methods recognized and approved by a third-party certification body or certifier that has no direct interest in the economic relationship between the supplier and the buyer. These standards can be established by nongovernment organizations (e.g., the Forest Stewardship Council or the Rainforest Alliance), or by the industry, such as exporter or retailer groups.

REDD = Reducing Emissions from Deforestation and Forest Degradation; REDD+ = Reducing Emissions from Deforestation and Forest Degradation, as well as conserving and enhancing forest carbon stocks and practicing sustainable forest management, in developing countries.
Source: CATIE (2012).

3.5 Mobilizing Public and Private Financing

Global assessments of the financing required to meet the Aichi Biodiversity Targets (Box 2.1) are useful in understanding the magnitude of the investment needed in natural capital (although natural capital is a broader concept than biodiversity). An estimated $150 billion to $440 billion per year is required from 2013 to 2020 to meet all the Aichi Biodiversity Targets worldwide. Compared with annual global agricultural and fossil-fuel subsidies, which are valued at $1 trillion–$2 trillion per year, even the high end of this estimate is relatively modest.

3.5.1 Public financing and investment

In most countries globally, public financing for the environment and natural capital amounts to less than 1% of total government expenditure (HSBC Global Research 2013). The government budget allocated to maintaining biodiversity and ecosystem services is even smaller (Box 3.5). Direct investments in natural capital have not been mainstreamed into planning processes or given adequate weight by ministries of finance and planning. A macroeconomic perspective could promote public investments in natural capital by demonstrating the necessity of doing so and the associated benefits it brings. A recent report by Standard & Poor's referred to climate change as a global "mega trend" for sovereign risk and suggested that the increased vulnerability of Southeast Asian nations could make it difficult for them to gain access to international capital markets for development purposes (S&P 2014). Natural disasters, such as floods and droughts, strain national budgets and divert scarce resources to disaster recovery, emergency support reconstruction, and rehabilitation. Debt and deficits increase, putting downward pressure on sovereign ratings. A lower rating would directly affect economic development because it would reduce FDI, increase the cost of borrowing, and make it more difficult to attract both indigenous and external investment capital.

Public budget allocations to environment programs such as PAs may be seen as an input of public finance into natural-capital management. A review of PA networks by the International Centre for Environmental Management (2007) found that PAs cover 20% or more of the land area in Cambodia and Thailand, making these among the world's largest PA networks as a proportion of national territory. Although government budget allocations for PA management have increased in the last 3 decades, they are still small considering the land area to be managed and the contributions PAs make to local and national development. In 2001, for example, just 0.18% of Cambodia's national budget and 0.5% of Viet Nam's national budget were allocated to PAs. A lack of information on the development value of PAs and the revenues they generate makes it difficult to justify greater investment in them; other sectors are better able to demonstrate direct earnings and income. Mechanisms to ensure that users pay for the maintenance of the benefits they receive from PAs should be adopted so that sectors such as agriculture, energy, fisheries, manufacturing, tourism, and transport help fund the management of PAs and other forms of natural capital.

Environmental tax reform may be effective in mobilizing public financing for natural-capital management. The aim of such reform would be to shift away from taxes on labor, income, and capital toward taxes on natural-capital consumption and pollution in ways that leave total tax revenue unchanged. Well-designed tax reform of this sort could yield multiple dividends, including sustained economic growth and more jobs. It could also directly alleviate environmental problems such as water contamination and air pollution, which tend to affect the poor most. Environmental tax reform could also help reduce poverty indirectly by generating or freeing up resources for anti-poverty programs in areas such as water supply and sanitation (OECD 2014).

Box 3.5: Public expenditure review on biodiversity in Malaysia

Malaysia joined the Biodiversity Finance Initiative (BIOFIN) as one of the original 12 pilot countries in 2013 to review its public investment in the conservation and management of biodiversity and ecosystems and identify future required actions to halt biodiversity loss. BIOFIN is a global project of the United Nations Development Programme (UNDP) with funding from the European Union, and the governments of Germany and Switzerland. In Malaysia, national budget allocations for biodiversity are sourced from the development and operating budgets. The development budget is planned and allocated through the 5-year development plan (Malaysia Plan), under the supervision of the Prime Minister's Department, while the operating budget for federal agencies is allocated on an annual basis by the Ministry of Finance.

After analyzing the financial data provided by the Economic Planning Unit, the initiative made two preliminary observations about Malaysia's public investment in biodiversity and ecosystems conservation and management:

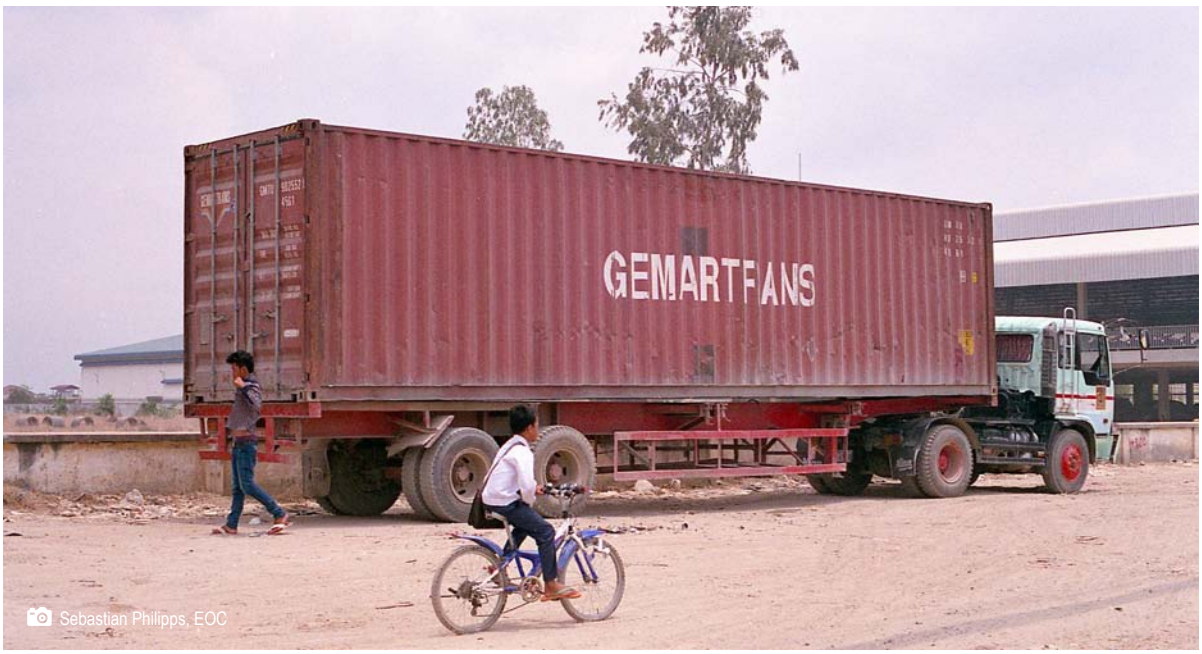
- Only 0.0028% of the development budget allocation of RM200 billion ($57 billion) for seven agencies in 2006–2010 contributed to biodiversity. The agencies covered by the development budget are the Ministry of Natural Resources and Environment, the Department of Wildlife and National Parks, the Forestry Department of Peninsular Malaysia, Forest Research Institute Malaysia, the Department of Marine Park Malaysia, the Forest Department Sarawak, and the Sabah Forestry Department. These budget allocations do not include other relevant ministries and agencies relevant to biodiversity, for example, the Ministry of Agriculture and Agro-Based Industry.
- Operating expenditure for subnational protected area agencies has decreased about 60% since 2012.

Further analysis will be made in an effort to chart a more integrated and holistic way forward in the planning and allocation of financial resources for biodiversity conservation in Malaysia.

Source: Text contribution by the United Nations Development Programme.

Some GMS countries have introduced, or are considering, comprehensive environmental tax reforms to mobilize investments in natural capital (UNESCAP 2012). As noted in Chapter 2, Thailand is imposing user fees and charges for pollution management, product surcharges, and tradable permits as instruments in its Environmental Management Act to raise public revenues and promote green growth. Viet Nam's Environmental Protection Tax Law, which entered into force in 2012, targets diverse pollutants as well as harmful herbicides and restricted forest products. Importantly, taxes are applied at the source—that is, they are imposed on those organizations and individuals producing or importing the goods. Tax rates vary according to the goods and the environmental damage they cause (UNESCAP 2012, OECD 2014).

Removing fossil-fuel subsidies is an integral part of environmental tax reform. Such subsidies amounted to about $51 billion in Southeast Asia in 2012, equivalent to 11% of all general government spending. Thailand's fossil-fuel subsidy program, for example, cost about $10 billion. Removing or reducing these subsidies—while alleviating any social impact of such removals—and investing the savings in green growth, education, health, and social welfare programs would simultaneously reduce environmental pressures and increase human well-being (OECD 2014). The current drop of over 45% in fossil-fuel prices could make this an ideal time to eliminate fossil-fuel subsidies.



3.5.2 Private financing

Business investment in natural capital is still low in GMS countries compared with investments made by the public sector. A large number of businesses in the GMS are relatively small in scale, and many operate in the informal sector. In Cambodia, for example, 91% of all truck owners—involving 59% of all trucks—operate informally (ADB GMS-EOC 2014). In general, SMEs operating in the informal sector lack both the capacity to account for natural capital in their operations and access to affordable finance for investing in natural-capital management. Larger companies are more likely to recognize the need to manage natural capital because of their greater dependence on natural assets and because of shareholder demands to consider the sustainability of their operations. Large companies may struggle, however, in identifying natural capital–sensitive operations and in reaching out to their SME value-chain partners.[10]

The concept of sustainability has increased in importance in the corporate sector globally (United Nations Global Compact and Accenture 2013). This could be due to two factors. *First*, an increasing body of research has demonstrated a connection between sustainability, which includes factors such as efficient resource use and waste management, and operational and financial performance. For example, following an investigation into the operational and financial performance of 180 corporations, Eccles, Ioannou, and Serafeim (2013) found that stock value increased more over time for high-sustainability firms than for low-sustainability firms. Guenster et al. (2011) found a statistically significant positive relationship between eco-efficiency—the ability to create more value using fewer environmental resources—and corporate financial performance.

Second, a recent increase in extreme weather events (IPCC 2007a), and high-profile cases of corporate environmental disasters (such as the 2010 BP Oil spill in the Gulf of Mexico), have signaled to many companies the importance of sustainably managing natural capital as a way of minimizing supply-chain risk. This increased awareness is evident in Asia: significant percentages of chief executive officers in ASEAN countries (40% of those surveyed in 2013), Japan (37%), and India (33%) rated climate change as one of

[10] According to interviews carried out by EOC staff with selected businesses in the GMS.

the three most important sustainability challenges for their businesses (United Nations Global Compact and Accenture 2013). More than half (57%) of the chief executive officers surveyed in the PRC believed they had secured a price premium from consumers because of their approaches to sustainability (United Nations Global Compact and Accenture 2013).

Awareness among companies of the need for sustainability is heightened by the emergence of new business opportunities related to natural capital. The value of the biocarbon offsets market, for example, is projected to grow to more than $10 billion by 2020 (TEEB 2012). The market for water catchment services worldwide was worth $5.2 billion in 2008 and is expected to increase to $6 billion by 2020 and to $20 billion by 2050 (TEEB 2012) (Table 3.2).

Table 3.2: Emerging Global Market Opportunities for Natural Capital

Market opportunity	Estimated or projected value ($)		
	2008	2020	2050
Certified agricultural products	40 billion	210 billion	900 billion
Payments for catchment services	5.2 billion	6 billion	20 billion
Bio-prospecting contracts	30 million	100 million	500 million
Voluntary biodiversity offsets	17 million	100 million	400 million
Certified forest products	5 billion	15 billion	50 billion

Source: TEEB (2012).

Private sector investments in natural capital are emerging in the GMS. For example, Holcim Viet Nam leveraged funding from the International Finance Corporation to construct a greenfield cement plant at Hong Chong, an important site for limestone biodiversity and endangered water birds. To ensure continued operations at the plant, Holcim partnered with the International Crane Foundation to maintain one of its nearby sites as a conservation area for cranes and to provide sustainable local incomes. The involvement of Holcim Viet Nam in the conservation effort changed public attitudes and catalyzed the interest of the provincial government in sustainable development opportunities (IFC n.d.). An example of the use of sustainability labeling to encourage private sector investment in the restoration of degraded land is provided by the application for Forest Stewardship Council certification by a timber plantation in Cambodia. Grandis Timber is developing a teak plantation on a 10,000 ha economic land concession in Kampong Speu Province. The land was heavily degraded because of clear-cutting in the 1990s and subsequent fires in the regrowth, and Grandis Timber has undertaken extensive land restoration to prepare the site for use. The company has also developed strong relations with the local community by providing employment and by giving community members access to land in the concession area, thereby reducing the cost of protecting the investment and the risk of legal challenges.

The potential of public–private partnerships to fuel investment and efficiency gains in the environment sector has not been fully realized in the GMS. An assessment of public–private partnership readiness in the Asia and Pacific region, based on the regulatory and institutional framework, operational maturity, the investment climate, financial facilities, and subnational adjustment factors, categorized Viet Nam as “nascent” and Thailand as “emerging” (ADB 2011b).

Policy makers can facilitate business engagement in natural-capital investments by providing competitive intermediary services; financial support for buying down market risks, such as in ecotourism; and clear baselines for assessing the "additionality" of natural-capital investments so that companies can obtain credits for such investments and use them for trading purposes. In many cases, businesses also need new markets so that natural-capital investments can generate income. Governments in the GMS could consider the following courses of action (TEEB 2012):

- Promoting demonstration activities in PES schemes to show businesses where, in what form, and under what conditions PES works best. The aim would be to make it easier for businesses to engage with PES schemes by enabling them to reduce their transaction costs and build capacity in their own teams.
- Supporting the creation of national jurisdictional REDD/REDD+ structures that, in collaboration with businesses, put in place project qualification criteria and reward the successful development of projects with recognition and monetary compensation.
- Providing businesses that integrate ecological concerns and help conserve biodiversity with tax breaks, subsidized insurance premiums, and public leases of land at favorable rates.
- Improving public business advisory services to help businesses compete internationally in new markets.
- Developing biodiversity or ecological bonds using a credit-rating system based on sustainable revenue-generating opportunities with the aim of ensuring that investments in natural capital provide adequate financial returns.
- Establishing dedicated biodiversity or ecological funds that specifically target small and medium-sized enterprises (SMEs) with the aim of providing them with affordable financing for their natural-capital management (Box 3.6).

Box 3.6: Establishing Biodiversity Enterprise Funds

Biodiversity enterprises are small and medium-sized enterprises (SMEs) that operate in and around national parks and other natural areas and are engaged in site-based economic development that contributes significantly to biodiversity conservation. Such enterprises typically find it difficult to raise capital. Biodiversity enterprise funds funded by a combination of private investments and grants from governments and donor agencies could assist in reviewing, engaging in, and managing biodiversity enterprise investments while generating returns on investment (Conservation Finance Guide n.d.). Biodiversity enterprise funds would encourage SMEs to make sustainable use of natural capital in their endeavors.

Source: Conservation Finance Guide website, http://conservationfinance.org/guide/guide

Increasing environmental and social awareness is vital among businesses that operate in areas with rapidly growing economic needs and where large numbers of people, particularly the poor, are critically dependent on natural resources for their well-being. GMS governments need to take the following four primary actions to encourage the development of responsible corporations (Sukhdev 2012):

- Set regulations and policies that require businesses to disclose their externalities to investors and consumers so that both can decide on the value of a good on the basis of criteria that are broader than price and return on investment. This will require an assessment of the dependence of businesses on natural capital and the impact of their activities on natural capital.

- Impose resource taxation that focuses on the "bads" rather than the "goods" (taxes would be higher for corporations that are big net consumers of natural capital) and provides incentives to companies that integrate, value, and account for natural capital in their business models.
- Adopt stringent standards that result in more accountable advertising so that consumers are well informed about environmental costs.
- Limit leverage, especially for those companies that are considered "too big to fail," because their leverage is essentially a negative externality on taxpayers.

3.5.3 Innovative financing instruments

Market-based financial instruments such as PES and REDD/REDD+ are innovative approaches to the financing of natural-capital conservation and management. Such instruments could play a particularly important role in the GMS, where ecosystem services underpin rapid economic growth and where there are many rural poor. They could help to secure natural capital, reduce poverty, and encourage green growth.

Various PES schemes have been deployed in the GMS, ranging from macro-scale schemes, such as Viet Nam's PFES scheme (Box 3.7) and the Eco-compensation Scheme under the Sloping Land Conversion Program in the PRC, to small-scale initiatives such as community-based biodiversity protection payments in Cambodia.

Box 3.7: Viet Nam's Payments for Forest Environmental Services Scheme

Since 2011, Viet Nam's Payments for Forest Environmental Services (PFES) scheme, Southeast Asia's largest payments for ecosystem services (PES) program by far, has generated $140 million for rural households to protect around 4 million hectares (40%) of the country's forests. More than 350,000 Vietnamese households are helping to patrol and manage vital forest and watershed areas and, in compensation, they are paid by hydroelectric-power and water-supply companies that rely on clean water and other ecosystem services in these areas.

Key achievements of the scheme include the following:

- The extensive legal framework for the PFES scheme has reinforced political commitment and strengthened the capacity of implementing agencies operating both nationally and provincially.
- Revenue from the scheme has increased the forest sector's contribution to the national economy.
- Communities are benefiting from job creation and financial rewards, and they understand sustainable forest management better.
- PFES is contributing to environmental protection, and there is reduced forest degradation and fewer legal violations.

But challenges remain:

- Government implementing agencies lack capacity, leading to high transaction costs and delays in PFES payments.
- PFES payments remain relatively low compared with the high opportunity costs. Forest clearing for agriculture provides greater economic gains.
- Payment systems inevitably create trade-offs between effectiveness, efficiency, and equity.

Source: Viet Nam MARD (2014).

The Lao PDR, Thailand, and Viet Nam are progressing well in their REDD+ readiness preparations, assisted by the interim performance-based payment systems offered by the Lao PDR (worth about $150 million)[11] and the Forest Carbon Partnership Facility in Thailand (about $21.7 million) and Viet Nam (about $8.7 million). REDD+ readiness preparations are important for ensuring that all stakeholders at the provincial, district, and community levels are ready to participate in emerging REDD+ schemes because, ultimately, forest conservation and sustainable management interventions will be implemented at those levels.

The successful uptake of PES and REDD+ in the GMS requires the following, among other things:

- clearly defined land tenure and strengthened property rights;
- the promotion of participatory forest management and carbon monitoring;
- trust and collective negotiation capacity in local communities and among smallholders (OECD 2013);
- diverse governance structures and regulatory frameworks; and
- measures to overcome high transaction costs (Alana 2009).

Biodiversity offset schemes have been used in development projects that have unavoidable detrimental impact on natural capital, serving to compensate for such impact by creating similar or related biodiversity habitat at receptor sites with the aim of achieving no net loss (and preferably a net gain) in biodiversity. The Business and Biodiversity Offset Program developed 10 principles of biodiversity offsetting as part of the Biodiversity Offsetting Standard.[12] These principles have been referenced by International Finance Corporation–financed projects as an internationally recognized standard in biodiversity offset design.

Biodiversity offsetting is a complex process because information may be incomplete and estimates or predictions of biodiversity gains at receptor sites may be unrealistic. Offset schemes should focus on vulnerable ecosystems that require urgent attention, thus creating additional or positive biodiversity value.

Impact investing is another new stream of financing for environmental conservation and natural-capital management (Box 3.8). Impact investing, currently worth an estimated $50 billion worldwide, offers investors the possibility of maximizing environmental, financial, and social returns for what is often referred to as the “triple bottom line.” The growth of the impact investing space is bringing together investors and intermediaries to develop innovative financial products and services that cater to the increasing demand.

Box 3.8: Impact Investments to Address Land Degradation

Impact investments are investments made in companies, organizations, and funds with the intention of generating measurable environmental and social impact alongside a financial return (Global Impact Investing Network n.d.). The United Nations Convention to Combat Desertification and other partners are establishing an innovative investment vehicle with a view to providing a structured portfolio through which private sector and public sector actors can engage in impact investing, with a specific focus on encouraging land degradation neutrality.

Source: Global Impact Investment Network website. http://www.thegiin.org/impact-investing

[11] This estimate includes the $30 million grant requested from the Forest Investment Program, the existing budgets of several partners in the forest sector that are aligning their programs and activities with REDD+, and new grant financing that will be under consideration by each of the multilateral development banks and bilateral donors (FIP Investment Plan 2011).

[12] Available at: http://bbop.forest-trends.org/documents/files/bbop_principles.pdf

3.6 Information, Tools, and Approaches to Support Decision Making

Deciding between investment alternatives, especially those associated with the greening of economic activities, involves weighing up and comparing their costs and benefits. For example, the establishment of a new PA involves costs such as the purchase of land, compensation for local communities, and ongoing maintenance and enforcement, while benefits might include biodiversity conservation, increased recreational use, and improved watershed services. These costs and benefits are likely to be measured in different units, be incurred by different social groups, and occur at different times. Organizing and comparing information about the costs and benefits and choosing between investment options with differing impact profiles requires a structured approach, which in turn requires innovative planning and dialogue tools.

In light of the risks associated with climate change and other future uncertainties, development planning increasingly requires rigorous spatial (see Box 3.9), socioeconomic, and environmental analysis. Strengthened planning processes will enable planning agencies and diverse stakeholders to articulate clear visions of the future and identify appropriate development pathways that are equitable and that support poverty reduction, environmental sustainability, and climate-change resilience.

Box 3.9: From Protected Area Conservation to Sustainable Landscape Management

Landscapes are important repositories of natural capital. Examples include provisioning services such as timber production and hydroelectric power, regulating services such as carbon sequestration, supporting services such as nutrient cycling and replenishment, and cultural services. Such services not only originate in landscapes, they often extend far beyond them. Intact landscapes are important contributors to sustainable economic growth and societal well-being in the Greater Mekong Subregion.

Landscapes are usually of sufficient size to encompass one or more ecosystem. They also typically comprise more than one form of land use, such as totally protected areas, and areas under productive use, such as forestry, agriculture, and urban settlement.

The societal importance of landscapes, as well as their underlying structural complexity, requires a dedicated approach to assessing, managing, and conserving them. To develop effective landscape management strategies, spatially explicit multi-criteria evaluations and trend models are needed to assess and economically value ecosystem stocks and flows, determine landscape resilience and coping capacity, and relate these to actual and projected resource demands and other external pressures such as climate change. On the basis of such a comprehensive analysis, planners can allocate appropriate management units to individual parts of the landscape, such as protected areas (and their buffer zones), ecological corridors, and community forests, agroforestry, forest concessions, and agriculture. An efficient monitoring system should be employed to provide feedback on management decisions and assist in adapting management to changing circumstances.

To be successful, landscape management plans need the commitment of all stakeholders. This can be obtained by actively involving local communities, private investors, local and national governments, conservation organizations, and international development agencies in decision making. Such involvement is crucial for ensuring that landscape management is harmonized with broader conservation policies, sector plans, and area-based plans, as well as with local-level land-use plans. Efficient coordination mechanisms are needed; these are particularly important in trans-boundary landscape management.

Source: Authors.

Inevitably, economic development leads to land-use change, the increased use of natural capital, the growth of infrastructure and transport networks, and increased movements of people and goods. The effective management of this process requires multisectoral planning involving collaboration among governments (at multiple scales), civil society, and the private sector (Box 3.10).

Box 3.10: Multisectoral Planning: Relevance, Process Design, and Tools

A lack of coordination among sectors and levels of government is likely to compromise the pursuit of sustainable development. The aim of "research for development" (R4D) is to encourage coordination and fill information gaps in sectoral and trans-boundary decision making. The Challenge and Reconstruct Learning (ChaRL) process is an innovative example of R4D that was recently tested, reviewed, and adapted for use in the Greater Mekong Subregion (GMS). The process involves five iterative steps:

- cross-sectoral and trans-boundary design of development investments;
- development of visions that are shared across sectors and countries;
- provision of research evidence in the form of a multi-method assessment;
- revision of the initial expectations of decision makers regarding the outcomes of particular interventions; and
- revised design of investments.

An effective method for ranking investment alternatives is multi-criteria analysis (MCA), in which a multidisciplinary group of actors discusses and defines criteria that are contributing to a problem (or solution), each actor valuing the criteria from his or her own sectoral perspective. The resulting multisectoral "criteria tree" is used to generate a suitability score using weighted linear combination. If the criteria are linked to map layers they become spatial MCA, and the output will be a map showing the geographic distribution of suitability scores. In developing the GMS Regional Investment Framework (see Section 1.5), for example, spatial MCA was used to map and categorize the risk to landscapes of various sector investments, guide investment prioritization, and indicate potential mitigation measures.

In situations where investment options are not independent—that is, where synergies or trade-offs exist between investment options—or where complex feedback mechanisms introduce risks that change over time, agent-based or system dynamics models that simulate changes in environmental, social, and economic processes over time are required. Agent-based models allow the explicit modeling of individual decision making, which system dynamics models cannot do. An example of an agent-based model is the Mekong Region Simulation Model (MerSim), which integrates assessments of development strategy combinations (e.g., irrigation, hydroelectric power, and land-use change), and the resulting impact on the environment (e.g., on forest cover, fish stocks, and biodiversity), poverty, migration, and economic performance. MerSim has been used to assess irrigation investments in the Lao People's Democratic Republic and Thailand; migration and poverty dynamics in response to sea-level rise in Viet Nam's Mekong Delta; livelihood changes in Cambodia's Tonle Sap; and payments for ecosystem services in rubber-tapper communities in Xishuangbanna, Yunnan Province, People's Republic of China.

Source: Text contribution by the Mekong Futures Institute.

Modeling and simulation visualization tools can improve understanding among stakeholders of the trade-offs involved in the demand and supply of scarce resources. Such tools are a means of bringing complex analysis to multistakeholder dialogues in ways that are understandable and meaningful to all stakeholders and that encourage constructive debate on development options.

Table 3.3 provides a non-exhaustive list of tools and approaches available to help organize complex information for decision making on natural capital. The most appropriate tools and approaches depend on the issue to be addressed, the data and resources available, and the technical capacity to conduct assessments. Many of the tools listed in Table 3.3 are complementary and may be used at different stages of the process of assessing investments in natural capital. The efficacy of environmental assessments is, however, undermined by a lack of technical capacity and funding, and of credible historical and contemporary data. Efforts to build capacity in monitoring natural capital and using policy tools need to be continued and strengthened.

Table 3.3: Information, Tools, and Approaches to Support Natural Capital–friendly Decision Making

Category of Tool/Approach	Tool/Approach	Source
Indicator frameworks	Diagnostic indicators for green growth	OECD
	Green-growth indicators	Global Green Growth Institute
	Green Economy Indicators	UNEP
	Planetary Boundaries	
	Ecological Footprint	
Natural-capital accounting frameworks	The System of Environmental and Economic Accounting	United Nations Statistics
	Adjusted Net Savings	World Bank
	Inclusive Wealth Index	United Nations University–International Human Dimension Programme on Global Environmental Change
	Corporate-level environmental accounting	World Resources Institute
	Corporate ecosystem services review	World Business Council for Sustainable Development
Impact assessment frameworks	Environmental impact assessment	
	Strategic environmental assessment	
Investment/Policy evaluation methods	Cost–benefit analysis	
	Life-cycle assessment	
	Cost-effectiveness analysis	
Natural-capital assessment tools	Integrated Valuation of Environmental Services and Trade Offs (InVEST)	WWF
	Artificial Intelligence for Ecosystem Services (ARIES)	
	Multiscale Integrated Models of Ecosystem Services (MIMES)	
	Integrated Model to Assess the Global Environment (IMAGE)	Netherlands Environmental Assessment Agency
	Global Methodology for Mapping Human Impacts on the Biosphere (GLOBIO)	
	Integrated Biodiversity Assessment Tool	UNEP–World Conservation Monitoring Centre
	Toolkit for Ecosystem Service Site-based Assessment (TESSA)	
	National Reporting Toolkit	
	Biodiversity Offsetting Standards	Business Biodiversity Offset Program

continued on next page

Table 3.3: continued

Category of Tool/Approach	Tool/Approach	Source
Spatial-planning tools	Multi-criteria assessment	
	Spatial multi-criteria analysis	
	Sustainable landscape management	
	Marxan	
	Seasketch	
	Conversion of Land Use and its Effects (CLUE)	Institute for Environmental Studies, the Netherlands
Policy-instrument screening tools	Screening tool for IMBMs	UNCCD
Climate-risk screening tools	AWARE	ADB
Scenario-creation tools (qualitative)	System maps	
	Delphi analysis and story and simulation	
	Shared Vision Planning and Scenario tools	
	ChaRL Framework	
Scenario-forecasting tools (quantitative)	Green Economy Systems Dynamic Model	
	Computable general equilibrium models	
	Integrated models	
	Global Unified Meta-model of the Biosphere (GUMBO)	
	International Futures simulator (Ifs)	
	MerSim model	
Ecosystem service classifications	Millennium Ecosystem Assessment	UNEP
	The Economics of Ecosystems and Biodiversity	UNEP
	Common International Classification for Ecosystem Services	European Environment Agency
Implementation initiatives	The Economics of Ecosystems and Biodiversity	UNEP
	Wealth Accounting and Valuation of Ecosystem Services	World Bank
	The Intergovernmental Platform on Biodiversity and Ecosystem Services	
	The Project for Ecosystem Services	UNEP

ChaRL = Challenge and Reconstruct Learning.
Source: Authors.

Steve Griffiths, ADB

Chapter 4. The Way Forward

Recommendations

The recommendations are as follows:

- Identify key regional and national policy and planning processes, engagement with which could significantly increase investment in natural capital.
- Support the development of underlying legal and institutional systems.
- Tailor messages on natural-capital investment for decision makers in ways that demonstrate the relevance of such investment in addressing major development challenges in the Greater Mekong Subregion.
- Build technical capacity to develop and deploy valuation and mainstreaming tools and approaches, such as natural-capital accounting, valuation, and strategic environmental assessment.
- Foster science–policy linkages to increase the relevance of assessment and research.
- Demonstrate the multiple benefits of natural capital by applying frameworks such as those that address the links between energy, food, and water security and ecosystem-based approaches to climate-change adaptation and mitigation.
- Mobilize public sector and private sector investment by strengthening fiscal and economic instruments targeting high-priority landscapes with rich natural capital and the supply chains of key commodities.

Increasing investment in natural capital is strategically important for securing human well-being in the GMS. This chapter provides a concise set of recommendations organized around the four enabling conditions in the natural-capital investment framework (Chapter 3). Many of the recommendations are derived from regional consultations supported by the CEP in the lead-up to the 4th GMS Environment Ministers Meeting (Table 4) and are based on existing country experiences. The recommendations are intended to guide the operationalization of the natural-capital investment framework by identifying key interventions and actions.

Create enabling policy conditions for investment in natural capital and mobilize broad-based partnerships for its delivery

- Identify policies and programs, engagement with which is likely to have most impact on increasing natural-capital investment. At the subregional level, programs likely to provide suitable opportunities include the GMS Regional Investment Framework, the Mekong River Commission's Basin Development Plan, and the ASEAN Heritage Parks Programme.
- At the subregional level, strengthen institutions by providing them with stronger mandates to pursue natural-capital investment opportunities. In some cases, institutional reform is also required at the national level to give greater authority to environmental ministries, consolidate their functions, and improve coordination.
- Increase coordination among subregional and national initiatives and bilateral and multilateral efforts to achieve common policy objectives.

- Foster partnerships among GMS country policy makers, businesses, civil society organizations, and other interested stakeholders to combine resources, maximize economies of scale, and identify opportunities for joint investments in natural capital.

Raise awareness and mobilize political support for the significant role played by natural capital and hence change the way in which policy makers, organizations, and individuals perceive and account for natural capital

- Ensure that messages are tailored to the needs of decision makers in ways that demonstrate the relevance of such investment in addressing major development challenges in the GMS. For example, realistic estimates of the number of jobs that would be created by natural-capital investments could be a powerful way of attracting the interest of ministries of finance, planning, and investment.
- Demonstrate the multiple benefits of natural capital by applying assessments and frameworks such as those addressing the links between energy, food, and water security and ecosystem-based approaches to climate-change adaptation and mitigation. Given the multisectoral nature of natural-capital investment, cross-sectoral engagement is an important aspect of communication strategies. The benefits of investing in natural capital should be conveyed in the context of each sector.
- Ensure that messages are compelling, backed by empirical evidence, and based on sound economic assessments demonstrating that investing in natural capital makes good political, social, and business sense.

Develop and deploy an analytical framework and processes to integrate the value of natural capital in development decisions

- Strengthen national and corporate statutory accounts by incorporating natural-capital accounting tools such as green GDP accounts and inclusive wealth accounts, and potentially instituting natural-capital accounting and propagating its application by introducing appropriate regulations.
- Feed reliable data and information from rigorous natural-capital assessments and valuation exercises into natural-capital accounting to ensure its credibility by strengthening the capacity of data service providers, universities, and academe.
- Develop and improve robust natural-capital monitoring and assessment systems and, to the extent possible, harmonize natural-capital accounting methodologies across the subregion.
- Strengthen national safeguard systems such as SEA and environmental impact assessment by incorporating robust analytical tools for trade-off analyses and participatory and appraisal processes.
- Promote regional knowledge platforms and communities of practice on natural-capital accounting and valuation, policy–science linkages, and the application of policy tools and approaches to encourage collective learning and sharing, and harmonize methodologies.

Mobilize public and private finance for the implementation of programs and activities aimed at (i) conserving and growing natural capital, and (ii) improving resource-use efficiency and mitigating negative impact on natural capital

- Support natural capital–friendly investments through environmental fiscal reform and the reallocation of government budgets. For example, removing fossil-fuel subsidies, amounting to about $51 billion in Southeast Asia in 2012, and reallocating them to the development of clean technologies, adopting sustainable land management, and building climate-resilient coastal protection, would simultaneously reduce environmental degradation and improve human well-being.
- Provide fiscal incentives such as tax breaks, subsidized insurance premiums, public leases of land at favorable rates, and reduced interest rates, to encourage investment in natural capital–friendly business sectors, such as organic farming, ecotourism, and green freight.
- Remove technical, legal, and market impediments to the scaling up of economic instruments such as PES, REDD+, and other conditional payment schemes.
- Support countries in obtaining the free, prior, and informed consent of local people; establish robust monitoring, reporting, and verification; and institute equitable benefit distribution systems to ensure the effective implementation of such instruments.
- Prioritize the spatial and thematic areas of interventions to improve the effectiveness and efficiency of natural-capital investments and identify strategically important geographic areas with a view to focusing natural-capital investment in the most vulnerable areas (e.g., landscapes with rich natural-capital endowments and biodiversity hotspots).
- Put management strategies in place to minimize the risks (such as those posed by climate change) to natural-capital investments.
- Adopt and encourage integrated approaches, such as supply-chain management, which enable stakeholders to collectively improve resource-use efficiency and minimize risks.

Table 4: Natural Capital–related Events Supported by the GMS Core Environment Program Leading Up to the 4th GMS Environment Ministers' Meeting

Title	Start	End	Location
GMS Green Growth Private–Public Dialogue	17/06/2013	20/06/2013	Bangkok, Thailand
Regional Workshop on Mainstreaming Ecosystem-based Approaches (EBA) to Climate Change	15/10/2013	16/10/2013	Ha Noi, Viet Nam
Second Roundtable Discussion—Collaboration with Nordic Development Fund (NDF) Supported Climate Change Programs in the GMS	16/01/2014	16/01/2014	Bangkok, Thailand
Joint Knowledge Event (Working Group on Environment/Working Group on Agriculture)— Managing Natural Capital to Ensure Food, Energy and Water Security	25/03/2014	25/03/2014	Nay Pyi Taw, Myanmar
Regional Consultation on Transboundary Biodiversity Landscape Forum	06/05/2014	07/05/2014	Bangkok, Thailand
Climate Change Adaptation in the GMS—Bridging the Divide: Linking Science-based Adaptation Approaches and Climate Change Policy-making in the GMS (Third Roundtable Discussion)	30/07/2014	30/07/2014	Bangkok, Thailand
Regional Workshop—Mekong Protected Areas and Climate Change—Implications for Livelihoods and Development	08/10/2014	10/10/2014	Bangkok, Thailand
Climate Change Adaptation in the GMS (Fourth Roundtable Discussion)	09/10/2014	09/10/2014	Bangkok, Thailand
GMS Strategic Environmental Assessment Knowledge Sharing Forum	30/10/2014	31/10/2014	Siem Reap, Cambodia
Strengthening Partnerships for Natural Capital in the GMS (Regional Workshop) and Working Group on Environment 9th Semi-Annual Meeting	11/11/2014	12/11/2014	Bagan, Myanmar
Climate Change Adaptation in the GMS (Fifth Roundtable Discussion)	11/12/2014	11/12/2014	Bangkok, Thailand

Source: Authors.

References*

Alana, G. 2009. Potential and Limitations for Payments for Environmental Services as a Means to Manage Watershed Services in Mainland Southeast Asia. *International Journal of the Commons.* 3 (1). pp. 16–40.

Asian Development Bank (ADB). 2011a. *Key Indicators for Asia and the Pacific 2011.* Manila.

———. 2011a. *Evaluating the Environment for Public–Private Partnerships in Asia-Pacific: The 2011 Infrascope.* Manila.

———. 2012a. *Socio-Economic Assessment and Gender Analysis: Project Preparation Technical Assistance for the Climate Change Resilient Rice Commercialization Project in Cambodia.* Manila.

———. 2012b. *Greater Mekong Subregion Power Trade and Interconnection: 2 Decades of Cooperation.* Manila.

———. 2013a. *Food Security in Asia and the Pacific.* Manila.

———. 2013b. *Asian Water Development Oulook 2013.* Manila.

———. 2014a. *Greater Mekong Subregion Economic Cooperation Program: Regional Investment Framework Pipeline of Potential Projects (2013–2022).* Manila.

———. 2014b. *Key Indicators for Asia and the Pacific 2014.* Manila.

Asian Development Bank GMS Environment Operations Center (ADB GMS-EOC). 2011. Valuation of Ecosystem Services of Biodiversity Conservation Corridors in Cambodia, Lao PDR and Viet Nam (Supplementary Appendix B). Greater Mekong Subregion Biodiversity Conservation Corridors Project (Loan 40253-REG). http://www.adb.org/sites/default/files/linked-documents/40253-02-reg-oth-05.pdf (accessed 15 December 2014).

———. 2014. Green Freight in Cambodia: Opportunities for market-based interventions. http://www.gms-eoc.org/uploads/resources/251/attachment/Green%20Freight%20Cambodia.pdf (accessed 10 December 2014).

Asian Development Bank (ADB) and World Wide Fund for Nature (WWF). 2012. *Ecological Footprint and Investment in Natural Capital in Asia and the Pacific.* http://www.adb.org/sites/default/files/pub/2012/ecological-footprint-asia-pacific.pdf (accessed 5 September 2014).

Balmford, A., A. Bruner, P. Cooper, R. Costanza, S. Farber, R. E. Green, M. Jenkins, P. Jefferiss, V. Jessamy, J. Madden, K. Munro, N. Myers, S. Naeem, J. Paavola, M. Rayment, S. Rosendo, J. Roughgarden, K. Trumper, and R. K. Turner. 2002. Economic Reasons for Conserving Wild Nature. *Science*. 297. pp. 950–953.

Bradshaw, C. J. A., N. S. Sodi, K. S.H. Peh, and B. W. Brook. 2007. Global Evidence that Deforestation Amplifies Flood Risk and Severity in the Developing World. *Global Change Biology.* 13. pp. 2379–2395.

Brander, L. M. and F. Eppink. 2012. The Economics of Ecosystems and Biodiversity for Southeast Asia (ASEAN TEEB): Scoping Study. ASEAN Centre for Biodiversity, Los Baños, Laguna, Philippines.

Brosia, B. J. and H. Briggs. 2013. Single Pollinator Species Losses Reduce Floral Fidelity and Plant Reproductive Function. *Proceedings of the National Academy of Sciences of the United States of America.* 110 (32). pp. 13044–13048.

Business and Biodiversity Offsets Program. 2012. Standard on Biodiversity Offsets. http://www.forest-trends.org/documents/files/doc_3078.pdf (accessed 20 December 2014).

Cambodia Ministry of Environment (MOE). 2010. *Fourth National Report to the United Nations Convention on Biological Diversity.* Phnom Penh.

Caughlin, T. T., J. M. Ferguson, J. W. Lichstein, P. A. Zuidema, S. Bunyavejchewin, and D. J. Levey. 2014. Loss of Animal Seed Dispersal Increases Extinction Risk in a Tropical Tree Species due to Pervasive Negative Density Dependence across Life Stages. *Proceedings of the Royal Society of London, Series B.* 2014–2095. http://dx.doi.org/10.1098/rspb.2014.2095

* ADB recognizes “Vietnam” as Viet Nam.

Chervier, C., M. Neang, and A. Yoeu A. 2013. Development of Ecosystem Services–Based Policy Tools in Cambodia. Paper presented at the European Society for Ecological Economics conference Ecological Economics and Institutional Dynamics, Lille, France, 18–21 June 2013.

Conservation Finance Guide. n.d. http://conservationfinance.org/guide/guide/ (accessed 8 January 2015).

Convention on Biological Diversity (CBD). 2009. Connecting Biodiversity and Climate Change Mitigation and Adaptation: Report of the Second Ad Hoc Technical Expert Group on Biodiversity and Climate Change. *Technical Series* No. 41. Montreal.

Costanza, R. and H. E. Daly. 1992. Natural Capital and Sustainable Development. *Conservation Biology.* 6. pp. 37–46.

Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, S. Naeem, K. Limburg, J. Paruelo, R. V. O'Neill, R. Raskin, P. Sutton, and M. van den Belt. 1997. The Value of the World's Ecosystem Services and Natural Capital. *Nature.* 387. pp. 253–260.

Costanza, R., R. de Groot, P. Sutton, S. van der Ploeg, S. Anderson, I. Kubiszewski, S. Farber, and R. K. Turner. 2014. Changes in the Global Value of Ecosystem Services. *Global Environmental Change.* 26. pp. 152–158. http://dx.doi.org/10.1016/j.gloenvcha.2014.04.002

Costanza, R., O. Pérez-Maqueo, M. L. Martinez, P. Sutton, S. J. Anderson, and K. Mulder. 2008. The Value of Coastal Wetlands for Hurricane Protection. *Ambio*. 37. pp. 241–248.

Cowen, C., C. Epple, H. Korn, R. Schliep, and J. Stadler. 2009. Working with Nature to Tackle Climate Change. Report of the ENCA/BfN Workshop "Developing Ecosystem-Based Approaches to Climate Change: Why, What and How," held on the Isle of Vilm, Germany, 22–25 June 2009. International Academy for Nature Conservation.

Critical Ecosystem Partnership Fund. 2011. Indo-Burma Biodiversity Hotspot 2011 Update. http://www.cepf.net/Documents/final.indoburma_indochina.ep.pdf (accessed 2 December 2014).

Dasgupta, S., U. Deichmann, C. Meisner, and D. Wheeler. 2005. Where Is the Poverty–Environment Nexus? Evidence from Cambodia, Lao PDR, and Vietnam. *World Development*. 33 (4). pp. 617–638.

Doswald, N. and M. Osti. 2011. *Ecosystem-Based Approaches to Adaptation and Mitigation: Good Practice Examples and Lessons Learned in Europe.* Germany: Bundesamt für Naturschutz (BfN), Federal Agency for Nature Conservation.

Eccles, R. G., I. Ioannou, and G. Serafeim. 2013. The Impact of a Corporate Culture of Sustainability on Corporate Behavior and Performance. Working paper. Harvard Business School.

The Economics of Ecosystems and Biodiversity (TEEB). 2009. TEEB Climate Issues Update. September.

———. 2010a. *The Economics of Ecosystems and Biodiversity for Local and Regional Policy Makers.* London: Earthscan.

——— 2010b. *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations.* Edited by Pushpam Kumar. London: Earthscan.

———. 2011. *The Economics of Ecosystems and Biodiversity in National and International Policy Making.* Edited by Patrick ten Brink. London: Earthscan.

———. 2012. *The Economics of Ecosystems and Biodiversity in Business and Enterprise.* Edited by Joshua Bishop. London: Earthscan.

———. 2013. Natural Capital at Risk: The Top 100 Externalities of Business. UNEP, Nairobi.

Ek, Göran. 2013. Cambodia Environmental and Climate Change Policy Brief. Sida's Helpdesk for Environment and Climate Change, Swedish International Development Cooperation Agency.

Emerton, L. 2013. *The Economic Value of Ecosystem Services in the Mekong Basin: What We Know and What We Need to Know.* World Wide Fund for Nature.

Food and Agriculture Organization of the United Nations (FAO). 2011. *Forests and Forestry in the Greater Mekong Subregion to 2020.* Rome.

———. 2012a. Irrigation in Southern and Eastern Asia in figures: AQUASTAT survey-2011, FAO.

———. 2012b. *FAO Statistical Yearbook 2012.* Rome.

———. n.d.(a). FAOSTAT database. http://faostat.fao.org/site/291/default.aspx (accessed 12 August 2012).

———. n.d.(b). FAOSTAT database 3. http://faostat3.fao.org (accessed 18 November 2014).

Foppes, J. and S. Phommasane. 2005. Experiences with Market Development of Non-timber Forest Products in Lao PDR. Paper presented at the International Workshop on Market Development for Improving Upland Poor's Livelihood Security, Kunming, People's Republic of China, 30 August–2 September 2005. Centre for Community Development Studies, Yunnan.

Gallai, N., J. Salles, J. Settele, and B. E. Vaissiere. 2009. Economic Valuation of the Vulnerability of World Agriculture Confronted with Pollinator Decline. *Ecological Economics*. 68 (3). pp. 810–821.

Global Footprint Network database. http://www.footprintnetwork.org/en/index.php/GFN/ (accessed 15 December 2014).

Global Impact Investment. n.d. What is Impact Investing? http://www.thegiin.org/cgi-bin/iowa/resources/about/index.html (accessed 8 January 2015).

Global Innovation through Science and Technology (GIST). 2013, Tradeoff and Synergies between Food Production and Ecosystem Services: Alignment of Goals and Coping Mechanism (Module 3). Prepared for the United Nations Environment Programme's Food Security Project on Capacity-Building in National Planning for Sustainable Food Production. Nairobi.

Guangxi Forestry Department. 2011. Nanning. Unpublished.

Guenster, N., R. Bauer, J. Derwall, and K. Koedijk. 2011. The Economic Value of Corporate Eco-Efficiency. *European Financial Management*. 17, Issue 4 (September). pp. 679–704.

HSBC Global Research. 2013. *Natural Capital: Identifying Implications for Economies*. Prepared by Zoe Knight, Nick Robins, and Wai-Shin Chan. November.

Intergovernmental Panel on Climate Change (IPCC). 2007a. *Climate Change 2007: Impacts, Adaptation, and Vulnerability.* Edited by M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, and C. E. Hanson. Cambridge University Press.

———. 2007b. *Climate Change 2007: The Physical Science Basis.* Edited by S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M. Tignor, and H. L. Miller. Cambridge University Press.

International Centre for Environmental Management (ICEM). 2007. Rapid Assessment of the Extent and Impact of Sea Level Rise in Viet Nam. http://www.icem.com.au/documents/climatechange/icem_slr/ICEM_SLR_final_report.pdf (accessed December 2014).

———. 2010. Mekong River Commission Strategic Environmental Assessment of Hydropower on the Mekong Mainstream. Ha Noi.

International Energy Agency (IEA). 2013. *World Energy Outlook 2013.* Paris.

International Federation of Red Cross and Red Crescent Societies (IFRC). 2011. *Breaking the Waves: Impact Analysis of Coastal Afforestation for Disaster Risk Reduction in Viet Nam.* Geneva.

International Finance Corporation (IFC). 2012. *Lighting Asia: Solar Off-Grid Lighting Market Analysis of India, Bangladesh, Nepal, Pakistan, Indonesia, Cambodia, and Philippines.* Final report. Washington, DC.

———. n.d. A Guide to Biodiversity for the Private Sector: Holcim Vietnam LTD. http://www.ifc.org/wps/wcm/connect/95c5fe0048855c758be4db6a6515bb18/Holcim.pdf?MOD=AJPERES (accessed 7 January 2015).

International Monetary Fund (IMF). 2012. *World Economic Outlook: Growth Resuming, Dangers Remain.* Washington, DC.

International Water Management Institute (IWMI) and WorldFish Center. 2010. *Rethinking Agriculture in the Greater Mekong Subregion: How to Sustainably Meet Food Needs, Enhance Ecosystem Services and Cope with Climate Change.* Sri Lanka.

Kubiszewski, I., R. Costanza, P. Paquet, and S. Halimi. 2013. Hydropower Development in the Lower Mekong Basin: Alternative Approaches to Deal with Uncertainty. *Regional Environmental Change.* 13 (1). pp. 3–15.

Lakanavichian, S. 2006. *Trends in Forest Ownership, Forest Resource Tenure and Institutional Arrangements: Are They Contributing to Better Forest Management and Poverty Reduction?* Food and Agriculture Organization of the United Nations. Rome.

Lao People's Democratic Republic. 2010. *Assessing Progress Towards the 2010 Biodiversity Target: 4th National Report to the United Nations Convention on Biological Diversity.* Vientiane.

Mekong River Commission (MRC). 2010. *State of the Basin Report 2010.* Vientiane.

———. 2011. *Planning Atlas of the Lower Mekong River Basin.* http://www.mrcmekong.org/assets/Publications/basin-reports/BDP-Atlas-Final-2011.pdf

———. n.d. *Agriculture and Irrigation.* http://www.mrcmekong.org/topics/agriculture-and-irrigation/ (accessed 17 November 2014).

Mendelsohn, R. 2011. The Impact of Climate Change on Land. In Gregory K. Ingram and Yu-Hung Hong, eds. *Climate Change and Land Policies.* Cambridge, Massachusetts: Lincoln Institute of Land Policy.

Mensah, A., A. Deeb, A. H. Grunwaldt, A. Andrade, A. Kontorov, A. Mills, B. Dickson, C. Petersen, C. Gordon, C. Chuku, D. Göhler, D. Mkwambisi, D. Benzaken, E. Barrow, E. Fida, F. van der Plaat, H. Gitay, H. Reid, I. Gordon, I. Thiaw, I. Meliane, J. Gaithuma, J. DeBlieu, J. Thompson, J. Shrestha, K. Tscherning, K. Alverson, K. Mwathe, M. Esquivel, M. Finlayson, M. van Voore, M. Rivington, M. Alam, M. Mumba, N. Doswald, N. Sekhran, N. Raasakka, N. Ikkala, O. Vestergaard, P. McCarthy, P. van Gardingen, R. Klein, R. Munang, R. Kay, R. Munroe, R. Lichte, S. Haeussling, S. Donner, S. Crane, T. Booth, and W. Vergara. 2012. Making the Case for Ecosystem-Based Adaptation: Building Resilience to Climate Change. Policy brief. UNEP, UNDP, and IUCN.

Meyfroidt, P., V. T. Phuong, and H. V. Anh. 2013. Trajectories of Deforestation, Coffee Expansion and Displacement of Shifting Cultivation in the Central Highlands of Vietnam. *Global Environmental Change.* 23. pp. 1187–1198.

Millennium Ecosystem Assessment. 2005. *Millennium Ecosystem Assessment: General Synthesis Report.* Washington, DC: Island Press.

Myanmar Ministry of Forestry, National Commission for Environmental Affairs. 2009. *Fourth National Report to the United Nations Convention on Biological Diversity.* Nay Pyi Taw.

Myanmar Ministry of National Planning and Economic Development (MNPED), Swedish International Development Cooperation Agency (Sida), United Nations Children's Emergency Fund (UNICEF), and United Nations Development Programme (UNDP). 2011. *Integrated Household Living Conditions Survey, 2011.* Yangon: MNPED, Sida, UNICEF, and UNDP.

Nuntapotidech, A. 2012. Asia Regional Dialogue on Green Economy Approaches: Thailand Case. Presentation at the Asia Regional Dialogue on Inclusive Green Economy Approaches, Bangkok, 27–29 September 2012.

Ogden, F. L., T. D. Crouch, R. F. Stallard, and J. S. Hall. 2013. Effect of Land Cover and Use on Dry Season River Runoff, Runoff Efficiency, and Peak Storm Runoff in the Seasonal Tropics of Central Panama. *Water Resources Research*. 49. pp. 1–20.

Organisation for Economic Co-operation and Development (OECD). 2012. *Greening Development: Enhancing Capacity for Environmental Management and Governance.* OECD Publishing.

———. 2013. *Putting Green Growth at the Heart of Development*. OECD Publishing.

———. 2014. *Towards Green Growth in Southeast Asia.* OECD Green Growth Studies. OECD Publishing.

Osborne, M. 2010. The Mekong River Under Threat. http://www.voltairenet.org/IMG/pdf/The_Mekong.pdf (accessed 8 January 2015).

People's Republic of China (PRC) Ministry of Environmental Protection. 2013. *Second Soil Pollution Survey, April 2005–December 2013.* Beijing.

Pham, D. C. 2011. Analysis of Fiscal Gap and Financing of Vietnam's Protected Areas. Economy and Environment Program for Southeast Asia (EEPSEA) Research Report. Penang, Malaysia, and Los Baños, Laguna, Philippines.

Pretty, J. N., A. D. Noble, D. Bossio, J. Dixon, R. E. Hine, F. W. T. Penning de Vries, and J. I. L. Morrison. 2006. Resource-Conserving Agriculture Increases Yields in Developing Countries. *Environmental Science & Technology.* 40 (4). pp. 1114–1119.

Richards, M. and M. Jenkins. 2007. Potential and Challenges of Payments for Ecosystem Services from Tropical Forests. *Forestry Briefing 16.* Forest Policy and Environment Programme, Overseas Development Institute. London.

Rosegrant, M., C. Ringler, T. J. Zhu, S. Tokgoz, and P. Sabbagh. 2012. Water and Food Security in the Mekong Subregion: Outlook to 2030–2050. Conference proceedings of the International Conference on GMS 2020, Bangkok, Thailand, 20–21 February 2012.

Scherr, S., A. White, A. Khare, M. Inbar, and A. Molnar. 2004. For Services Rendered: Current Status and Future Potential of Markets for Ecosystem Services Provided by Tropical Forests. International Tropical Timber Organization, Technical Series 21.

Standard and Poor's Rating Services (S&P). 2014. Climate Change Is a Global Mega-Trend for Sovereign Risk. http://www.acclimatise.uk.com/login/uploaded/resources/climate-change-is-a-global-mega-trend-for-sovereign-risk-15-may-14-.pdf (accessed 10 December 2014).

Stern, N. 2006. *The Stern Review on the Economic Effects of Climate Change.* Cambridge University Press.

Stibig, H. J., A. S. Belward, P. S. Roy, U. Rosalina-Wasrin, S. Agrawal, and P. K. Joshi. 2007. A Land-Cover Map for South and Southeast Asia Derived from Spot-Vegetation Data. *Journal of Biogeography.* 34. pp. 625–637.

Sukhdev, P. 2012. *Corporation 2020: Transforming Business for Tomorrow's World.* Washington, DC: Island Press.

Sukhdev, P., K. Varma, and A. M. Bassi. 2014. I-GEM Full Project Report. LECB Indonesia. Draft in preparation.

Swiss Agency for Development and Cooperation. 2011. *Effective Grain Storage for Better Livelihoods of African Farmers Project: Completion Report.* Submitted by the International Maize and Wheat Improvement Center, Mexico.

Thailand Ministry of Natural Resources and Environment, Office of Natural Resources and Environment Policy and Planning. 2009. *National Report on the Implementation of the Convention on Biological Diversity.* Bangkok.

Tropical Agricultural Research and Higher Education Center (CATIE). 2012. *Incentive and Market-Based Mechanisms to Promote Sustainable Land Management: Framework and Tool to Assess Applicability.* Global Mechanism, UNCCD.

Trumper, K., M. Bertzky, B. Dickson, G. van der Heijden, M. Jenkins, and P. Manning. 2009. *The Natural Fix? The Role of Ecosystems in Climate Change Mitigation. A UNEP rapid response assessment.* United Nations Environment Programme, UNEP-WCMC, Cambridge, UK.

United Nations Conference on Trade and Development (UNCTAD). n.d. UNCTADstat. http://www.unctadstat@unctad.org (accessed 7 January 2015).

United Nations Convention to Combat Desertification (UNCCD). 2014. Incentive and Market-Based Mechanisms for Sustainable Land Use Management in Cambodia. The Global Mechanism, UNCCD. Bonn, Germany.

United Nations Development Programme (UNDP). 2011. *Agriculture Development Issues and Strategies - Myanmar.* Yangon.

United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP). 2012. Environmental Tax Reform and Environmental Fiscal Report. http://www.unescap.org/sites/default/files/24.%20FS-Environmental-Tax-Reform-and-Environmental-Fiscal-Reform.pdf (accessed 10 December 2014).

United Nations Environment Programme (UNEP). 2011. Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication: A Synthesis for Policy Makers. http://www.unep.org/greeneconomy

United Nations Environment Programme (UNEP) and Thailand Environment Institute (TEI). 2007. *Greater Mekong Environment Outlook 2007.* Bangkok.

United Nations Global Compact and Accenture. 2013. CEO Study on Sustainability. http://www.accenture.com/SiteCollectionDocuments/PDF/Accenture-UN-Global-Compact-Acn-CEO-Study-Sustainability-2013.PDF (accessed 5 December 2014).

US Agency for International Development (USAID). 2013. *Mekong Adaptation and Resilience to Climate Change: Main Report, Climate Change Impact and Adaptation Study.* Prepared for USAID by the International Centre for Environmental Management. Ha Noi.

———. 2014. *Mekong Adaptation and Resilience to Climate Change: Climate Change in the Lower Mekong Basin (An Analysis of Economic Values at Risk).* Prepared for USAID by Development Alternatives Inc. (DAI). Washington, DC.

Veolia Water North America and International Food Policy Research Institute (IFPRI). 2013. Finding the Blue Path for a Sustainable Economy. http://www.veoliawaterna.com/north-america-water/ressources/documents/1/19979,IFPRI-White-Paper.pdf (accessed 27 November 2014).

Viet Nam Ministry of Agriculture and Rural Development (MARD). 2014. *Payments for Forest Environmental Services (PFES) in Vietnam: Findings from Three Years of Implementation.* Ha Noi.

Viet Nam Ministry of Natural Resources and Environment (MONRE). 2008. 4th Country Report: Viet Nam's Implementation of the Biodiversity Convention, IUCN Red List of Threatened Species, Version 2011. Ha Noi. Draft report.

———. 2014. Mainstreaming through Natural Capital Accounting and Valuation: Natural Capital Accounting Roadmap up to 2020. Prepared by the Institute of Strategy and Policy on Natural Resources and Environment (ISPONRE), with World Bank support. Draft version.

Viet Nam Trade Promotion Agency. n.d. http://www.vietrade.gov.vn/en/index.php?option=com_content&view=article&id=2098:vietnams-wooden-products-export-in-the-first-6-months-of-2013&catid=270:vietnam-industry-news&Itemid=363 (accessed 8 October 2014).

Wikramanayake, E., E. Dinerstein, C. Loucks, D. Olson, J. Morrison, J. Lamoreux, M. McKnight, and P. Hedao. 2011. *Terrestrial Ecoregions of the Indo-Pacific: A Conservation Assessment.* Washington, DC: Island Press.

World Bank. 2006. *Where Is the Wealth of Nations? Measuring Capital for the 21st Century.* Washington, DC.

———. 2011. The World Bank Supports Thailand's Post-Floods Recovery Effort. News. http://www.worldbank.org/en/news/feature/2011/12/13/world-bank-supports-thailands-post-floods-recovery-effort" (accessed 15 December 2014).

———. 2013. Energizing Green Cities in Southeast Asia. http://www.worldbank.org/en/region/eap/publication/energizing-green-cities-in-southeast-asia (accessed 10 December 2014).

———. n.d.(a). Wealth of Nations Database. http://data.worldbank.org/data-catalog/wealth-of-nations (accessed 25 November 2014).

———. n.d.(b). World Development Indicators. http://data.worldbank.org/data-catalog/world-development-indicators (accessed 5 December2014).

WorldFish Center. 2009. Climate Change and Fisheries: Vulnerability and Adaptation in Cambodia. *Issue Brief No. 2008.* Penang, Malaysia.

World Health Organization (WHO) and United Nations Children's Fund (UNICEF). n.d. Joint Monitoring Programme for Water Supply and Sanitation. http://www.wssinfo.org (accessed 25 November 2014).

World Resources Institute. n.d. Climate Analysis Indicators Tool (CAIT) 2.0. http://cait2.wri.org/wri (accessed 3 December 2014).

World Wide Fund for Nature (WWF). 2013a. *Ecosystems in the Greater Mekong: Past Trends, Current Status, Possible Futures.* Gland, Switzerland.

———.2013b. *The Economic Value of Ecosystem Services in the Mekong Basin: What We Know, and What We Need to Know.* Gland, Switzerland.

WWF and World Bank. 2013. *Strengthening Community and Ecosystem Resilience Against Climate Change Impact: Viet Nam Case Study from Field Testing and Operational Framework for Ecosystem-based Adaptation.* Ha Noi.

Yunnan Statistical Bureau. 2011. *Overview of Agriculture in Yunnan.* Kunming.

———. 2013. *Yunnan Statistics Yearbook 2013.* Kunming.

Zheng, F. L. 2006. Effect of Vegetation Changes on Soil Erosion on the Loess Plateau. *Pedosphere.* 16, Issue 4 (August). pp. 420–427.

Investing in Natural Capital for a Sustainable Future in the Greater Mekong Subregion

This report aims to demonstrate the compelling need to increase investments in natural capital in the Greater Mekong Subregion (GMS) and identifies actions now being taken regionally and nationally to manage natural capital. It also proposes a guiding framework for promoting investments and actions by GMS countries to secure natural capital and thus ensure sustainable and inclusive growth in the subregion.

About the Asian Development Bank

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to the majority of the world's poor. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

About the Core Environment Program

The Core Environment Program (CEP) supports the Greater Mekong Subregion (GMS) in delivering environmentally friendly economic growth. Anchored on the Asian Development Bank's (ADB) GMS Economic Cooperation Program, CEP promotes regional cooperation to improve development planning, safeguards, biodiversity conservation, and resilience to climate change—all of which are underpinned by building capacity.

CEP is overseen by the environment ministries of the six GMS countries and implemented by the ADB-administered Environment Operations Center. Cofinancing is provided by ADB, the governments of Finland and Sweden, the Global Environment Facility, the People's Republic of China Regional Cooperation and Poverty Reduction Fund, and the Nordic Development Fund.

GREATER MEKONG SUBREGION
CORE ENVIRONMENT PROGRAM

GMS Environment Operations Center
Asian Development Bank, 23rd Floor, The Offices at Central World
999/9 Rama 1 Road, Pathumwan Bangkok 10330
Tel: (+66) 2 207 4444 Fax: (+66) 2 207 4400
E-mail: info@gms-eoc.org Website: www.gms-eoc.org