GREATER MEKONG SUBREGION
CORE ENVIRONMENT PROGRAM

GREATER MEKONG SUBREGION

ENVIRONMENTAL PERFORMANCE ASSESSMENT 2006–2016

GREATER MEKONG SUBREGION

ENVIRONMENTAL PERFORMANCE ASSESSMENT 2006–2016

December 2017

ADB
GREATER MEKONG SUBREGION
CORE ENVIRONMENT PROGRAM

Title: Greater Mekong Subregion Environmental Performance Assessment 2006–2016

Note: Version for 5th GMS Environment Ministers' Meeting

Disclaimer

Note: In this report, "$" refers to US dollars.

Photo Credits:

Asian Development Bank: Front cover, pages 4 and 6

Shutterstock.com: Pages iv, 2, 4, 15, 17, 20, 23, 27, 29, 31, 32, and 35

GMS Environment Operations Center
Asian Development Bank
23rd Floor - The Offices at Central World
999/9 Rama Road, Pathumwan
Bangkok 10330 Thailand
Tel +66 2 207 4444

Contents

Tables

Figures

Boxes

Abbreviations

3R	Reduce, reuse, recycle
CEP	Core Environment Program
DPSIR	Driver-pressure-state-impact-response
ELC	Economic land concession
EPA	Environmental performance assessment
FAO	Food and Agricultural Organization of the United Nations
FDI	Foreign direct investment
GDP	Gross domestic product
GHG	Greenhouse gas
GMS	Greater Mekong Subregion
Lao PDR	Lao People's Democratic Republic
IUCN	World Conservation Union
MDG	Millennium Development Goal
MRB	Mekong River Basin
PM	Particulate matter
PFES	Payments for forest environmental services
PRC	People's Republic of China
PSR	Pressure-state-response
REDD+	Reducing emissions from deforestation and forest degradation
SDG	Sustainable Development Goals
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization

Weights and Measures

ha	hectare
kg	kilogram
km	kilometer
m	meter
t	ton

EXECUTIVE SUMMARY

The Greater Mekong Subregion (GMS) has experienced impressive economic growth over the last 25 years, since the launching of the GMS Economic Cooperation Program in 1992, becoming one the world's fastest growing regions. Unfortunately, this impressive economic growth has precipitated worrying environmental consequences, including depletion of natural resources, environmental degradation, and impacts on human health. Such negative impacts undermine sustainable development in the GMS. This affects future economic growth and poverty reduction in the six member countries—Cambodia, the People's Republic of China, the Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand, and Viet Nam.

This environmental performance assessment examines the consequences of rapid development in the GMS, characterizing natural resource and environmental issues and how well the countries have responded to them. The assessment covers the period 2006–2016. During this period the GMS Core Environment Program supported country efforts to address the subregion's natural resources and environmental management challenges with its goal of creating an "environmental friendly and climate resilient GMS Economic Cooperation Program."

The environmental issues covered by the assessment are air, biodiversity and habitat, climate change, fish, forest, land degradation, solid waste management, and water resources. Although pressures continued to be consistently medium to high for all issues during 2006–2016, the overall state of the environmental was generally satisfactory and stable. Individual country responses were largely sustained but more substantive actions are necessary to address persistent pressures.

Urban air quality across the GMS continued to be mostly satisfactory despite medium to high pressures associated with large numbers of vehicles on city roads and increasing industrial emissions. Air quality contaminants such as fine particulate matter rose steadily in all countries, with corresponding impacts on human health. Countries have employed a variety of responses such as more stringent emission standards, which are proving successful to some extent in addressing pressures.

Pressures on biodiversity and habitat remain high, stemming from regional demand for wildlife and non-timber forest products and loss and/or degradation of forest and mangrove habitats. Protection policies are in place and management actions have been taken to reduce wildlife trafficking and protect remaining habitats. Despite this, law enforcement remains too weak to cope with the many pressures, while protected areas are insufficiently funded to ensure their effective management.

Although contribution to global emissions by the GMS remains low, fossil fuel energy consumption, hydropower generation, land-use change and intensified agriculture, and deforestation are generating growing greenhouse gas emissions. Impacts of climate change in the subregion include reduced agricultural production, infrastructure damage, and loss of human life caused by extreme weather events. Country responses to climate change encompass national and sector policies, and a combination of adaptation and mitigation measures. Countries are additionally pursuing green growth through encouraging cleaner, less polluting, production technologies and striving for energy savings.

Inland and marine fisheries are very important in Cambodia, the Lao PDR and Viet Nam, where they account for a large portion of gross domestic product. Key pressures on fish populations are high harvesting levels and habitat loss. Freshwater migratory species are further affected by waterway obstructions such as hydropower dams and irrigation weirs. Declines in wild fisheries are partly offset by expanding aquaculture production. Nevertheless, depleted fish populations have worrying implications for people dependent on fish for their diet and livelihoods. Country responses have involved both fisheries management and habitat protection, although measures being taken are considered only partly effective in maintaining fish stocks.

The GMS is richly endowed with forest resources, with a reported forest cover of 52% of total land area. Forest depletion is occurring primarily in Cambodia and Myanmar, while other countries have increased their forest cover. Pressures on forests are generally high and increasing, the key pressures being natural forest conversion to agriculture and plantation forest, excessive logging, and land clearance for large-scale development projects such as hydropower and mining. While total forest cover has increased, forest composition has changed, with naturally regenerated forest predominating over planted forest and primary forest. However, the reported trend of increasing forest cover is largely an artifact of how the countries report forest cover. Calculations are now based on a standard of 10% canopy cover and include plantation forest, masking a worrying loss of primary forest of critical importance as biodiversity habitat. Forest management efforts are proving partially effective as countries continue to focus on forest protection and sustainable management, and devote more resources to reforestation and natural regeneration of degraded forests.

Land degradation caused by forest loss, agricultural intensification, growing upland populations, and associated farming is of concern in several GMS countries. The impacts include declining agricultural yields, increasing desertification, and soil erosion. These impacts have food security and income generation implications, and are affecting ecosystem services such as flood retention and erosion control. Affected countries are making sustained efforts to address land degradation through policy frameworks, designating protected areas, soil rehabilitation, and restrictions on agrochemical use.

Economic growth, industrialization, and urbanization are contributing to increasing solid waste generation. Cities in particular are struggling to respond to the volume of waste generated by rising urban populations and associated increasing consumption. Tourism and industry are also major solid waste sources. Urbanization has not been matched with enough investment in infrastructure to provide effective waste collection, disposal, and treatment. Countries are making sustained but belated efforts to improve solid waste management by setting up waste collection and disposal infrastructure, addressing pollution concerns arising from handling and disposal of hazardous waste, promoting greater public awareness, and adopting reduce, reuse, and recycle strategies.

Riverine and marine water quality in the GMS continues to be generally satisfactory despite increasing pressures. Water pollution is mainly attributable to discharges of untreated domestic wastewater, agricultural runoff containing harmful chemicals, and effluent discharges by industry. However, instances of poor water quality associated with highly urbanized and industrialized areas persist. Recognizing that degraded water quality can affect human well-being and environmental health, countries are increasingly putting in place pollution prevention strategies and more stringent control measures.

Water supply and sanitation have broadly improved across the GMS, with most countries approaching or achieving their 2015 Millennium Development Goal targets. Access to safe drinking water and adequate sanitation continues to be greater in urban than in rural areas. Unsatisfactory drinking water and sanitation access have high human health and economic costs. This emphasizes the need for more expenditure on drinking water supply and sanitation; continued awareness raising on good water, sanitation, and hygiene practices; and efforts to prevent pollution and manage water in a way that protects both water quality and quantity.

1 INTRODUCTION

The Greater Mekong Subregion (GMS) comprises six countries—Cambodia, the Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand, and Viet Nam, as well as the Guangxi Autonomous Region and Yunnan Province of the People's Republic of China (PRC). The GMS has shown continual positive economic growth and poverty reduction over the last 25 years, since the launching of the GMS Economic Cooperation Program in 1992. The GMS countries' economic success is largely founded on the subregion's rich natural resources. While these resources have so far sustained the growing demand for water, food, energy, and commodities, they have declined considerably, along with decline in environmental quality and ecosystem services, and rising human health impacts. This report examines these consequences of rapid development in the GMS, characterizing natural resource and environmental issues and how well the countries have responded.

This assessment covers the period 2006–2016, during which the GMS Core Environment Program supported country efforts to address the subregion's growing environmental challenges and respond to emerging opportunities. The GMS Core Environment Program has strived to create an "environmental friendly and climate resilient GMS Economic Cooperation Program". It has helped improve natural resources management and environmental protection in the GMS by strengthening strategic planning processes, enhancing country environmental safeguard and institutional capacities, supporting enhanced biodiversity and livelihoods in key biodiversity landscapes, supporting climate change adaptation and mitigation, and improving national environmental monitoring and reporting systems.

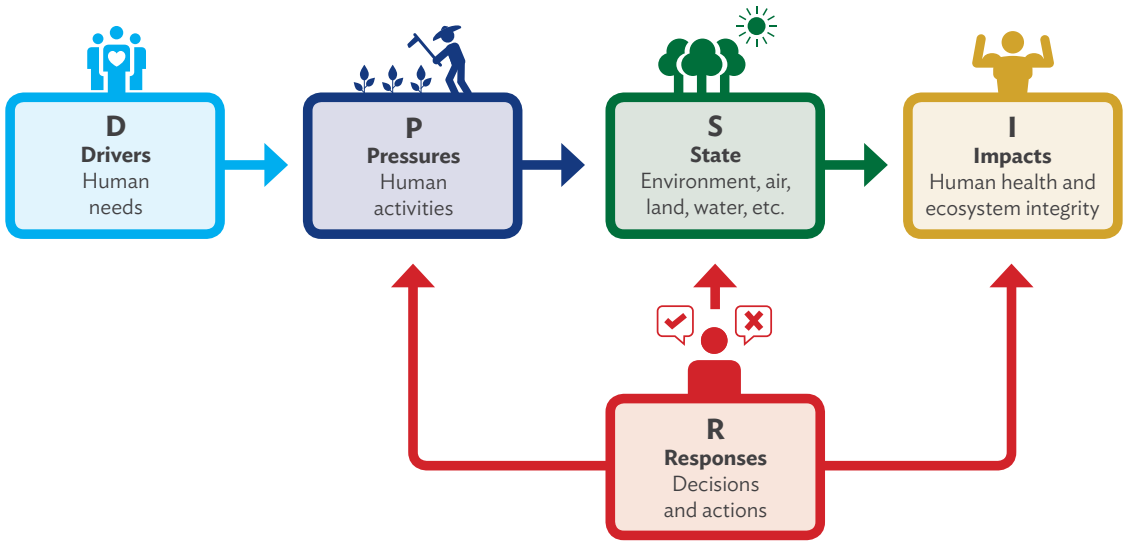
2 ENVIRONMENTAL PERFORMANCE ASSESSMENT

Environmental performance assessment (EPA) is an analytical framework used to assess environmental performance over a defined period, revealing conditions and trends, and progress in reaching environmental and social targets.

A common feature of EPAs is the use of causal analysis *(Figure 1)* to better understand and explain cause-effect relationships. Both pressure-state-response (PSR) and driver-pressure-state-impact-response (DPSIR) are used to assess priority issues. The terms are defined as follows:

- "**Pressure**" refers to the forces exerted by human activities on the environment, particularly on natural resources and ecosystem services. Typical pressures include the generation of air pollutants and other waste, clearing land, and intensity of natural resource extraction.
- "**State**" refers to the environmental condition, the status of natural resources, or the capacity of an ecosystem service. State indicators include the degree of contamination of a water source, human health effects from exposure to a degraded environment, the status of wildlife populations and habitats, and the condition of natural resource stocks.
- "**Response**" refers to actions intended to mitigate, prevent, or adapt to environmental damage; to rehabilitate ecosystems and their services; and to preserve and conserve environmental and natural resources. Responses can involve expenditure on environmental protection, imposition of environment-related taxes and subsidies, prosecution of illegal wildlife trade cases, or enforcement of pollution abatement and control measures. More broadly, society responds to changes in environmental state through economic and environmental policy and management choices.
- "**Driver**" and "**impact**" provide deeper insights into pressures on the environment and the resulting effects on humans and the environment. Using a forest management example, drivers such as population growth or external demand can produce a pressure—forested land clearance—which results in a change of state in forest cover. Reduced forest cover negatively affects households that depend on income from non-timber forest products, and wildlife that depends on intact forest habitats. A government response might be to expand protected forest area or introduce multiple-use forest management regimes.

Figure 1: Driver-Pressure-State-Impact-Response Analytical Framework



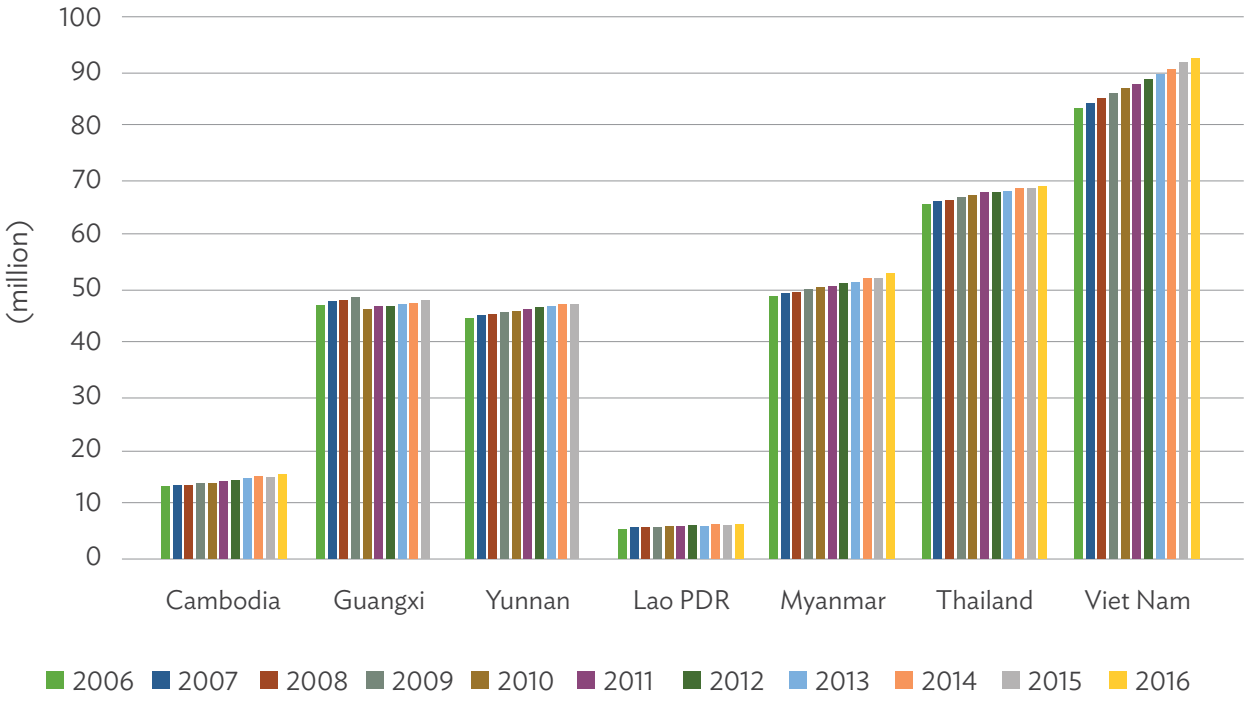
Source: Adapted from Organisation for Economic Co-operation and Development. 1993. *Report of OECD Core Set of Indicators for Environmental Performance Review*. Paris.

A key feature of EPA is the identification of policy targets, against which performance is judged. Target examples are Greater Mekong Subregion (GMS) country commitments to achieve the Millennium Development Goals (MDGs) by 2015 and more recently the broader Sustainable Development Goals (SDGs) by 2030. Progress toward MDGs was tracked annually, allowing countries to gauge their progress, assess the likelihood of achieving the goals by the target date, and identify any additional interventions required to achieve the goals.

3 SOCIOECONOMIC CONTEXT

The population of the GMS grew continually during 2006–2016 (*Figure 2*), with the highest annual growth rate in the Lao PDR (5.13%), followed by Cambodia (3.72%), Viet Nam (3.32%), and Myanmar (2.39%).

Figure 2: Greater Mekong Subregion Country Populations, 2006–2016

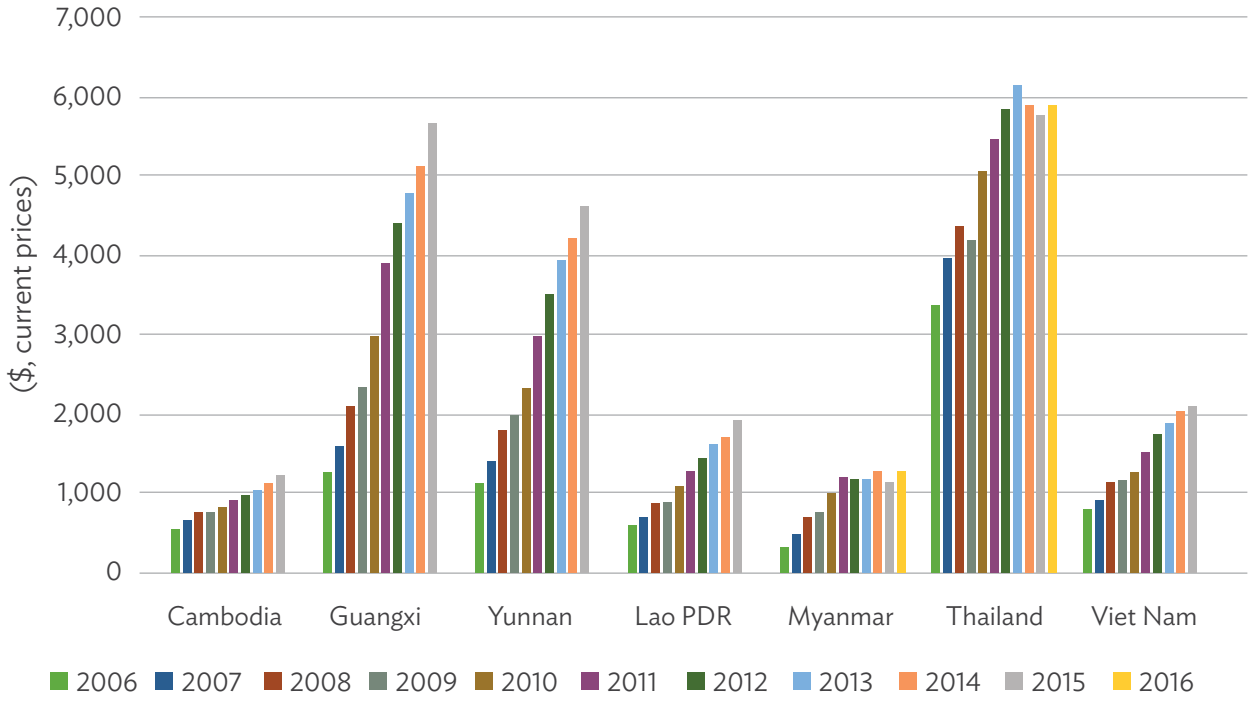


Source: World Bank. Population, total. http://data.worldbank.org/indicator/SP.POP.TOTL

GMS economies grew rapidly during 2006–2016 (*Figure 3*), particularly in Guangxi and Yunnan. Strong growth was also seen in the Lao People's Democratic Republic, largely due to hydropower and mine development; and Myanmar, which benefited from opening up its economy since 2012. Thailand experienced comparatively slower growth, in part because of its relatively advanced integration into global markets that suffered financial crises beginning in 2008. Strong country growth performances resulted in increases in gross domestic product (GDP) per capita and per capita incomes throughout the region. In 2006, gross GDP per capita averaged $1,354 in the GMS, ranging from $346 in Myanmar to $3,379 in Thailand. By 2016, GDP per capita had increased to $1,269 in Myanmar and $5,899 in Thailand.

Increasing prosperity in the GMS as a result of economic growth enabled countries to make good progress on some MDG commitments. These are the goals to eradicate extreme poverty and hunger, achieve universal primary education, promote gender equality and empower women, reduce child mortality rates, improve maternal health, and combat HIV/AIDS, malaria, and other diseases. Most notably, as incomes increased, poverty levels fell dramatically, with all the GMS countries meeting the 2015 target of halving the proportion of people who live in extreme poverty. This mirrors the impressive progress achieved across Southeast Asia where poverty declined from 52% to 17% between 1990 and 2015, with the rate of reduction accelerating since 2008. Good progress was also made toward other MDGs: infant mortality rates halved in almost all the GMS countries, life expectancy increased in all the GMS countries, and primary and secondary school enrollment rates and literacy levels increased significantly throughout the GMS.[1, 2]

Figure 3: Gross Domestic Product per Capita in Greater Mekong Subregion Countries, 2006–2016



Source: Greater Mekong Subregion Information Portal. http://portal.gms-eoc.org/

Achievements under MDG 7—Ensuring Environmental Sustainability—have been mixed. Deforestation has generally slowed, but continues to jeopardize biodiversity and people's livelihoods. Global greenhouse gas (GHG) emissions continue to rise. Inland and marine fisheries are increasingly overexploited, threatening aquatic ecosystems and livelihoods. Conservation efforts are in a race against time to save animals and plants from extinction. More encouragingly, targets for drinking water were mostly met ahead of schedule and many people have gained access to improved sanitation.

Although an EPA is primarily concerned with MDG 7, which deals specifically with natural resource and environmental issues, there are negative implications for other MDGs if MDG 7 is not achieved. For example, there is a cause–effect relationship between the MDG target to halve the proportion of the population without sustainable access to safe drinking water and basic sanitation by 2015 and the MDG 4 target on reduction of child mortality, because contaminated water and poor sanitation are major causes of infant mortality.

1 United Nations. 2015. *The Millennium Development Goals Report. 2015*. New York.

2 The ASEAN Secretariat. 2017. *ASEAN Statistical Report on Millennium Development Goals 2017*. Jakarta.

Table 1 presents a summary of the 7 out of the 17 new SDGs that have the same or equivalent indicators used for EPA reporting in the GMS.

Table 1: Mapping Sustainable Development Goals and Environmental Performance Assessment Indicators

Sustainable Development Goal Indicator	Environmental Performance Assessment Indicator
SDG 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture.	• Proportion of agricultural area under productive and sustainable agriculture.
SDG 3: Ensure healthy lives and promote well-being at all ages.	• Mortality rate attributed to ambient air pollution. • Mortality rate attributable to chronic respiratory disease.
SDG 6: Ensure availability and sustainable management of water and sanitation for all.	• Proportion of population using safely managed drinking water services. • Proportion of population using safely managed sanitation services. • Proportion of wastewater safely treated.
SDG 11: Make cities and human settlements inclusive, safe, resilient and sustainable.	• Annual mean levels of particulate matter in cities. • Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated. • Hazardous waste generated and treated. • Proportion of bodies of water with good ambient water quality.
SDG 13: Take urgent action to combat climate change and its impacts.	• Number of deaths, missing persons, and persons affected by disasters. • Economic costs of disasters, including damage to critical infrastructure and disruption of basic services.
SDG 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development.	• Proportion of fish stocks within biologically sustainable levels. • Coverage of protected areas in relation to marine areas. • Coverage of protected areas in relation to inland fisheries.
SDG 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.	• Proportion of land area that is degraded over total land area. • Red List Index. • Proportion of traded wildlife that was poached or illicitly trafficked. • Forest area as a proportion of total land area. • Proportion of important biodiversity habitat covered by protected areas.

Source: Adapted from United Nations Sustainable Development Goals from http://www.un.org/sustainabledevelopment/sustainable-development-goals/

4 GREATER MEKONG SUBREGION ENVIRONMENTAL PERFORMANCE ASSESSMENT

Considerable commonality in priority natural resources and environment issues exists across the Greater Mekong Subregion (GMS), although the economies prioritize these issues differently and often use different indicators in their performance assessments. Most or all the economies are concerned about some aspects of air quality; biodiversity and habitat; climate change; solid waste management; and fish, forest, land, and water resources. In this section, the issues are described and subregional environmental performance assessed, with country examples.

4.1 Synopsis

Box 1: Condition and Trend Ranking

The overall analysis for each issue in this assessment combines the following condition and trend rankings.

Condition Rank	Color Code		
Pressure	High	Medium	Low
State	Poor	Satisfactory	Good
Response	Limited	Moderate	Substantive

Trend Rank	Symbol Code		
	▲	■	▼
Pressure	Increasing	Stabilizing	Decreasing
State	Deteriorating	Stabilizing	Improving
Response	Sporadic	Intermittent	Sustained

By combining the condition and trend ranking, each issue is summarized as in the colored bar below. In this instance, pressure is high and increasing, the state is satisfactory and stabilizing, while the response is substantive and sustained.

Source: Authors

Summary ratings for the natural resource and environmental issues examined in this assessment are provided in *Table 2*.

Table 2: Summary Ratings for Priority Issues Using the Pressure-State-Response Framework

Issue	Pressure	State	Response
Air Quality	■	■	▼
Biodiversity and Habitat	■	■	■
Climate Change	▲	■	■
Fish	▲	■	▲
Forest	■	■	■
Land Degradation	■	■	▼
Solid Waste Management	▲	■	▼
Water Pollution	■	■	▲
Drinking Water and Sanitation Access	■	▼	▼

Source: Author's calculations.

4.2 Air Quality

Large cities in the GMS countries are increasingly facing problems with urban ambient air quality. The transport sector is usually the largest contributor to air pollution. Pollutants of main concern are particulate matter (PM), especially very small particles (known as PM_{10} and $PM_{2.5}$), and nitrogen and sulfur oxides. There has been a moderate to slight decrease in sulfur dioxide levels, although they remain below the guideline limit set by the World Health Organization (WHO).[3] In contrast, total PM has often reached levels harmful to human health, while ambient concentrations of nitrogen dioxides have gradually increased and slightly exceed the WHO guideline.

Car ownership has been increasing with increasing per capita incomes of urban residents (*Figure 4*). The number of registered vehicles in 2015 is highest in Thailand (16.2 million), Yunnan (4.8 million), and Guangxi (3.6 million). Car ownership has also grown rapidly in all the other GMS countries. In addition to passenger cars that emit mainly carbon dioxide, commercial diesel trucks and buses are associated with particulate emissions, while two-wheel vehicles emit nitrogen oxides and three-wheel vehicles emit hydrocarbons. Increasing traffic congestion in major cities and the generally low quality of petroleum-based fuel used in the subregion have worsened the problem.

Country reporting on air quality is not uniform due to differences in the indicators being used. For example, Myanmar compares measured air quality against WHO guidelines. Thailand uses an air quality index based on selected pollutants and reports on a scale ranging from good, to moderate, some health effects, high health effects, and dangerous. Viet Nam has a national air quality standard.[4]

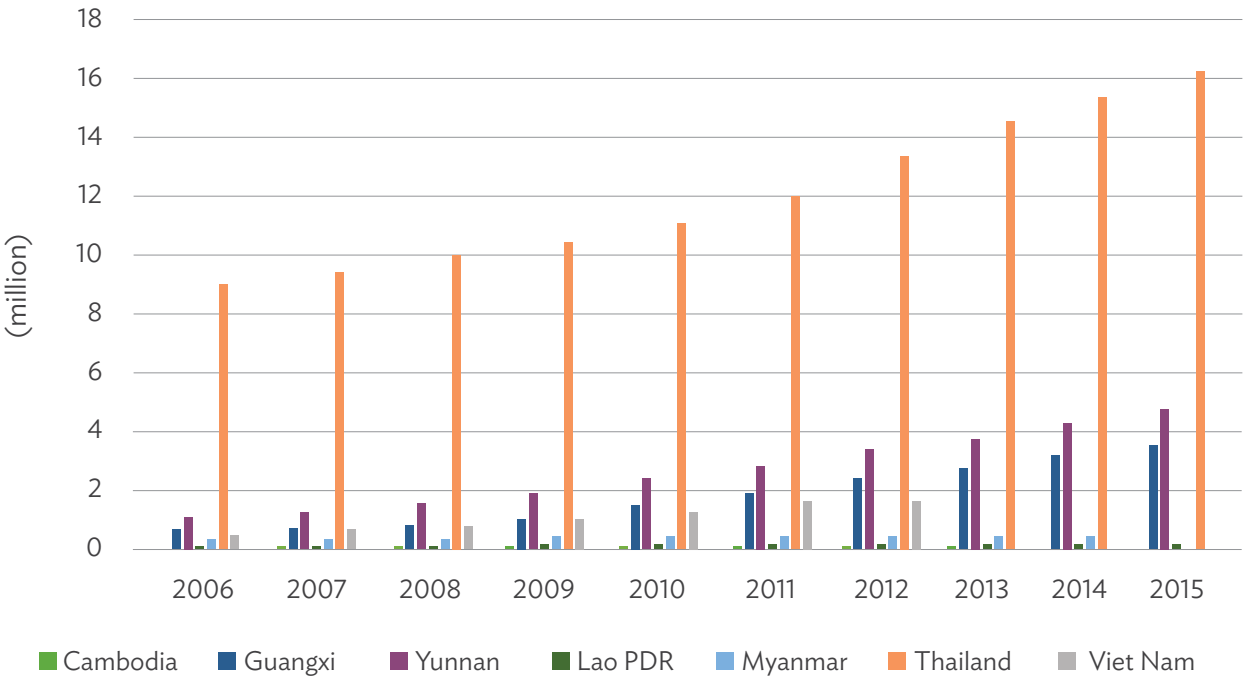
3 World Health Organization. 2006. *Air Quality Guidelines Global Update 2005.* Geneva.

4 Greater Mekong Subregion Core Environment Program. 2014. *Viet Nam National Environmental Performance Assessment Report 2010.* Bangkok.

State indicators for air quality in Guangxi and Yunnan are the percentage of cities meeting applicable air quality standards and, for major cities, number of days with air quality better than the standard values.

In Myanmar, increasing industrialization and increasing use of automobiles are the primary causes of declining outdoor air quality.[5] The number of motor vehicles, excluding motorcycles, more than doubled from 2007 to 2014. In Yangon, vehicle ownership in 2012–2013 alone rose almost 5%.[6] From 2006 to 2015, air pollution worsened, particularly in peri-urban areas where industry is concentrated. In 2006, concentrations of PM exceeded the WHO guideline while nitrogen dioxide and sulfur dioxide remained within the guideline values. By 2015, total PM, PM10, and concentrations of nitrogen dioxide and sulfur dioxide all exceeded the WHO guideline values in Yangon and Mandalay, with concentrations continuing to be acceptable in Nay Pyi Taw.

Figure 4: Number of Motor Vehicles (excluding motorcycles) in the Greater Mekong Subregion, 2006–2015



Source: Greater Mekong Subregion Information Portal. http://portal.gms-eoc.org/

In Thailand, motor vehicles are the largest source of air pollution; vehicle numbers increased from 9.0 million in 2006 to 16.2 million in 2015, linked to population and economic growth. In rural areas, open burning of domestic waste and agricultural residues are the main causes of air pollution. Urban air quality has remained generally acceptable, however, with conditions typically being moderate to good. Some parameters have shown a slightly rising trend, e.g., the average PM increased from 24.8 micrograms per cubic meter (μg/m^3) in 2006 to 26.4 μg/m^3 in 2015. Air quality in cities sometimes reaches unhealthy levels, particularly in Chiang Mai, which is also affected by haze from agricultural field burning.[7]

5 Greater Mekong Subregion Core Environment Program. 2014. *Myanmar National Environmental Performance Assessment (EPA) Report 2010.* Bangkok.

6 United Nations Environment Program. *Myanmar Environmental Outlook 2014. Status of Environment: Atmosphere.* Bangkok. Draft.

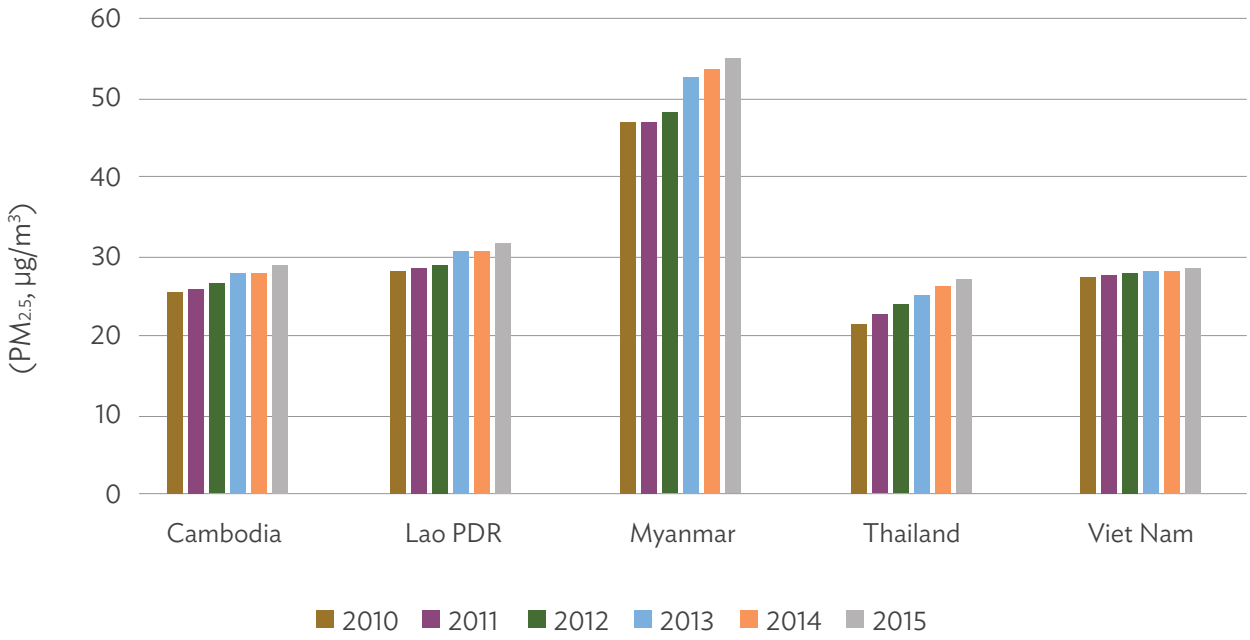
7 Greater Mekong Subregion Core Environment Program. 2014. *Thailand National Environmental Performance Assessment Report 2010.* Bangkok.

In Viet Nam, the main contributor to air pollution is the increase in travelling passengers. Vehicular traffic accounts for about 70% of the pollution load, with the remainder attributable to industrial zones and factories located in peri-urban areas. The number of cars increased from 656,000 in 2006 to 1,540,000 in 2012. The number of motorcycles in major cities such as Ho Chi Minh and Ha Noi has now reached saturation (e.g., Ha Noi's population of seven million owns five million motorcycles). Industrial parks have also increased rapidly, reaching 299 parks in 2015. Urban air pollution in Viet Nam's cities is worsened by infrastructure and residential construction, which causes dust and PM pollution. As a result, air quality in most urban areas is typically moderate to poor with the amount of PM exceeding the allowable limit. Monitoring data, primarily for PM, show that concentrations consistently exceed the national air quality standard.

Air quality in Guangxi and Yunnan also suffers from vehicular and industrial emissions and is significantly worsened by air pollution due to continually increasing sulfur dioxide emissions from burning high-sulfur coal. Overall air quality has worsened during the period; the number of cities meeting the applicable criteria is lower than targeted.[8, 9]

Overall, urban air quality has worsened in the GMS as evidenced by increasing $PM_{2.5}$ concentrations (*Figure 5*).

Figure 5: Urban Particulate Matter Concentrations in the Greater Mekong Subregion, 2010–2015



Source: World Bank. PM2.5 Air Pollution, Mean Annual Exposure (micrograms per cubic meter). http://data.worldbank.org/indicator/EN.ATM.PM25.MC.M3 (accessed October 2017).

8 Greater Mekong Subregion Core Environment Program. 2014. *Guangxi National Environmental Performance Assessment Report 2010.* Bangkok.

9 Greater Mekong Subregion Core Environment Program. 2014. *Yunnan National Environmental Performance Assessment Report 2010.* Bangkok.

Air pollution is a major environmental risk to human health, increasing the burden of disease from stroke, heart disease, lung cancer, and both chronic and acute respiratory diseases, including asthma; the lower the air pollution, the better the cardiovascular and respiratory health of a population. Economic and health impacts due to air pollution include the cost of medical treatment for respiratory diseases, income loss due to absence from work, and having to miss work to care for children and adults. Further, the increase in acid rain in major cities is causing a health hazard and damaging buildings and vegetation.

Myanmar responded to outdoor air pollution by promoting the use of liquefied petroleum gas as a fuel for public transportation and by replacing very old cars with newer and less polluting models through the liberalization of vehicle imports. National Environmental Quality Emission Guidelines were issued in 2015 to manage source emissions of nitrogen and sufur oxides and PM, including from thermal power plants.

Responses in Thailand included progressively adopting some of the strictest standards in Southeast Asia. For example, Euro II equivalents were introduced for passenger vehicles in 2001 and Euro III standards for light duty vehicles were introduced in 2004, and the low-sulfur Euro IV standard was adopted in 2012 for gasoil and gasoline. Improvements in fuel quality and implementation of more stringent vehicle emission standards have helped reduce concentrations of ambient and roadside air pollutants. Additionally, improved public transport is helping to reduce the number of vehicles on the road in major cities such as Bangkok.

Responses in Viet Nam included revising their regulatory framework of environmental protection laws and strategy, implementing emission standards for road vehicles and motorcycles, and improving public transport in large cities such as with new subway systems in Ha Noi and Ho Chi Minh. In Ha Noi, a ban on motorcycles has been proposed.

Guangxi and Yunnan made similar investments in public transportation and have introduced stricter controls on industrial emissions; they have promoted adoption of clean energy technologies, including use of low-sulfur coal and alternative fuels such as natural gas, in order to reduce sulfur dioxide emissions.

4.3 Biodiversity and Habitat

The GMS is one of the world's richest biodiversity hotspots. It harbors many endemic species, including 430 mammals, 800 reptiles and amphibians, 1,200 birds, and 20,000 plants. New species are regularly identified; 2,409 new species were discovered from 1997 to 2015.[10] Many of these species are vulnerable, endangered, or critically endangered. Their fragility is demonstrated in the high proportion of the world's threatened species, as assessed by the World Conservation Union (IUCN), that are located in GMS.

All GMS countries consider biodiversity and habitat as a priority issue, emphasizing the loss of biodiversity from terrestrial forested areas, inland waters, and coastal zones.

The main driver of biodiversity loss is the Asia-wide demand for wildlife, timber, and non-timber forest products. Other drivers include loss or fragmentation of forests for highway construction and clearing of forests for mining and hydropower projects. High poverty levels, particularly in upland areas, are also leading to increased forest exploitation.

10 http://greatermekong.panda.org/discovering_the_greater_mekong/species/

> **The biodiversity and habitat indicator** track the protection of terrestrial and marine areas as well as the species that conservation policies aim to protect.
>
> Source: A. Hsu et al. 2016. 2016 Environmental Performance Index. New Haven, CT: Yale University.

Habitat loss is the main pressure on biodiversity, followed by trade in wildlife and forest products, and introduction of invasive species. Habitat loss is caused by a wide variety of human activities: forest logging, deforestation and land conversion for economic land concessions, shifting cultivation in upland areas, plantation forests, degradation of coastal zones, infrastructure development, and mine and hydropower development. Such pressures can be transferred between countries; for example, logging moratoriums in neighboring countries are causing increased logging of forests in the Lao People's Democratic Republic (PDR).

The state of biodiversity in all the GMS countries is measured by the number or population size of threatened species. Most countries use the IUCN Red List of Threatened Species to determine the percentage of globally threatened species that occur within their borders as the state indicator.[11] Viet Nam uses the number of species in the Viet Nam Red Book. Yunnan tracks populations of four key species (black gibbon, Asian elephant, black-necked crane, and snub-nosed monkey), wildlife seizures, and product confiscations as its biodiversity state indicators. Available data suggest that the number of threatened species in the GMS as a percentage of all globally threatened species declined slightly from 2006 to 2016. Numbers of threatened species—birds, fish, plants, and mammals—in the GMS (excluding Guangxi and Yunnan) are shown in *Table 3*.

Table 3: Threatened Species in Greater Mekong Subregion Countries in 2016

	Birds	Fish	Plants	Mammals	Total
Cambodia	27	47	36	38	**148**
Lao PDR	24	55	41	45	**165**
Myanmar	48	50	61	48	**207**
Thailand	51	106	150	56	**363**
Viet Nam	46	86	204	55	**391**

Source: United Nations Economic and Social Commission for Asia and the Pacific. Access Data. http://data.unescap.org/escap_stat/#data

11 United Nations Economic and Social Commission for Asia and the Pacific. Access Data. http://data.unescap.org/escap_stat/?#data/10

Viet Nam has the highest number share of threatened species among GMS countries, reflecting the large number of species, including many endemic species, found there. Loss of biodiversity in the GMS has ecosystem, human livelihood, and economic impacts. Impacts include reduced food security and income generation among local communities. In the Lao PDR, for example, more than 60% of the country's population live in rural areas and are often highly dependent on harvesting wild plants, animals, and animal products for their daily subsistence and income.[12] Tourism is also an important revenue source for the Lao PDR and ecotourism is steadily expanding. Continued loss of biodiversity will inevitably affect the appeal of the country as a tourist destination.[13]

GMS country responses to biodiversity loss have primarily involved comprehensive policy frameworks, establishing protected areas, and applying penalties for illegal activities in protected areas such as logging, wildlife poaching, and wildlife trade. All countries are party to the Convention on Biological Diversity, and are committed to the Strategic Plan for Biodiversity and its Aichi Targets (2011–2020). These include Target 11 on Protected Areas and Identification of Key Biodiversity Areas and Target 12 on Conservation of Species. There is a common recognition in the subregion that greater funding support and human resources are needed to protect biodiversity and extend protection efforts outside already designated conservation areas.

Protected area as a percentage of total land area in GMS countries (not including Guangxi and Yunnan) is shown in *Figure 6*.

Cambodia uses this indicator to measure the success of its responses to biodiversity loss. It increased the proportion of its protected areas in total area to 26.1% by 2010—the highest percentage in the GMS.[14] In early 2017, Cambodia announced a new subdecree that protects almost 1.5 million hectares as biodiversity conservation corridors—areas of land that connect existing protected areas, allowing animals to move unimpeded between them.

The Lao PDR uses the same measure as an indicator of response to biodiversity loss. By 2010, protected areas comprised 16.7% of its total land area.

Myanmar responded to the loss of biodiversity primarily by establishing marine and terrestrial protected areas. Terrestrial protected areas reached 6.5% of land area by 2010, but marine protected areas represent only 0.3% of its territorial waters. Although Myanmar is a signatory to the Convention on the International Trade in Endangered Species of Wild Flora and Fauna, ineffective control in border areas and limited enforcement enable trade in wildlife species to neighboring countries to persist.

Thailand has also primarily responded to terrestrial biodiversity loss by establishing both marine and terrestrial protected areas. Terrestrial protected areas reached 20.4% of the country's land area by 2010. More than half of the protected areas are national parks, followed by wildlife sanctuaries, no-hunting areas, and forest parks. Marine protected areas made up 5.2% of Thailand's total territorial waters in 2014. Other responses have included improving the capacity of rangers and park managers to control both the trade and trafficking of vulnerable species, and to protect these species.

Viet Nam has responded to biodiversity loss by establishing protected areas, increasing ranger forces for forest protection, strengthening the role of environmental police in investigating and handling criminal activities related to wildlife trade, increasing forest cover, restoring degraded ecosystems, rehabilitating mangrove forests, and establishing Ramsar[15] sites. The proportion of the terrestrial protected area in Viet Nam was 6.6% of its total land area in 2010.

12 Greater Mekong Subregion Core Environment Program. 2014. *Lao PDR National Environmental Performance Assessment Report 2010*. Bangkok.

13 Government of the Lao PDR, Ministry of Natural Resources and Environment. 2012. *Lao Environmental Outlook 2012*. Vientiane.

14 GMS Environment Operations Center. 2014. *Cambodia National Environmental Performance Assessment Report 2010*. Bangkok.

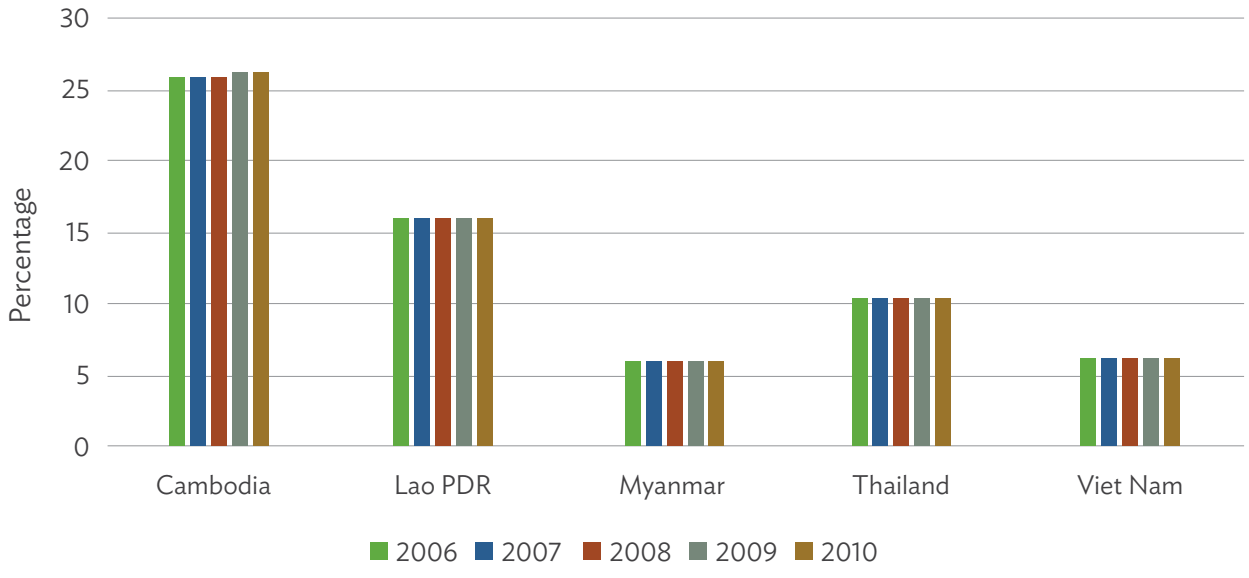
15 The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

> The World Conservation Union defines a **protected area** as an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

Responses in Guangxi and Yunnan to biodiversity loss have focused on the establishment of nature reserves and the creation of a nature reserve network to protect rare and endangered animals and plants. The number of nature reserves has been increasing, but the percentage of reserve areas out of the total area has not yet met their targets. Other responses include natural forest protection, protection of key species, and biodiversity conservation action plans.

All GMS countries have national wildlife policies, laws, and management strategies. For example, the Lao PDR Wildlife and Aquatic Law provides for the management, conservation, protection, development, and use of wildlife and aquatic life. Most GMS countries have a Biodiversity Strategy and Action Plan to integrate conservation with sustainable use of biodiversity. In Thailand, biodiversity and biodiversity habitats are protected under existing laws. Viet Nam has a specific Biodiversity Law, which provides for conservation of natural ecosystems and protection of wildlife and their natural habitats.

Figure 6: Protected Area as Percentage of Total Land Area in the Greater Mekong Subregion, 2006–2010



Source: Food and Agriculture Organization of the United Nations. Land Use. http://www.fao.org/faostat/en/#data/EL

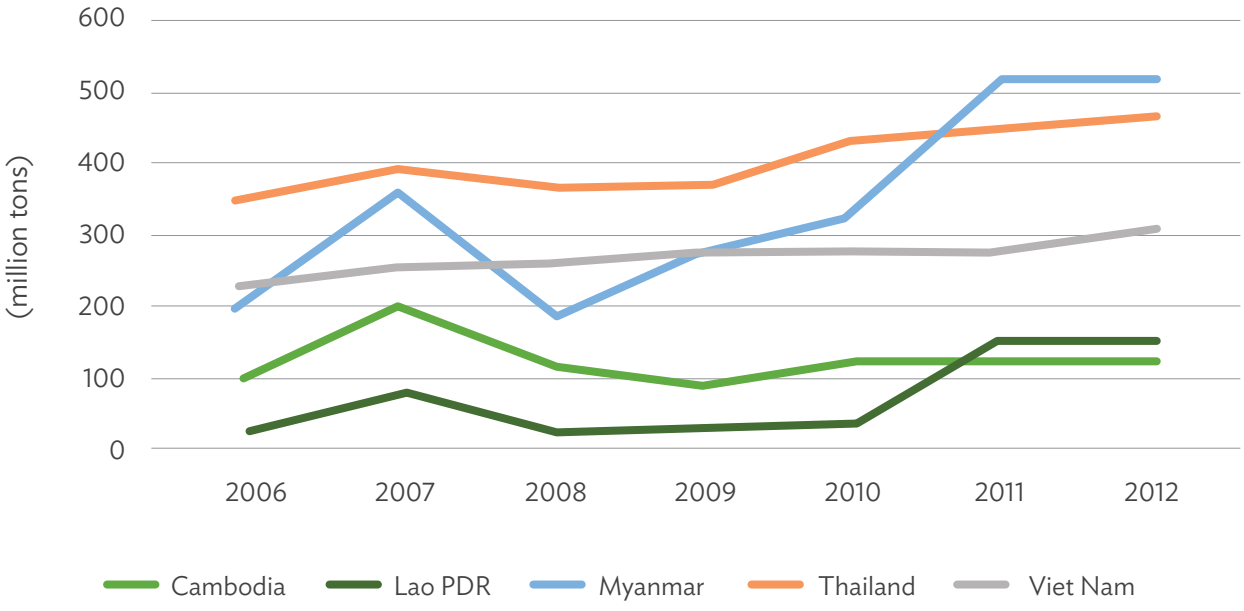
4.4 Climate Change

During 2006–2016, climate change progressively became a priority issue for GMS countries as subregional greenhouse (GHG) emissions rose and negative impacts of climate change became more apparent. Although the subregion's contribution to global emissions remains low, increasing energy use, expanding transportation, deforestation, and land-use change are all contributing to accelerating GHG emissions. Climate change has important implications for economic development in the GMS, affecting both human well-being and ecosystem integrity. It is affecting infrastructure such as energy and transport, in addition to life, property, and other assets across the GMS. Extreme weather events have a significant impact on GMS countries and are likely to increase in frequency or intensity.

Key pressures contributing to increased GHG emissions in the GMS are fossil fuel consumption, hydropower generation, land-use change and intensified agriculture, and deforestation due to logging and forest fires. While per capita energy-related fossil fuel emissions remain among the lowest in the world, GHG emissions per capital in carbon dioxide equivalent increased rapidly in most GMS countries (excluding Guangxi and Yunnan, for which comparable data are not available) from 2006 to 2012 (*Figure 7*). During this period, GHG emissions average increase was 72%. The largest increases were in the Lao PDR (from 25.1 million tons (t) to 161.7 million t) and Myanmar (from 199.3 million to 528.4 million t).

The rapid expansion of vehicle ownership in the subregion is associated with increasing GHG emissions from transport. This is predicted to further increase by 300%–500% by 2030 if no new policies are introduced to tackle these emissions. Rapidly expanded hydropower development in the GMS, particularly in the Lao PDR, has raised concerns about the potent GHG methane released from inundated reservoirs. Logging associated with such development schemes compounds the problem. Land-use change in general and deforestation in particular represent a significant climate change pressure in the GMS. Forest fires are also an important issue relating to human health, air pollution, and GHG emissions. All the GMS countries grow rainfed and/or irrigated rice, and rice fields are a major source of atmospheric methane.

Figure 7: Greenhouse Gas Emissions from the Greater Mekong Subregion, in Carbon Dioxide Equivalent, 2006–2012



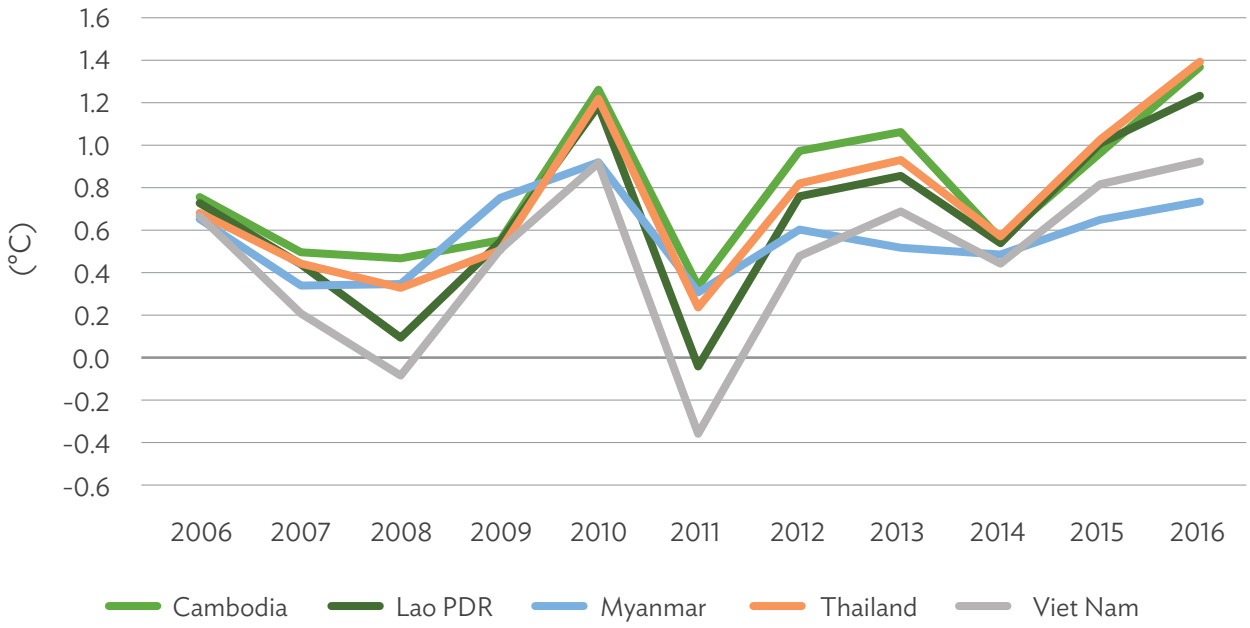
Source: World Bank. Total greenhouse gas emissions. http://data.worldbank.org/indicator/EN.ATM.GHGT.KT.CE

The state of climate change in the GMS countries is typically tracked by assessing the frequency of natural disasters and climate phenomena—rising temperature, shorter monsoon period, increasing rainfall with higher intensity, more severe cyclones affecting coastal areas, and increasing rate of sea level rise. A commonly used indicator of climate change impact is change in land area prone to floods and droughts.

All the GMS countries are particularly vulnerable to climate change because their populations are largely agrarian; 64% of the GMS population (not including Guangxi and Yunnan) still lived in rural areas in 2016.

Across the subregion, temperatures rose by an average of 0.65 degrees Celsius during 2006–2016 (*Figure 8*). A particular concern for GMS countries as a consequence of this temperature change is the increase in wet season rainfall and the decrease in dry season rainfall.

Figure 8: Temperature Change in the Greater Mekong Subregion, 2006–2016



Source: Food and Agriculture Organization. Temperature change. http://www.fao.org/faostat/en/#data/ET

Impacts of climate change in the GMS include injuries and loss of human life from extreme weather events, reduced agricultural production, and infrastructure damage. The cost of climate change in Thailand and Viet Nam by 2100 could reach nearly 7% of annual gross domestic product (GDP), which is significantly higher than the global average. In Cambodia, floods in 2011 alone caused an estimated $451 million in damage and $174 million in losses. A flood in the Lao PDR in 2008 caused a loss of $58 million.

GMS country responses to climate change impacts include establishing policy frameworks and programs for adaptation and mitigation. All the countries consider ratification of the United Nations Framework Convention on Climate Change (UNFCCC) and its associated treaty and agreement requirements as the overarching context for policy targets. Country actions arising out of UNFCCC ratification include the (i) National Adaptation Plan of Action, (ii) Action Plan for Disaster Risk Reduction, (iii) initiation of Clean Development Mechanism projects, and (iv) programs on reducing emissions from deforestation and forest degradation, and fostering conservation, sustainable management of forests, and enhancement of forest carbon stocks (REDD+). All GMS countries have formally adopted the Paris climate agreement, having finalized their Nationally Determined Contributions, which specify the post-2020 actions they will take to achieve the long-term climate change targets set under this agreement.

Adaptation responses on the ground include construction of water reservoirs, development of irrigation systems, and rehabilitation of coastal infrastructure. Mitigation measures range from management and exploitation of biomass (forest and agricultural residues), to carbon sequestration (capturing and storing carbon dioxide and other forms of carbon in the ground), and conservation of carbon in soils and forests. Countries are additionally pursuing green growth initiatives such as seeking to achieve energy savings—and thus emission reductions—through more energy-efficient infrastructure, and encouraging cleaner production technologies that emit less GHGs.

4.5 Fish

An estimated 1,100 freshwater fish species live in the six major GMS river basins—the Ayeyarwady, Thanlwin, Chao Phraya, Mekong, Red, and Pearl—and a further 250 marine species reside in coastal waters.[16]

Freshwater capture fisheries and aquaculture in the lower Mekong River Basin (MRB) alone totaled more than 3.9 million tons in 2008, comprising 1.9 million tons from capture and 2 million tons from aquaculture. The generally increasing trends in inland fisheries production in the GMS are presented in Figure 9 and marine capture fisheries production are evident in Figure 10. Fisheries account for nearly 12% of Cambodia's GDP and contribute more to the country's economy than rice production. In the Lao PDR, fisheries account for 7% of the GDP. The Mekong River fishery sectors in Thailand and Viet Nam are not as important to the national economy, but contribute well over $750 million to the GDP each year. The total economic value of Mekong River fisheries is estimated at $3.9 billion–$7.0 billion per year.[17]

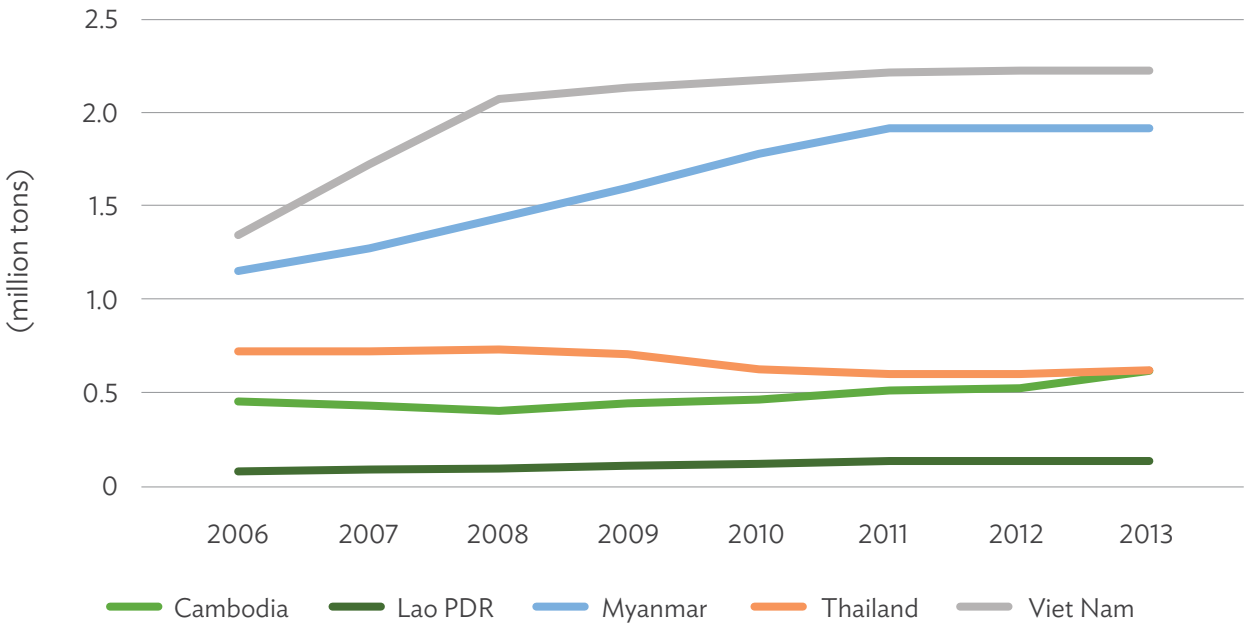
Key pressures on fish populations are high harvesting levels, loss of habitat, and hindrance of migratory patterns.

Migratory fish species are particularly vulnerable to excess harvesting because large numbers of fish migrate at the same time and are subject to intensive fishing. Fishing pressure in Cambodia's Tonle Sap, including from large-scale commercial operations, is thought to exceed sustainable catch levels, as evidenced by the decreasing size of fish being caught. Several fish species in the subregion's rivers are already endangered, such as the giant Mekong catfish. This iconic species can grow up to 3 meters long and weigh more than 300 kilograms (kg). It is endemic to the Mekong River and migrates great distances to spawn in tributaries. Threats to the giant Mekong catfish and other species include excessive fishing and obstruction of migratory routes by hydropower development; there are about 20,000 dams and weirs in the lower MRB alone.

16 Asian Development Bank. 2012. *Greater Mekong Subregion Atlas of the Environment. 2nd Edition.* Manila.

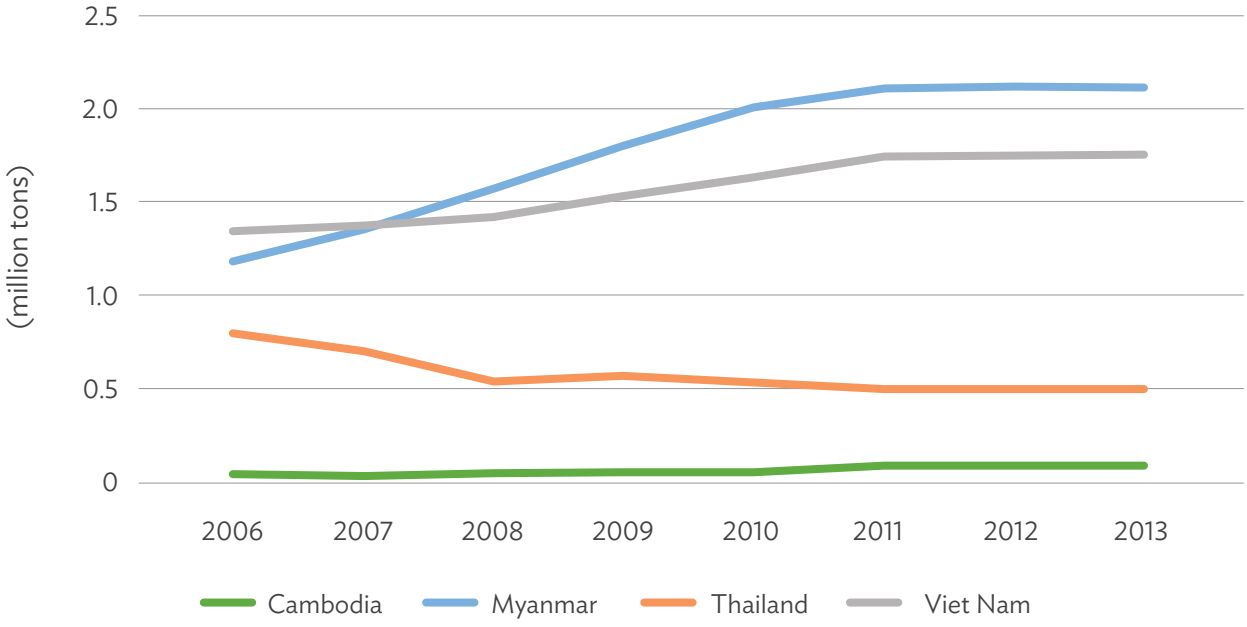
17 Mekong River Commission. 2010. *State of the Basin Report 2010.* Vientiane.

Figure 9: Inland Fish Catch in the Greater Mekong Subregion, 2006–2013



Source: Food and Agriculture Organization of the United Nations. Commodity Balances—Livestock and Fish Primary Equivalent. http://www.fao.org/faostat/en/#data/BL

Figure 10: Marine Fish Catch in the Greater Mekong Subregion, 2006–2013



Source: Food and Agriculture Organization of the United Nations. Commodity Balances—Livestock and Fish Primary Equivalent. http://www.fao.org/faostat/en/#data/BL

Myanmar, with a 2,800-kilometer coastline and extensive wetlands and mangrove areas, is endowed with abundant marine fisheries resources. Fish catches have increased substantially in recent years. The combined production from capture fisheries and aquaculture increased at an annual rate of 11% during 2004–2013. It is not clear whether Myanmar's fish stocks can sustain such catches. Some 30% of harvested species are thought to be overfished and overall fish stocks declined by 12.7% over the last decade. Another major concern in Myanmar is the loss of riparian vegetation cover and, in particular, the rapid loss of flooded forests, which provide crucial habitat for fishes. The loss of mangrove forests, which provide a nursery habitat for some marine fish, due to coastal zone development is of particular concern in Cambodia, Myanmar, and Viet Nam.

Declines in wild fish populations have been partly offset by expanding aquaculture production, which doubled from 3 million tons to 6 million tons during 2000–2007, and to around 7 million tons in 2010, with Viet Nam showing the fastest growth.

Depleted fish populations have worrying implications for people dependent on fish for their diet and livelihoods. For example, in Cambodia, fish and rice production is the basis for food security. In other GMS countries, people rely heavily on fish as a source of protein. Fish processing, transporting, marketing of fishery products, and many other supporting industries provide people with full- or part-time work, and generate revenue for commercial operations. Local consumption surveys in the lower MRB imply an average consumption of freshwater fish and other aquatic organisms of 44 kg/person/year and marine fish consumption of 16 kg/person/year.[18] However, statistics from the Food and Agriculture Organization of the United Nations (FAO) suggest average consumption rates of about 19 kg/person/year in Cambodia, 14 kg/person/year in the Lao PDR, and 7 kg/person/year in Thailand and Viet Nam. While the FAO figures are lower than local consumption estimates, it is clear that with a population of 60 million people, consumption of freshwater fish in the lower MRB is the highest in the world.

Country responses involve fisheries management and habitat protection. Cambodia has focused predominantly on the establishment of community fisheries and investment in community-based sustainable fishery management. It has introduced reforms in commercial fishing lots and released fishing areas for community use in order to reduce illegal fishing, overfishing and destructive fishing, and clearance of flooded forests for agriculture. The Lao PDR has continued to promote aquaculture by investing in government hatchery production and is protecting wild fish through the construction of fish passages to allow fish to bypass irrigation weirs and small hydropower dams as part of its integrated water resource management initiative. Myanmar has concentrated on aquaculture development and fishery stock management such as restrictions on fishing gear. While Myanmar's stock management efforts appear to have been partly effective, enforcement is undermined by the lack of a system to regulate catches of coastal fishing operators. Thailand's efforts have focused on the protection of mangrove forest areas by maintaining shoreline integrity. The country's expansion of designated protected areas is continuing but is still not considered sufficiently effective in reducing threats to coastal and marine resources. Viet Nam has focused on improved management of fisheries through licensing, gear restrictions, and community co-management; and strong support for aquaculture, partly through integration into coastal zone management.

4.6 Forest

The GMS is richly endowed with forest resources. The total forest coverage for the six GMS countries is estimated at 1.2 million square kilometers (km^2) in 2015, or 52% of the subregion's total land area. Myanmar has the largest forest area among the GMS countries, and the Lao PDR has the highest percentage of forest cover. According to country reports to FAO,[19] the GMS countries except Cambodia and Myanmar increased their forest cover during 2006–2015, with the Lao PDR reaching 81.3% of total land area.

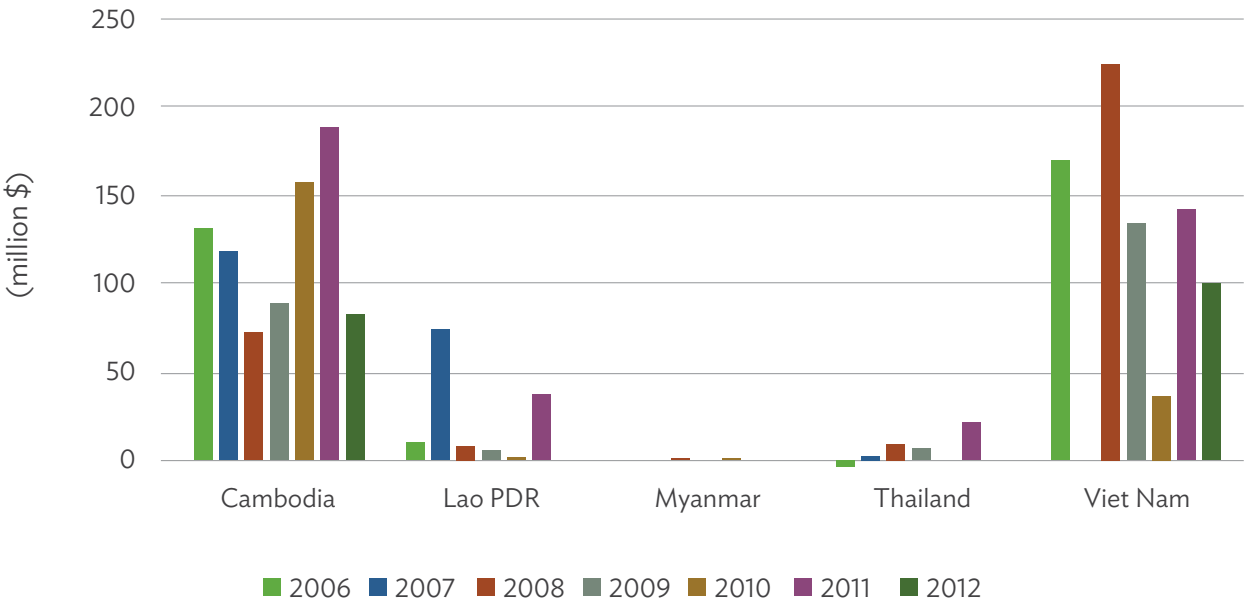
18 Basin Development Programme, Mekong River Commission. 2011. *Planning Atlas of the Lower Mekong River Basin.* Phnom Penh.

19 FAO. 2015. *Global Forest Resources Assessment 2015.* Rome.

> **Tree cover loss** has implications on ecosystem health, habitat preservation, climate change mitigation, and many other environmental services.
>
> Source: A. Hsu et al. 2016. 2016 Environmental Performance Index. New Haven, CT: Yale University.

The drivers of deforestation and forest degradation in the GMS are poverty, weak governance, poor law enforcement, and international demand for timber, rubber, food, electricity, and minerals. The specific drivers of forest loss vary among the countries.[20] In the Lao PDR, the demand for energy from hydropower development and expanding inflows of foreign direct investment (FDI) are key contributors to deforestation. FDI in the Lao PDR flows predominantly into commercial tree plantations and agriculture and mining and hydropower projects. The pattern of FDI in industrial agriculture across the subregion (*Figure 11*) shows that considerable investments have been made in Cambodia and Viet Nam, and to a lesser extent, in the Lao PDR.

Figure 11: Foreign Direct Investment Inflows into the Greater Mekong Subregion to Agriculture, 2006–2012



Source: Food and Agriculture Organization of the United Nations. Foreign Direct Investment. http://www.fao.org/faostat/en/#data/FDI

20 J. Costenbader et al. 2015. *Drivers Affecting Forest Change in the Greater Mekong Subregion (GMS): An Overview.* Rome: FAO.

In Myanmar, the main driver of deforestation in recent years has been the government allocation of agribusiness concessions in areas with natural forest cover. Other drivers are population growth, which has increased demand for wood for both construction and as a fuel. Timber extraction, particularly of teak, often exceeds the annual allowable cut, which can threaten sustainable forest management efforts. In Viet Nam, drivers include both the increasing area dedicated to industrial crops and high poverty rates in mountainous regions. In Yunnan, commercial demand for timber and wood and rural energy supply are important drivers.

The pressures on forests in the GMS are generally high and increasing. In Cambodia and the Lao PDR, a key pressure has been forest conversion for agriculture, spurred on by government economic development policies. For example, Cambodia's economic land concession (ELC) policy, which began in 1995, supported monoculture agro-industrial crops in plantations and forest clearing for agricultural expansion. Many concessions were subsequently cancelled as the government sought control over logging activities. What remained of the unpopular ELC policy was suspended in 2012 and curtailed in 2014. In the Lao PDR, the key pressures leading to deforestation are shifting cultivation in upland areas, excessive logging, and land clearance for hydropower and mine development. In Myanmar, the key pressures are wood removal for charcoal production and fuelwood, commercial logging operations that consistently exceed the annual allowable cut, and illegal logging in remote areas.

In general, the GMS countries use forest cover as a proportion of total land area as their state indicator. Yunnan also considers the quantity of forest stock by volume and by age. In all countries except Cambodia and Myanmar, forest area as a percentage of total land area increased from 2006 to 2015 (*Figure 12*). Thailand and Viet Nam have reported the largest increases in monoculture forests, accounting for 80% of all forest plantations in GMS countries. Myanmar has seen the largest fall in forest cover and is ranked third-worst for forest loss in the world. Forest cover decreased from 50.5% to 44.5% of total land area from 2006 to 2015. The rate of forest loss in Myanmar is accelerating, rising from 0.9% annually during 2000–2010 to 1.8% annually during 2010–2015.

Figure 12: Forest Cover as a Percentage of Land Area in Greater Mekong Subregion Countries, 2006–2015

Source: Food and Agriculture Organization of the United Nations. Forest Land. http://www.fao.org/faostat/en/#data/GF

Forest cover statistics reported by GMS countries need to be carefully disaggregated to understand the relative contribution of forest resources to economic growth in contrast to the importance of intact forest as biodiversity habitat. While reported forest cover includes primary forest, planted forest, and naturally regenerated forest, naturally regenerated forest predominates. Only in Thailand and Viet Nam does planted forest make a large contribution to the total forest area. Most of the change in forest cover has been in naturally regenerated forests. Primary forests have decreased substantially in Cambodia, the Lao PDR, and Viet Nam, with worrying implications for dependent wildlife.[21]

It is important to note that the methodology for country reporting of forest cover has also changed, with forest cover now including plantation forests and calculated based on a 10% canopy cover as explained in *Box 2*. This change in methodology largely accounts for the significant change in forest cover being reported by countries such as the Lao PDR where forest cover doubled from 2010 to 2015.

The consequences of forest loss in the GMS, other than ecosystem-related impacts already covered in the section on Biodiversity and Habitat, include undermining country efforts to achieve the Millennium Development Goals (MDGs) and the Sustainable Development Goals (e.g., livelihoods of forest-dependent households), infestations and disease associated with monocropping, siltation of rivers and reservoirs, and weather-induced landslides on unstable slopes and ensuing fatalities and economic losses.

Box 2: Measuring Forest Cover

Forest resource statistics are complicated by the methodology used by countries in calculating and reporting forest cover. Forest quality and type vary greatly spatially, necessitating high intensity surveys to collect accurate information. Many countries lack the financial and human resources required to collect such forest data. Measurement conventions and conversion factors additionally create difficulties in comparing statistics among countries and over time. Of particular interest is how forest resource definitions have contributed to significant increases in forest cover. Reported forest includes areas of different forest types (e.g., plantation forest, primary forest, agroforestry) and different species groups (e.g., bamboo, rubber), which are aggregated to give a figure of limited use in relation to the different values of forest. The inclusion of "potential" forests and areas designated as forest but with no trees, may cause accounting problems in relation to forest values. Low forest-cover resolution may result in hidden deforestation. The Food and Agriculture Organization of the United Nations defines forest as any forested area with greater than 10% canopy cover; thus, changes in forest resources may not be captured until forests are very highly degraded.

Source: Food and Agriculture Organization of the United Nations. 2011. *Forests and Forestry in the Greater Mekong Subregion to 2020: Subregional Report of the Second Asia-Pacific Forest Sector Outlook Study*. Bangkok.

The establishment and management of protected or managed forest areas form a common response to forest loss in the GMS countries. Some countries have also promoted community forest management and introduced compensation schemes that support farmers and local communities to protect their local forests.

Cambodia has focused on maintaining designated protected areas and recruitment of additional forest rangers. The Lao PDR has taken a top-down approach, affirming state control over all forests, with centralized decision making over who can use the forest and for what purpose. The government is increasingly trying to combat illegal logging and timber exports. It set a goal of 70% of total land area under forest cover by 2020, with afforestation efforts concentrating both on reforestation and

21 Y. Yasmi et al. 2017. *Forest Change in the Greater Mekong Subregion. An Overview of Negative and Positive Drivers.* Bangkok: FAO.

expansion of plantation forest (e.g., eucalyptus, rubber). This goal was achieved by 2015 following the reclassification of forest cover and type. The Lao PDR is receiving grant support from the Forest Carbon Partnership Facility Carbon Fund to develop its National REDD+ Program and National REDD Strategy.

Myanmar has focused on setting up more forest reserves called permanent forest estates, and spending more on forest management, in addition to reforestation and natural regeneration of degraded forests. Thailand has focused on maintenance and expansion of forest protected areas. Viet Nam has invested heavily in afforestation, including reforestation and rubber plantations, and enacted policies on forest protection and development.

Viet Nam has a national Payment for Forest Ecosystem Services (PFES) program, which compensates communities for sustainably managing and protecting their forest. It plans to link PFES with REDD+, which rewards and compensates governments as well as communities for protecting forests and reducing emissions from deforestation and forest degradation.

Guangxi has also focused on reforestation to service the growing demand for industrial wood products, and requires logged areas to be quickly replanted. Yunnan is concentrating on controlling commercial logging operations, replanting forest in sloping areas, and promoting alternative energy to reduce household fuelwood use.

4.7 Land

Land degradation is of high concern in the GMS, affecting 10%–40% of land area. Key contributors to land degradation vary among countries; they include forest loss, agricultural intensification, and growing upland populations and associated shifting cultivation. The resulting landscape changes have affected ecosystem services such as flood retention and erosion control.

The common drivers of land degradation are land-use change influenced by FDI, especially in Cambodia and the Lao PDR, into forest, agriculture, hydropower, and mining development. In Yunnan, other factors contributing to land degradation include mountainous terrain with steep slopes with poorly consolidated rocks and overlying red soils that erode easily and cause landslides and mudflows; hazards that are exacerbated by clearing for agricultural use.

Key pressures on land vary across the subregion. The Lao PDR has become increasingly concerned about the effects that badly planned and mismanaged development projects can have on land. Foreign and domestic investments have involved concession arrangements between developers and the government whereby already degraded forests were replaced with rubber and eucalyptus plantations rather than being regenerated with natural species. Mining concessions for gold, copper, iron ore, limestone, sand, and gravel have also caused land degradation. In Myanmar, growth in upland populations has meant increasing upland farming and shifting agriculture to an unsustainable level in terms of land degradation. In Cambodia, Thailand, and Viet Nam high agricultural chemical inputs have been recognized as an unsustainable agricultural practice. Viet Nam additionally has concerns that climate change is leading to intensifying desertification, salinization, leaching, erosion, and land loss due to sea level rise.

In Guangxi and Yunnan, cultivated land per capita and vegetation cover are used to gauge the impact of intensified cultivation of erosion-prone slopes and other fragile areas. For example, in Guangxi, 38% of the total land area is karst, of which 2.4 million hectares or 29%, is subject to rocky desertification due to natural conditions and human activities. In Yunnan, 64% of the cultivated land is on slopes, creating a high potential for land degradation. Additionally, significant erosion occurs in upland farmed areas.

Indicators of the area or proportion of degraded land vary among the GMS countries. In Cambodia, rice yield has been improving but increased yields are mainly attributable to heavy agro-chemical use, rather than improved irrigation infrastructure and cultivation practices. Excessive chemical use is considered unsustainable and a cause of land degradation, among other negative impacts.

The Lao PDR categorizes land-use changes for current forests, potential forest area, other wooded area, permanent agricultural land, and other nonforest areas. Trends show that natural forested area has decreased over the last 20 years while potential forests and permanent agricultural land area have increased. Myanmar tracks the proportion of vulnerable farmland in total cultivated area, and has found it to be increasing. Thailand measures the area of various problem soils to track the threats from shallow and saline soils.

Viet Nam uses two indicators to monitor land degradation: the area affected by desertification and the area of eroded soil or potential erosion. The country's rugged topography and high precipitation rates result in serious erosion on steep slopes, such that about 28% of the country's total land area has become desert.

Guangxi also uses two indicators to assess land degradation: the total areas affected by soil erosion and rocky desertification; both are pointing to steadily deteriorating land conditions. Yunnan tracks the area subject to soil erosion, intensity of soil erosion, and sediment delivery by rivers. Data on all three indicators show that Yunnan has serious soil erosion problems.

Under-regulated land-use change in the Lao PDR, where the population is highly dependent on natural resources for food security and income, has affected household incomes and livelihoods. In Viet Nam and in Yunnan, land degradation has resulted in reduced crop productivity.

Country responses to land degradation include establishing policy frameworks, designating protected areas, soil rehabilitation, and introducing restrictions on chemical use.

Cambodia has focused on rehabilitation of irrigation systems, regulating the importation and use of agricultural chemicals, and promoting integrated pest management, in which chemical control is minimized and replaced by biological control and change in farming practices.

The Lao PDR's response to land-use change has been in accordance with a land reform agenda, entailing allocating land for conservation, agriculture, and production forest; land titling; and a moratorium on ELC.

Myanmar is undertaking land rehabilitation in cropping areas, promoting soil conservation methods to farmers, and establishing and managing forest reserves and protected public forest.

Thailand is rehabilitating degraded land according to the nature of the soil problem (i.e., acid soils, saline soils, infertile soils, and eroded surface soils), and is promoting organic cultivation techniques to decrease misuse of chemical fertilizers and pesticides.

Viet Nam worked to apply legal instruments and a policy framework for land preservation and conservation, involving the Land Law, Act of Environmental Protection, the Strategy for Environmental Protection, and the Anti-Desertification National Program Act.

Guangxi responded to land degradation through efforts to preserve farmland protection zones and to rehabilitate eroded areas. Yunnan is rehabilitating eroded areas, preventing soil erosion through investment in erosion treatment and implementing a Natural Forest Protection Project.

4.8 Solid Waste Management

Countries undergoing rapid economic growth typically ignore problems associated with solid waste production and management until after they already pose a threat to human well-being and environmental health. The GMS is no exception.

In Cambodia, cities like Phnom Penh are struggling to respond to the volume of waste generated by a rising population, increased consumer consumption, and industrial development. The country is becoming progressively more urbanized, with the urban population increasing from 19.3% in 2006 to 20.9% in 2016. Phnom Penh's population is estimated to have grown from 1.3 million in 2008 to 2.2 million in 2014, an astonishing 41% increase. With economic growth and rising household incomes, waste generation per household has also increased. The expansion of tourism activities and development of industries are also major sources of solid waste. Because of poor waste management infrastructure, uncollected waste has become a serious problem.

The Lao PDR situation is similar to that in Cambodia, with continuing growth in urban population, tourism, and industry creating increasingly large volumes of solid waste. The Lao PDR's urban population grew from 1.6 million in 2006 to 2.6 million in 2016. In Vientiane, the existing solid waste landfill site is adequately operated, but smaller cities and towns typically lack proper waste collection and disposal. The inadequacy of solid waste collection and disposal services has led households to rely mainly on burning or open dumping.

Myanmar's increasing population and accelerating pace of economic development are similarly generating increasing volumes of solid waste. In 2014, the urban population in Yangon was 5.2 million; 2.1 million in Mandalay, Myanmar's second largest city; and 0.4 million in the administrative capital Nay Pyi Taw. While solid waste generation per capita has remained constant or even declined in large cities, total waste generation is increasing as the urban population expands.

In Thailand, industrial development, population growth, urbanization, and changing lifestyles and consumer behavior have contributed to steadily increasing solid waste volumes. Thailand's population increased from 65.8 million in 2006 to 68.9 million in 2016. Daily waste generation per capita countrywide averages 0.64 kg. Waste generation is particularly high in major urban areas such as Bangkok and in tourist destinations such as Pattaya and Phuket. Waste generation steadily increased during 2006–2016, with some downward variation due to economic contraction.

In Viet Nam, investment in infrastructure, particularly for solid waste management, has lagged behind the country's socioeconomic development. Viet Nam's population increased by nearly 10 million during 2006–2016, from 82.9 million to 92.7 million. In urban areas, an improved standard of living has resulted in more than 50% increase in average solid waste generation per household. Continued rapid industrial development has also resulted in increasing solid waste generation, including hazardous wastes. Urban expansion and renewal projects generate a lot of construction waste, much of which is not being properly disposed of.

Both Guangxi and Yunnan also face challenges dealing with the high amount of waste generated by rapid population growth and urbanization; waste treatment remains poor and they are unable to effectively dispose of hazardous waste or deal with illegal and open dumping of large amounts of municipal solid waste.

The main state indicator of solid waste management across the GMS countries is the percentage of waste collected (and properly disposed of). In Phnom Penh, a reported 63.9% of solid waste was collected in 2014, but this figure may not include waste generated in poorer parts of the city that are difficult to access by road. The waste is sent to a newer landfill opened in 2009 and expanded in 2015.

In the Lao PDR, waste collection efficiency has remained comparatively low. Less than 47% of solid waste is collected in cities and large towns. In Vientiane, with a 2013 population of about 0.8 million, 52% were served by municipal waste collection.

In Myanmar, waste collection capacity has generally been increasing in major cities. Yangon for example, had a 92% collection rate in 2011–2012, but about 86% of the solid waste collected is disposed through traditional open dumping and the remainder recycled. While solid waste collection and disposal have improved considerably in Yangon and Mandalay over the last decade, the situation remains unsatisfactory in most of Myanmar's towns.

In Thailand, the ratio of generated to disposed solid waste shows significant differences, with a reported 100% of waste generated in major cities being disposed of in landfills compared to less than 50% of municipal waste nationwide. Waste collection and disposal in nonmunicipal areas is less than 6%, reflecting the lack of collection systems and disposal sites in these areas.

Solid waste collection rates in Viet Nam rose from 60% to 82% in urban areas from 2002 to 2012, while collection rates in rural areas rose from 20% to 50% during the same period.

In Guangxi and Yunnan, the amount of domestic solid waste collected and transported has shown an overall increasing trend as waste collection and disposal systems continue to be improved. The amount of industrial and hazardous waste discharged outside designated disposal facilities and sites has decreased in response to government regulations requiring proper disposal.

Waste management in Phnom Penh has been improved through the implementation of strategies and environmental protection measures. These measures include establishing a comprehensive waste collection and disposal infrastructure, preventing pollution from toxic and hazardous waste (e.g., dedicated landfill for industrial waste, incineration of medical waste), and adopting a reduce, reuse, recycle (3R) strategy. Despite efforts to improve garbage collection in the city, the responsible sole contractor has not been able to keep up with city growth and the ever increasing volume of solid waste.

The Lao PDR introduced solid waste management facilities in five urban centers and improved waste collection systems through increased government expenditure, although the percentage of waste collected remains relatively low. Community involvement and promotion of waste segregation and the 3R strategy have resulted in greater awareness and increased waste recycling. Myanmar recognizes the need for more efficient solid waste management systems as the country becomes more industrialized and urban populations and waste generation rates continue to grow. Additional solid waste management facilities are being established in Yangon and Mandalay. Thailand continues to invest in solid waste management systems and to promote a 3R strategy.

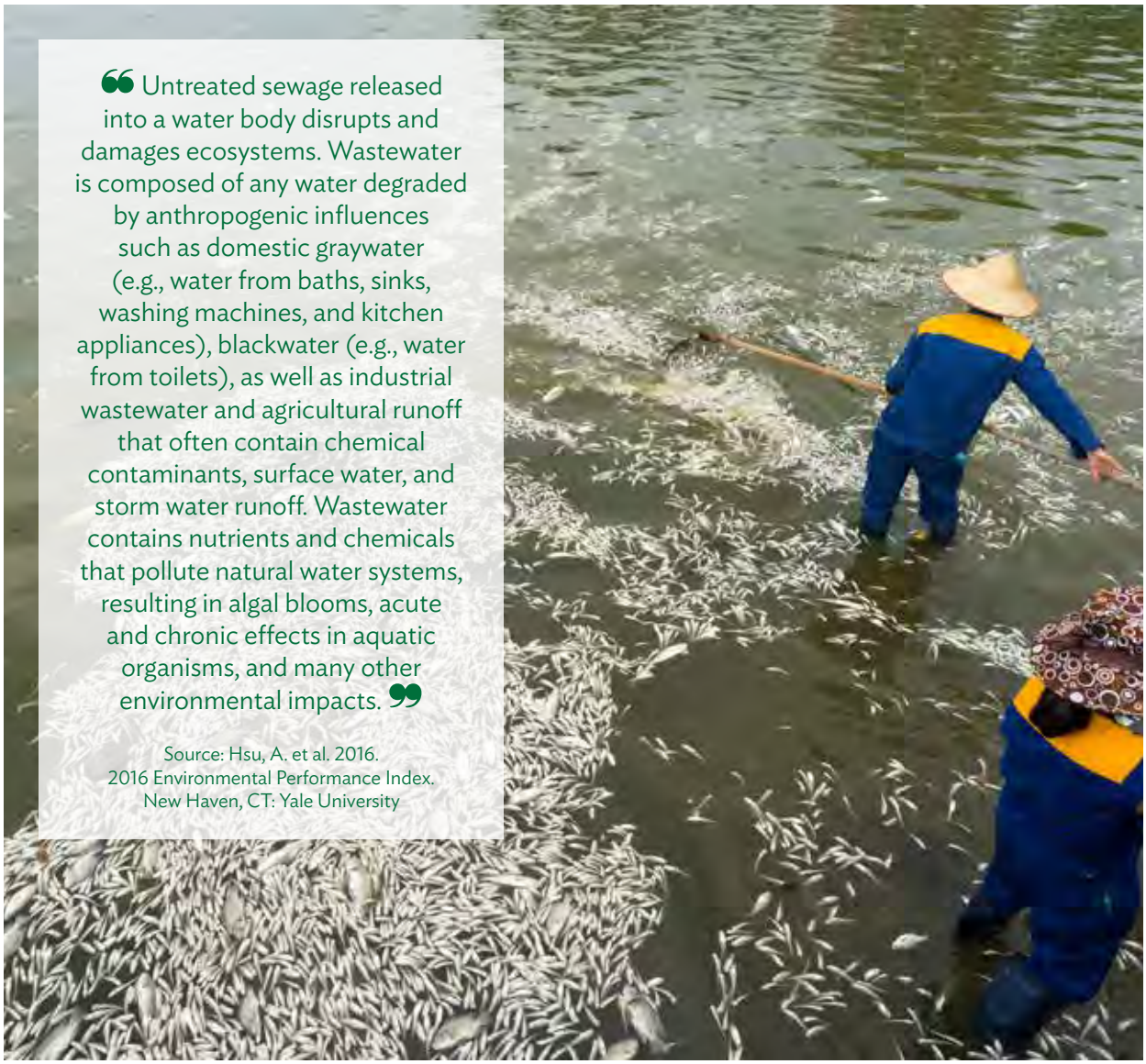
Responses in Viet Nam include revising their regulatory framework (environmental protection laws and strategy), introducing regulations for solid waste management, implementing plans to upgrade and build new solid waste treatment facilities in economic areas and compliance and enforcement of an existing environmental pollution regulation. Guangxi and Yunnan have made considerable investments in building new waste disposal facilities and improvements in collection and transportation systems in order to achieve the treatment capacity stipulated in their five-year plans; and in the control, storage, and disposal of industrial and hazardous wastes.

4.9 Water Resources

Water resources are a priority issue for most GMS countries, while placing different emphasis on water quantity and quality. Water resources for the purposes of this assessment concern pollution of water bodies due to release of wastewater from household, agricultural, and industrial sources; and the proportion of populations with access to safe drinking water and sanitation infrastructure.

The availability of renewable surface water resources varies widely in the GMS. In 2014, the Lao PDR had the largest per capita availability of water resources at 28,952 m^3/annum. Viet Nam had the highest per capita withdrawal rate of water resources followed by Thailand. Over 90% of total annual freshwater withdrawal in the GMS countries is allocated to the agricultural sector, except in Guangxi (58.0%) and Yunnan (64.6%). Water withdrawal for domestic use, as a percentage of freshwater availability, is highest in Guangxi (23.4%), followed by Yunnan (15.5%), with the lowest in Viet Nam (1.5%). Although hydropower accounts for relatively little water consumption in the GMS, existing and planned hydropower development is probably the largest driver of change for water resources, because water is stored in reservoirs in the wet season and released in the dry season.

Water Pollution



> “Untreated sewage released into a water body disrupts and damages ecosystems. Wastewater is composed of any water degraded by anthropogenic influences such as domestic graywater (e.g., water from baths, sinks, washing machines, and kitchen appliances), blackwater (e.g., water from toilets), as well as industrial wastewater and agricultural runoff that often contain chemical contaminants, surface water, and storm water runoff. Wastewater contains nutrients and chemicals that pollute natural water systems, resulting in algal blooms, acute and chronic effects in aquatic organisms, and many other environmental impacts.”

Source: Hsu, A. et al. 2016. 2016 Environmental Performance Index. New Haven, CT: Yale University

Common driver indicators of water pollution in the GMS countries include urban population and water consumption per capita, irrigation water consumption per ha, and percentage contribution of industry to gross domestic product (GDP). The rate of GMS urbanization sharply increased from 28.8% to 36.2% during 2006–2016, without concurrent development of wastewater treatment infrastructure, resulting in an increase in direct discharge of waste into water bodies. In 2006, GMS industries (not including Guangxi and Yunnan) contributed 28.5% of GDP and agriculture accounted for 30.2%. By 2016, industries contributed 33.2% of GDP while the share of agriculture fell to 20.2%. Although water used in agriculture may be decreasing somewhat, as is the total area under cultivation, the increasing amount of chemical fertilizers being used is causing corresponding increases in the pollution level of discharges to receiving waters.

Pressure indicators vary among the GMS countries. Cambodia tracks agricultural and industrial water demand, chemicals in agricultural runoff, and industrial effluent discharges. Domestic wastewater discharges are also considered, in view of the rapidly growing urban areas where sewage systems or wastewater treatment are deficient. The Lao PDR is less industrialized and less densely populated than other GMS countries. However, it has been increasingly concerned about effluent discharges from industrial estates, surface water runoff from mining development, untreated domestic sewage from cities and towns, and increased chemicals in runoff due to intensified agricultural practices.

In Myanmar, rising urban populations, increasing industrialization, intensifying agriculture, and mining are the main sources of discharges containing nutrients, heavy metals, and organic pollutants. In Thailand, the deterioration of receiving water (e.g., rivers, lakes, coastal waters) quality is largely attributable to inadequate treatment of domestic wastewater. Industrial effluent discharges and agricultural runoff are additional pressures, contributing toxic substances. Similar pressures occur in both Viet Nam and Yunnan where water pollution is caused by discharges from domestic, agricultural, and industry sources. In Guangxi, the rapid rate of urbanization has resulted in a significant rise in domestic wastewater discharges.

Although the GMS countries do not share common water quality standards, they are generally consistent in reporting the state of receiving waters. Countries with an established water quality monitoring network such as Cambodia, the Lao PDR, Thailand, and Viet Nam (which all participate in the Mekong River Commission Water Quality Monitoring Network) report annually on water quality using indices for protection of human health and aquatic life. Myanmar currently monitors freshwater and marine water quality on a limited scale. Guangxi and Yunnan track the percentage of rivers meeting set standards for water pollution state. Water quality trends in the six major rivers in the GMS are summarized in *Box 3*.

Box 3: Water Quality Trends in Major Rivers in the Greater Mekong Subregion

The Greater Mekong Subregion has six major rivers: the Ayeyarwady, Thanlwin, Chao Phraya, Mekong, Red, and Pearl. Apart from the Chao Phraya, these rivers originate in the mountainous terrain of the southwestern People's Republic of China (PRC). The Ayeyarwady and Thanlwin rivers drain into the Andaman Sea, while the Chai Phraya, Mekong, Red, and Pearl rivers drain into the South China Sea. The combined catchments of these six rivers cover most of the subregion's land area.

Water quality in most of the subregion's rivers is generally good but degradation exists, most prominently in river deltas and associated with high population densities and still inadequate domestic and industrial wastewater treatment. Water quality degradation is typically most prominent as rivers flow through large cities, where effluent and wastewater discharges cause increased pollution. Chemical pollution from agriculture is significant in the Chao Phraya, Mekong, and Red rivers. Irrigation-induced salinity affects parts of northeastern Thailand and the central Lao People's Democratic Republic (PDR). Soil erosion, particularly in upland areas, also affects water quality.

The 2,170-kilometer (km) long Ayeyarwady River runs the entire length of Myanmar, with a basin catchment area covering 413,710 square kilometers (km^2), or roughly 61% of the total country area. Surface water quality indicates that conditions are partly satisfactory. Levels of nutrients, heavy metals, and organic pollutants indicate deteriorating water quality due to land-based discharges from agricultural, municipal, industrial, and mining sources.

The 2,815-kilometer long transboundary Thanlwin River has a basin catchment area of 271,914 km^2, of which 53% is in the PRC, 42% in Myanmar, and the remaining 5% in Thailand. Mining and deforestation, including shifting cultivation, in the upper reaches of the river cause high sedimentation. Surface water quality indicates that conditions are partly satisfactory. Data on nutrients, heavy metals, and organic pollutants indicate deteriorating water quality due to land-based discharges from agricultural, municipal, industrial, and mining sources.

The Chao Phraya River is the most economically important river in Thailand, stretching 980 km. The basin catchment area is 178,785 km^2, covering 30% of the country's land area. While conditions in the upper and central reaches of the river is considered fair, water quality in the lower reaches has progressively worsened due to increasing discharges from domestic, industrial, and agricultural sources.

The Mekong River is 4,909 km in length from its source on the Tibetan Plateau in the PRC to its mouth in the Viet Nam delta. The basin has a catchment area of 795,000 km^2, extending over six countries—PRC (21%), Myanmar (3%), Lao PDR (25%), Thailand (23%), Cambodia (20%), and Viet Nam (8%). The lower MRB population was approximately 65 million in 2016. The overall water quality in the river is good, although localized pollution occurs from agricultural, industrial, and urban sources. Water quality deteriorates progressively with distance downstream.

The Red River originates in Yunnan and flows 1,149 km through northern Viet Nam into the Gulf of Tonkin. The total basin catchment area is 169,000 km^2, of which 48% is in the PRC, 1% in the Lao PDR, and 51% in Viet Nam. The estimated basin population was 32 million in 2013. Water quality in the upper basin is generally acceptable, although localized deterioration occurs near urbanized areas. Water quality in the lower basin, where the river flows through intensively cultivated, industrialized, and urbanized areas, progressively deteriorates.

The Pearl River basin comprises an extensive river system in the southern PRC and northeastern Viet Nam. The river is 2,210 km in length and has a total catchment drainage area of 409,480 km^2. Agriculture is the main use of the river's water in the PRC, with an estimated 65% of water withdrawals for agriculture, followed by 23% for industrial, and 12% for municipal uses. Overall quality of the Pearl River is considered generally satisfactory, although some tributaries are considered extremely polluted.

Source: ADB. 2012. Greater Mekong Subregion Atlas of the Environment. Manila.

Degraded water quality can affect both human well-being and environmental health. Exposure of fish and aquatic organisms to polluted water causes both chronic and acute toxicity. Consumers of polluted water or fish containing high contaminant concentrations and even persons exposed to polluted water may suffer from chronic and potentially acute health conditions.

Country efforts to maintain acceptable water quality typically combine pollution prevention strategies and control measures. Common GMS responses include public expenditure on domestic wastewater treatment, introduction of stringent environmental quality standards for industry and application of penalties for noncompliance, and regulation of agricultural chemical use combined with promotion of integrated pest management approaches. Corresponding response indicators include the total number and capacity of treatment facilities, enforcement of laws enacted to control the sources of the pollution, and investment in industrial wastewater treatment.

All GMS countries have environmental protection laws and pollution control strategies. For example, in Cambodia a new National Environmental Strategy and Action Plan and forthcoming Environmental Code provide, among other things, for strengthened environmental safeguards and pollution control. Similarly in the Lao PDR, the Environmental Protection Law and recently drafted National Pollution Control Strategy aim to prevent environmental degradation.

Drinking Water and Sanitation Access

All GMS countries prioritized access to safe drinking water and adequate sanitation and made commitments to achieve set targets up to 2015 under MDG 7C. A challenge faced by countries in achieving such targets has been rising populations and changing population demographics. For example, in the Lao PDR, while the rural population has continued to outnumber the urban population, the proportions have shifted, with rural numbers decreasing from 71.5% in 2006 to 60.3% in 2016. Increasing population and concentration of population into urban areas represent pressures that will require effective and efficient responses to ensure that water and sanitation needs are met.

Good progress has been made in the GMS toward achieving MDG water and sanitation goals (*Figures 13 and 14*). For example, Cambodia aimed to improve access to safe water supplies from 30% in 1998 to 58% in 2015. In 2006, access to safe drinking water was 55.1%, rising to 75.5% in 2015; far exceeding the modest target set. Cambodia did not achieve its sanitation target of 55%, with access to adequate sanitation rising only from 26.6% in 2006 to 42.4% in 2015.

The Lao PDR's target was to increase the proportion of population with sustainable access to an improved water source from 58% in 2002 to 80% in 2015, and increase the proportion of urban population with access to improved sanitation from 42% in 1998 to 70% in 2015. In 2006, 59% of the total population has access to safe drinking water, which rose to 75.7% in 2015; 46.5% had access to adequate sanitation, rising to 70.9% in 2015.

Myanmar set a 90% target for both drinking water and access to sanitation by 2015. Access to safe drinking water increased from 73.5% to 80.6% in 2006–2015, and access to adequate sanitation increased from 70.8% to 79.6%.

Despite these improvements, access to safe water and sanitation generally continues to be unequal. People living in rural areas and those from poor and marginalized groups are less likely to have access to improved water and sanitation facilities and less likely to enjoy piped water on premises (footnote 1).

Access to safe drinking water sources and adequate sanitation, particularly in rural areas, is a crucial consideration for households. Localized contamination of available water sources (e.g., multiple use of the same water source—for bathing, clothes washing, animal watering, and drinking water) is also

> **Access to drinking water** describes the proportion of a country's population with access to an "improved drinking water source," defined as a facility or delivery point that protects water from external contamination, particularly fecal contamination. This improved source could mean piped water into a dwelling or yard, a public tap or standpipe, a tubewell or borehole, a protected spring, or rainwater collection. Access to sanitation describes the portion of a country's population that has access to toilets that provide the safe disposal of human waste. Improved sanitation sources include connection to a public sewer, septic system, pour-flush latrine, simple pit latrine, or ventilated pit latrine. The system is considered "improved" if it hygienically separates waste from human contact and is not a public or shared facility.
>
> Source: A. Hsu et al. 2016. 2016 Environmental Performance Index. New Haven, CT: Yale University

a concern. Unsatisfactory drinking water and sanitation access have both high human health (i.e., morbidity and access time costs, typically borne by women and children) and economic costs. For example, in 2006, the Lao PDR lost an estimated $193 million due to poor sanitation and hygiene, including spending on health care, loss of income or production and time losses associated with disease, and the value associated with premature loss of life.[22]

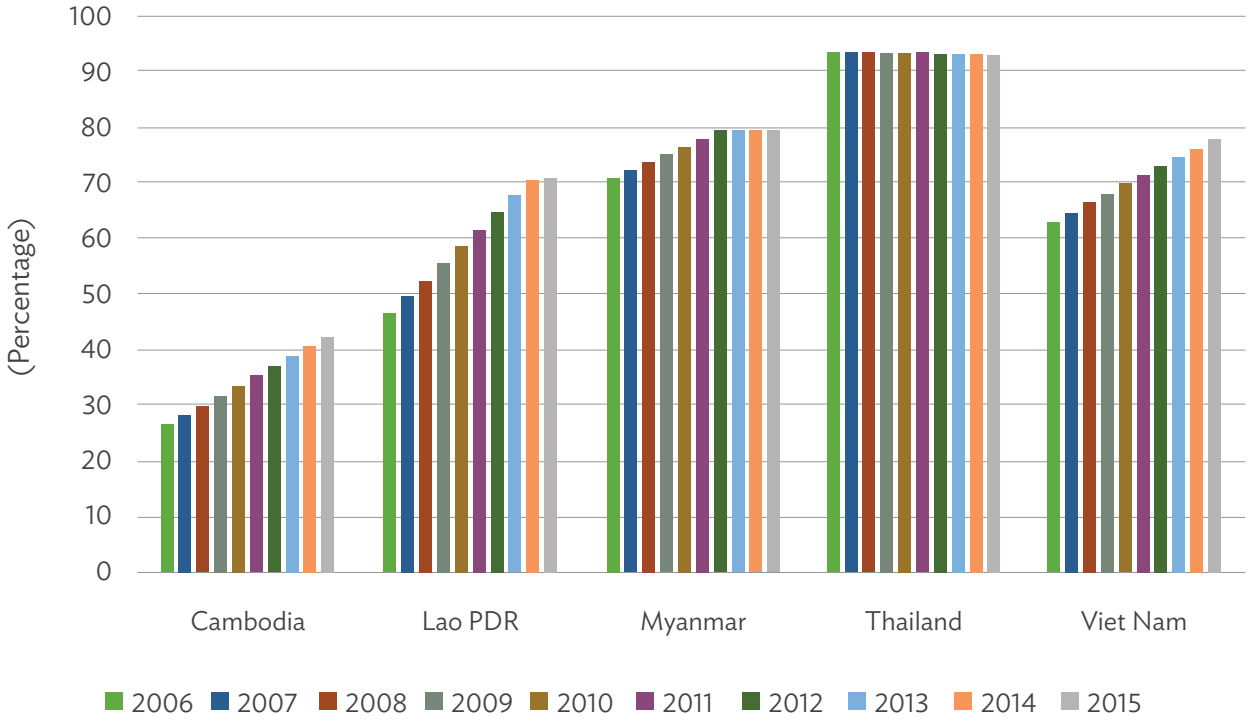
The GMS countries used roughly the same response indicators to track progress toward drinking water and sanitation MDG targets, variously reporting on urban and rural drinking water provision, and expenditure on drinking water supply and sanitation.

22 World Bank Water and Sanitation Program. 2009. *Economic Impacts of Sanitation in Lao PDR*. Jakarta.

Figure 13: Percentage of Populations in Greater Mekong Subregion Countries with Access to Improved Drinking Water, 2006–2015

Source: World Bank. Improved water source, urban. http://data.worldbank.org/indicator/SH.H2O.SAFE.UR.ZS

Figure 14: Percentage of Populations in Greater Mekong Subregion Countries with Access to Adequate Sanitation Facilities, 2006–2015



Source: World Bank. http://data.worldbank.org/indicator/SH.STA.ACSN

5 LOOKING AHEAD IN PERFORMANCE ASSESSMENT

The Greater Mekong Subregion (GMS) countries increasingly require robust data for assessing the sustainability of their development. Strengthening data production and the use of better data in policymaking and monitoring are recognized as fundamental means for development. Monitoring of country progress in achieving 2015 Millennium Development Goal targets and other natural resource and environmental protection targets clearly demonstrated that effective use of data can help to galvanize development efforts, implement targeted interventions, and track performance. Thus, "sustainable development demands a data revolution" to improve the availability, quality, timeliness, and disaggregation of data (footnote 1).

Despite improvements, key data needed to track Sustainable Development Goal (SDG) progress and for environmental performance assessment (EPA) reporting are still lacking. Poor data availability and quality can undermine country efforts to track future SDG progress and to assess the success of natural resources and environmental management decisions and actions. Missing or poor quality data represent a major limitation to indicator selection in EPA reporting, with the consequence that theoretically superior indicators are often overlooked in favor of indicators that are more readily quantifiable. The timeliness (e.g., the multi-year time lag in updating forest cover data) of data is an additional constraint that affects both the usefulness and relevance of indicators being used.

Dissatisfaction with the availability and quality of existing data raises the question of what should and can be done. Country efforts to devote sufficient resources to the strengthening of statistical capacity are essential in this respect. To improve the availability, reliability, timeliness, and accessibility of data, national statistical capacities have to be enhanced. Strengthening and modernization of country statistical systems will require effective institutional arrangements, internal coordination, and technical coordination (footnote 1). An important finding of the EPA reporting experience in the GMS countries was that data and information are not being sufficiently shared, and that effort needs to be devoted to reconciling conflicting or inconsistent data held by different government institutions. The development of data- and information-sharing platforms at national and subregional levels in the GMS are making a major contribution to tracking SDG progress and natural resource and environment protection efforts. The GMS Information Portal maintained by the GMS Environment Operations Center, which provides charts, maps, tools, and geospatial data, is a good example of a knowledge-sharing platform. Such platforms reflect the necessary direction of data and information sharing where governments, international and regional organizations, the private sector, and civil society contribute data that are essential for evidence-based decision making and accountability (footnote 1).

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 ADB-supported 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 Global Environment Facility, the Government of Sweden, and the Nordic Development Fund.

GMS Environment Operations Center

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

ADB | GREATER MEKONG SUBREGION **CORE ENVIRONMENT PROGRAM**