ASEAN BIODIVERSITY OUTLOOK

ASEAN CENTRE FOR BIODIVERSITY

ASEAN
BIODIVERSITY OUTLOOK

ASEAN Biodiversity Outlook

ASEAN Centre for Biodiversity (2010) *ASEAN Biodiversity Outlook.* Philippines, (208 pages)

ISBN : 978-971-94164-4-9

Printed by : Dolmar Press, Inc.

Year of publication : 2010

Disclaimer : The views expressed are those of the writers and contributors and do not necessarily reflect the views of the ASEAN Centre for Biodiversity (ACB), the Association of Southeast Asian Nations (ASEAN) or the European Union (EU).

Funding partners : European Union
Association of Southeast Asian Nations

Table of Contents

List of Tables, Figures and Boxes

TABLES

FIGURES

BOXES

LIST OF APPENDICES

Acronyms and Abbreviations

ABS	Access and Benefit Sharing
ACB	ASEAN Centre for Biodiversity
ABO	ASEAN Biodiversity Outlook
ADB	Asian Development Bank
AHP	ASEAN Heritage Park
AIDS	acquired immune deficiency syndrome
AME	ASEAN Ministers of Environment
AMME	ASEAN Ministerial Meeting on the Environment
AO	Administrative Order
APMS	ASEAN Peatland Management Strategy
ARA	Academic Research Agreement
ARCBC	ASEAN Regional Centre for Biodiversity Conservation
ASCC	ASEAN Socio-Cultural Community
ASF	animal-sourced food
ASEAN	Association of Southeast Asian Nations
ASEAN-WEN	ASEAN Wildlife Enforcement Network
BCCI	Biodiversity Conservation Corridors Initiative
BFAR	Bureau of Fisheries and Aquatic Resources
BIMP-EAGA	Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area
BISS	Biodiversity Information Sharing Service
CBD	Convention on Biological Diversity
CBI	City Biodiversity Index
CCD	Convention to Combat Desertification
CEP	Core Environment Program
CEPA	Communication, Education and Public Awareness
CEPA-Net	Southeast Asia CEPA and Media Network for Biodiversity
CG	corporate governance
CHM	Clearing House Mechanism
CI	Conservation International
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CL	converted lands
CMS	Convention on Migratory Species
COP	Conference of the Parties
CRA	Commercial Research Agreement
CSR	corporate social responsibility
CTI-CFF	Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security
DA	Department of Agriculture
DAD-IS	Domestic Animal Diversity Information System
DENR	Department of Environment and Natural Resources
ESABII	East and Southeast Asia Biodiversity Information Initiative
FAO	Food and Agriculture Organization

FCCC	Framework Convention on Climate Change
FEOW	Freshwater Ecoregions of the World
FLEGT	Forest Law Enforcement, Governance and Trade
FOB	Friends of Biodiversity
FPIC	Free and Prior Informed Consent
GBIF	Global Biodiversity Information Facility
GBO	Global Biodiversity Outlook
GDP	gross domestic product
GEF	Global Environment Facility
GHG	green house gases
GMO	Genetically Modified Organism
GMS	Greater Mekong Subregion
GPCB	Global Partnership on Cities and Biodiversity
GTI	Global Taxonomy Initiative
HCA	Host Country Agreement
HDI	Human Development Index
HF	human footprint
HIV	human immunodeficiency virus
HoB	Heart of Borneo
HPO	high performance organization
HYV	high yielding variety
IAS	invasive alien species
IBA	Important Bird Area
IOSEA	Indian Ocean - South-East Asian
IPCC	Intergovernmental Panel on Climate Change
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IPPC	International Plant Protection Convention
IRRI	International Rice Research Institute
ISEAS	Institute of Southeast Asian Studies
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
IUU	illegal, unreported and unregulated
KBA	Key Biodiversity Area
KMNP	Kayan Mentarang National Park
LC	large cities
LIPI	Indonesian Institute of Sciences
LECZ	Low Elevation Coastal Zone
LME	Large Marine Ecosystem
LMO	Living Modified Organism
MA	Millennium Ecosystem Assessment
MAF	Ministry of Agriculture and Forestry
MARD	Ministry of Agriculture and Rural Development
MBCC	marine biodiversity conservation corridor
MDG	Millennium Development Goal
MEA	Multilateral Environmental Agreement
MFF	Mangroves for the Future
MKBA	Marine Key Biodiversity Area
MPA	Marine Protected Area
NABP	National Agricultural Biodiversity Programme
NAFRI	National Agriculture and Forestry Research Institute
NBCA	National Biodiversity Conservation Area

NBSAP	National Biodiversity Strategies and Action Plan
NCBP	National Committee on Biosafety of the Philippines
NCIP	National Commission on Indigenous Peoples
NGO	non-government organization
NWFP	non-wood forest product
OECD	Organisation for Economic Co-operation and Development
PA	protected area
PCU	Program Coordination Unit
PEMSEA	Partnerships in Environmental Management for the Seas of East Asia
PES	payments for ecosystem services
PGR	plant genetic resources
PoWPA	Programme of Work on Protected Areas
PRF	permanent reserved forest
REDD	Reducing Emissions from Deforestation and Forest Degradation
RPoA	Regional Plan of Action
SBC	Sarawak Biodiversity Centre
SBCA	Seima Biodiversity Conservation Area
SCBD	Secretariat of the Convention on Biological Diversity
SGP	Small Grants Programme
SFM	sustainable forest management
SSME	Sulu-Sulawesi Marine Ecoregion
SSS	Sulu Sulawesi Seascape
SWA	surface water abstraction
TBPA	transboundary protected area
TEEB	The Economics of Ecosystems and Biodiversity
TIHPA	Turtle Islands Heritage Protected Area
TIWS	Turtle Islands Wildlife Sanctuary
ULC	urban land cover
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
USD	United States Dollar
WCMC	World Conservation Monitoring Centre
WCPA	World Commission on Protected Areas
WHO	World Health Organization
WTO	World Trade Organization
4NR	Fourth National Report to the Convention on Biological Diversity

Acknowledgement

The ASEAN Centre for Biodiversity published the ASEAN Biodiversity Outlook in collaboration with the 10 ASEAN Member States – Brunei Darussalam, Cambodia, Indonesia, The Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Viet Nam.

First acknowledgements and thanks go to the countries which provided valuable biodiversity information through their 4th National Reports to the Convention on Biological Diversity. Without these reports, the Outlook could not have been prepared.

The team who dedicated time and expertise to piece together the Outlook is also recognized: Rodrigo U. Fuentes, Clarissa C. Arida, Sheila G. Vergara, Rolando A. Inciong, Wilfredo J. Obien, Filiberto A. Pollisco, Jr., Monina T. Uriarte, Norman Emmanuel C. Ramirez, Leslie Ann Jose-Castillo, Lilibeth R. Cabebe, Jerome S.J. Alano, Erica T. Villavelez, Nanie S. Gonzales, Ana Maria E. Tolentino, Rhia C. Galsim, Corazon A. de Jesus, and Reynaldo F. Molina. We appreciate the invaluable assistance provided by Susan Warren-Mercado, technical writer and consultant.

The Fourth ASEAN State of the Environment Report produced by the ASEAN Secretariat and the Third Edition of the Global Biodiversity Outlook published by the Secretariat of the Convention on Biological Diversity were key sources of information.

The ASEAN Biodiversity Outlook team is most grateful to the guidance provided by the peer review group who went over numerous drafts to ensure that the Outlook has proper scope and focus: Dato' Zakri A. Hamid, Science Advisor to the Government of Malaysia; Dr. Marc Hockings, Associate Professor and Program Area Manager for Natural Systems School of Integrative Designs, University of Queensland; Dr. Raman Letchumanan, Head, Environment Division, ASEAN Socio-Cultural Community Department, ASEAN Secretariat; Dr. Theresa Mundita S. Lim, Director, Protected Areas and Wildlife Bureau, Department of Environment and Natural Resources, Philippines; Ms. Cristi Marie C. Nozawa, Regional Director, BirdLife International (Asia); and Dr. Damon Stanwell-Smith, Senior Programme Officer, Ecosystem Assessment Programme, UNEP-World Conservation Monitoring Centre.

The European Union provided financial support for the production of the ASEAN Biodiversity Outlook.

We convey our sincerest apologies to anyone who may have contributed to the preparation of this Outlook but whose names were inadvertently omitted.

While great care has been taken to ensure the accuracy of the information presented in this report, the ASEAN Centre for Biodiversity assumes full responsibility for any errors or omission in this Outlook.

Foreword

DR. SURIN PITSUWAN
Secretary-General
Association of Southeast
Asian Nations (ASEAN)

I am pleased to lend a few words to the first edition of the ASEAN Biodiversity Outlook (ABO) publication. The ABO charts out the progress made by the ASEAN Member States in contributing to the region's collective efforts to significantly reduce the loss of biodiversity by 2010. It also offers assessment of the current status of biodiversity in the ASEAN region.

Our region is increasingly losing its biodiversity within various ecosystems – forest, agro-ecosystems, peatlands, freshwater, mangroves, coral reefs, and seagrass. It continues to be confronted with escalating environmental threats, including habitat change, invasive alien species, climate change, pollution, over-exploitation and poverty -- all of which contribute to the declining sustainability of natural resources in these ecosystems.

Concerted efforts, however, have been made to address biodiversity loss at both the regional and national levels. Innovative ecosystem-based approaches to address these challenges that have been implemented include the establishment of more protected areas, the ASEAN Heritage Parks Programme, the Heart of Borneo Initiative, Coral Triangle Initiative, and the Greater Mekong Sub-region Biodiversity Conservation Corridors Initiative, all of which have attracted worldwide attention.

But much more needs to be done, both by the Member State individually and by the ASEAN community collectively, to put an end to the deterioration of biological resources. We need to re-examine our lifestyles and consumption patterns to make our choices more responsible and environmental friendly. We need to assume a fair and equitable share of burden and responsibility as users and providers of these natural resources. We must exert greater efforts in increasing the awareness among the people to protect these ecosystems for future generations, more so to ensure our own continued prosperity and survival.

The ASEAN Vision 2020 to achieve "a clean and green ASEAN with fully established mechanisms for sustainable development, and ensure that protection of the region's environment and natural resources are sustained as well as the high quality of life of its peoples" is clear on ASEAN's commitment to biodiversity conservation. As we in the region continue to realise this Vision through various programmes and projects, we need all the commitment and dedication we can get to face the daunting challenges through international collaboration.

I hope the ABO will not only inform us on the status of biodiversity conservation in the region, but it will also invite us to the opportunities for collaboration to realise our common purpose to conserve the life and livelihood sustaining natural resources of the ASEAN region and the world.

Preface

RODRIGO U. FUENTES
Executive Director
ASEAN Centre
for Biodiversity (ACB)

On studying the mass extinctions of the 20th century and their relation to modern society, E.O. Wilson once said, "Now when you cut a forest, an ancient forest in particular, you are not just removing a lot of big trees and a few birds fluttering around in the canopy. You are drastically imperiling a vast array of species within a few square miles of you. The number of these species may go to tens of thousands. Many of them are still unknown to science, and science has not yet discovered the key role undoubtedly played in the maintenance of that ecosystem, as in the case of fungi, microorganisms, and many of the insects."

Unfortunately, this fundamental lesson on the web of life still escapes many of us. We exploit the earth's bounty with absolute disregard to ecological balance, acting as if biodiversity is an infinite resource solely designed for the human species to use. It, therefore, no longer comes as a surprise that our global biodiversity report card shows our overall failure to meet the 2010 target of halting biodiversity loss.

Here in the ASEAN, how are we faring?

The ASEAN Biodiversity Outlook (ABO) is a modest attempt at responding to this question by capturing and presenting the progress made by the ASEAN Member States in the global effort of achieving the 2010 biodiversity target.

With the region's well-recognized richness in biological resources and its impact on global environmental sustainability, the ASEAN countries saw it as imperative to come up with an outlook focusing on the region. Work on the report commenced in 2008 when countries started identifying suitable biodiversity indicators at the regional and national level that would aid in monitoring the progress of reducing the rate of biodiversity loss by 2010. Some of these indicators were used in preparing the 4th National Reports submitted by countries to the Convention on Biological Diversity.

Analyzing data from the 4th National Reports, the Fourth ASEAN State of the Environment Report, the Global Biodiversity Outlook, and numerous other sources, the outlook features the status and trends across all ecosystems and looks into the pressures faced by each ecosystem, as well as the responses initiated to address these pressures. It likewise presents a snapshot of some of the actions by ASEAN nations in combating the loss of biodiversity.

A timely contribution for the International Year of Biodiversity, the outlook is envisioned as a tool to generate awareness on the status of biodiversity in the region, the obstacles faced by countries in their efforts to conserve biodiversity, and the next steps that have to be undertaken to fare better. The prospects of biodiversity in the region beyond 2010 are likewise outlined in this report.

Status and trends show that drivers and threats to biodiversity continue to intensify in the region. Habitat loss, unsustainable use and overexploitation of resources, climate change, invasive alien species and pollution have not been arrested and continue to negatively impact biodiversity.

ASEAN countries also reported an overall decline in the mangrove, coral reef, seagrass, forest, agro-, peatland, and freshwater ecosystems.

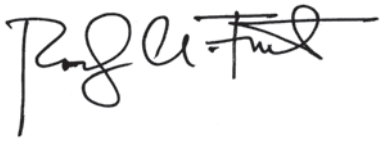
The picture is clear: the region's biodiversity targets indeed remain unmet.

However, rather than dwell on this grim reality, we must also take pride on the steps we have collectively taken and build on them. This we started by revisiting our past efforts and drawing clear lessons and experiences that would benefit not only the ASEAN region, but also the entire global community as a shared desire and responsibility to significantly reduce biodiversity loss in our next vision for 2020.

Clearly, we have to sustain the momentum gained through the major regional programs in the Greater Mekong Subregion, the Heart of Borneo, the ASEAN Heritage Parks, and Sulu Sulawesi. These programs have resulted in significant headway in terms of gathering political support for regional initiatives.

Greater emphasis has to be also placed on mainstreaming biodiversity conservation into various sectors – government, corporate, economic, education, tourism, trade, food production, among many others – to ensure that everyone including the man on the street will be aware of the need for individual and collective action to conserve what is left of our biodiversity. Unless we all get a full grasp of the crucial connection between biodiversity and our survival, we will continue to fall short of achieving the biodiversity targets.

This ASEAN Biodiversity Outlook is rich in facts and figures. We hope this information will be shared and disseminated with the end view that it will significantly contribute in identifying pragmatic options for addressing the complex issue of protecting biodiversity resources and enhancing ecosystems services. With the information that is available, the choices are there for us to take. What is called for is that we make intelligent and informed choices with a sense of urgency. The imperatives are there for us to choose life – our lives and those of future generations depend on it.



Executive Summary

While occupying only three per cent of the earth's surface, the ASEAN region boasts of globally significant terrestrial and marine biodiversity that include an astonishing 18 per cent of all species assessed by the International Union for Conservation of Nature (IUCN). It has the most diverse coral reefs in the world and is home to the mega-diverse countries of Indonesia, Malaysia and the Philippines. The region also spans several unique bio-geographical units such as Indo-Burma, Malesia, Sundaland, Wallacea and the Central Pacific.

To protect this richness, the 10 ASEAN Member States, all Parties to the Convention on Biological Diversity (CBD), committed themselves in 2002 to the 2010 Biodiversity Target: "the achievement by 2010 of a significant reduction of the current rate of biodiversity loss at the global, regional and national levels as a contribution to poverty alleviation and to the benefit of all life on earth."

This report, the ASEAN Biodiversity Outlook, confirms that the region, like the rest of the world, is increasingly losing biodiversity at an alarming rate within various ecosystems – forest, agro-ecosystems, peatlands, freshwater, mangroves, coral reefs and seagrass. The region's biodiversity report card confirms the findings of the Third Global Biodiversity Outlook that the world failed to meet the target of significantly reducing biodiversity loss by 2010:

- The growing population's dependence on timber, fuel wood, and other forest products, as well the conversion of forests into agricultural and industrial lands, are taking their toll on the region's forests. Already, Southeast Asian countries had lost a total of 555,587 square kilometers of forests between 1980 and 2007.
- While the ASEAN region is gifted with immense mangrove resources, it nonetheless suffers the highest rates of mangrove losses in the world. An area of 628 square kilometers of mangrove got stripped away each year throughout the last couple of decades. In 1980, the estimated regional total mangrove area was 63,850 square kilometers. As of 2005, this whittled down to 46,971 square kilometers for an aggregate decline of about 26 per cent within a 25-year period.
- There has been a general decline in coral reefs in the ASEAN region between 1994 and 2008. Although the region hosts the largest coral reef areas in the world, it also has the highest rate of loss, which today stands at 40 per cent.
- Bottom-trawling, extensive coastline destruction and modification, decline in coastal water quality, and human-induced development have endangered seagrass beds in the ASEAN region. Indonesia, the Philippines, Singapore and Thailand have each experienced from 30 up to 50 per cent losses of seagrass habitats, compounded by the fact that the loss figures for other Southeast Asian countries remain largely unknown.

The Outlook underscores that the drivers of biodiversity loss continue to intensify. The key drivers of biodiversity loss in the ASEAN region include ecosystems and habitat change, climate change, invasive alien species, over-exploitation (as a result of deforestation and land-use and water-use change, as well as wildlife hunting and trade for food), pollution and poverty.

In terms of addressing the drivers and threats to biodiversity loss, the ASEAN region remains slow in delivering progress, particularly in preventing invasive alien species, addressing the impact of biodiversity to species and ecosystems, and abating pollution and the exploitation of forests and wetlands.

But the ASEAN region registered significant pockets of success stories. Progress has been made in expanding the coverage of terrestrial and marine protected areas. The ASEAN Member States prioritized protecting major ecosystems and habitats through regional initiatives focusing on huge, biologically rich and critical ecosystems. Biodiversity corridors covering transboundary protected areas, for example, have been launched and initiated. Networks of protected areas such as the ASEAN Heritage Parks were given special attention. The countries also shored up efforts to further develop capacities and expand the network of wildlife law enforcers.

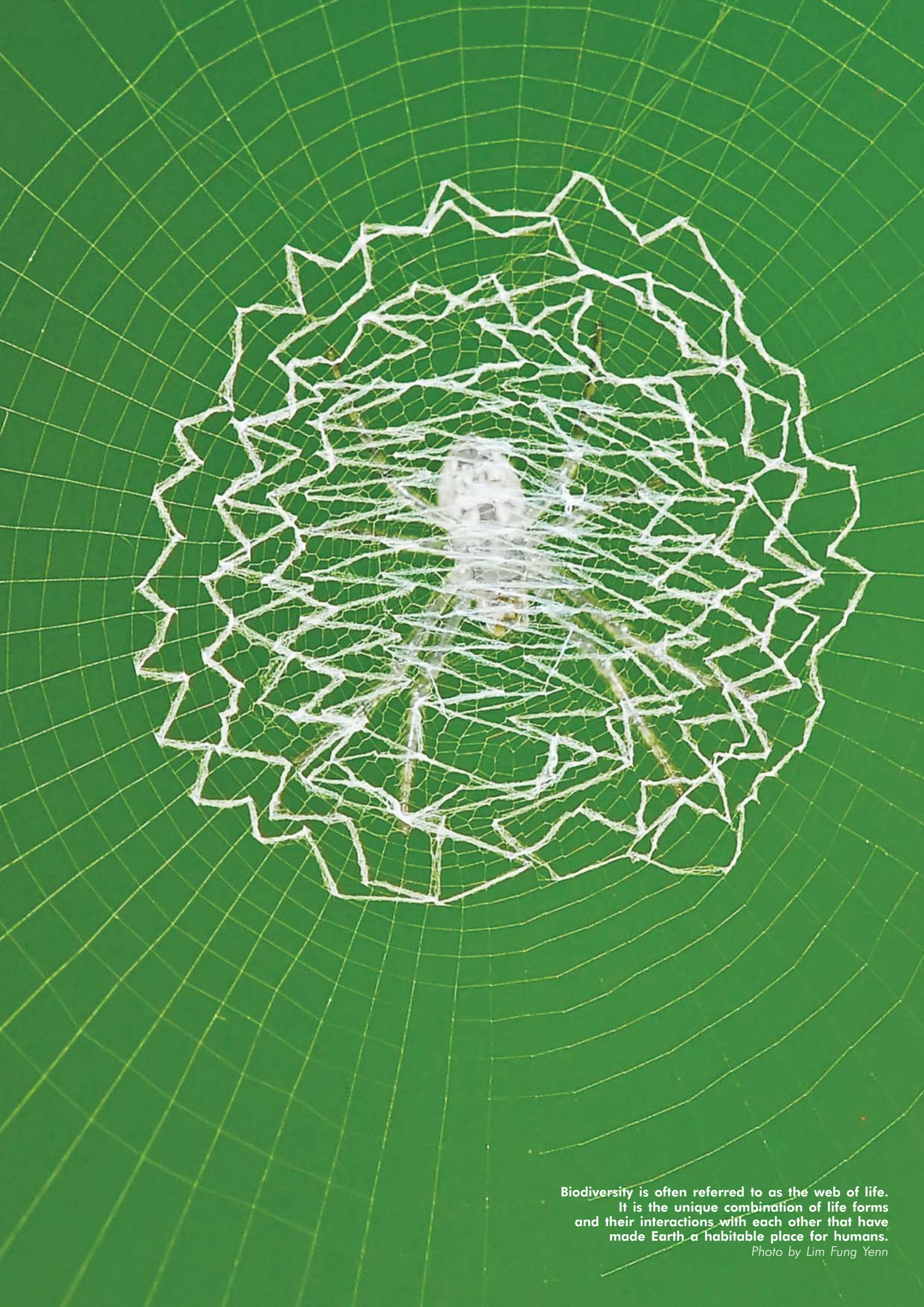
The Outlook for the ASEAN region is summarized as follows:

- **Terrestrial ecosystems** – The region's forest ecosystems and agro-ecosystems shall continue to play the crucial role of providing ecological stability to the ASEAN countries and globally. Both, however, face numerous pressures. Addressing the pressures on these two ecosystems is critical for ASEAN. It will entail taking multiple measures that should be linked to enhancing the productivity from existing crop and pasture lands, reducing post-harvest losses, sustainable forest management and changing excessive and wasteful consumption.
- **Inland water ecosystems** – Inland water ecosystems in the ASEAN region are considered to be high value areas. These cover wetlands, peatlands and freshwater bodies. Unfortunately, these ecosystem functions are often undervalued, consequently placing the rich biodiversity resources in these areas at imminent risk. As many of these areas are the initial frontiers for conversion for development expansion, there will be an increasing need for an integrated management of the ecosystems. By approaching the development of these areas in such a manner, the potential negative impacts from competing pressures can be minimized or averted.
- **Marine and coastal ecosystems** – Marine and coastal ecosystems are considered as one of the most valuable natural assets of the ASEAN region. They, however, are faced with multiple pressures that may affect their ability to supply food, functional buffer zones for natural weather disturbances, and livelihood for communities. There is an urgent need to establish marine protected areas (MPAs) and MPA networks, as well as promulgate policies that allow marshes, mangroves and other coastal ecosystems to persist and even migrate inland to make these ecosystems more resilient to the impact of sea level rise, and thus help protect the vital services they provide.

The ASEAN region, as with the entire global community, has to move forward in collectively achieving the Biodiversity Target beyond 2010. Clearly, ASEAN Member States have to exert greater effort to inch their way toward achieving the biodiversity targets set for the region. Ways forward have to be explored in order to successfully do this. There is a need to:

- Target efforts to critical areas and ecosystems
- Mainstream biodiversity in the national development process
- Connect biodiversity management with climate change efforts
- Take pride on the current efforts and building on them for designing future efforts
- Support efforts that will lead to the adoption of the access and benefit-sharing regime in the region

The ASEAN Member States have already taken numerous steps in addressing biodiversity loss. The challenge is to push the envelop further, mindful that striking a balance between having a healthy life, secured livelihood and prosperity coupled with protected biodiversity resources and ecosystems is achievable if humans put their hearts into it.



Biodiversity is often referred to as the web of life. It is the unique combination of life forms and their interactions with each other that have made Earth a habitable place for humans.
Photo by Lim Fung Yenn

ASEAN and the Convention on Biological Diversity

The Southeast Asian region has one of the most diverse forest ecosystems in the world.
Photo by Mishael Jacob Pueblas

The Convention on Biological Diversity: An international agreement for a critical global commons

Historical Perspective and Rationale

BIOLOGICAL diversity or biodiversity is the web of life that encompasses all species on earth. It includes the full-range of ecosystems, their component species and the genetic variety of those species produced by nature or shaped by men.

The Convention on Biological Diversity (CBD) defines biodiversity as "the variability among living organisms including, *inter alia,* terrestrial, marine and other aquatic systems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

Biodiversity brings enormous benefits to humankind. Man will always be dependent on basic products provided by nature such as food, medicine, shelter, clean water and a host of ecosystems services. It also underpins the sources of our cultural and spiritual values. Biodiversity is critical in moderating the impacts of climate change. The diversity of all living forms of plants, animals, and ecosystems services has huge economic value.

Biodiversity creates health and wealth. But the benefits we derive from ecosystem services continue to decline as forests, soils, wetlands and coral reefs continue to gradually disappear. Species are under threat of extinction. As a result, the multiple and complex values of ecosystems decline in proportion to these negative trends.

The ratification of the CBD by 193 parties signifies a global recognition that biodiversity is a common concern of mankind. Parties to the CBD have committed themselves to conserve, sustainably use, and fairly and equitably share the benefits arising from the use of genetic resources. Underpinning the implementation of the Convention is the recognition that the states have sovereign rights over their natural resources given that the composition of biodiversity varies enormously. Clearly, the implementation of the CBD depends largely on each state and their pursuit of effective action at the national level.

Every single species is part of biodiversity. Each has a key role to play. An insect runs on water at Admiralty Park Singapore. *Photo by Li Zhi Wang*

The 2010 Biodiversity Target

The CBD gained high political profile at the global, national and regional levels when, in 2002, the 2010 Biodiversity Target was set and called for "the achievement by 2010 of a significant reduction in the current rate of loss of biological diversity." Within this global covenant and wider sustainable development agenda, specific goals and targets were identified covering the seven focal areas of the Convention (Table 1):

Table 1. Goals and targets under the CBD focal areas

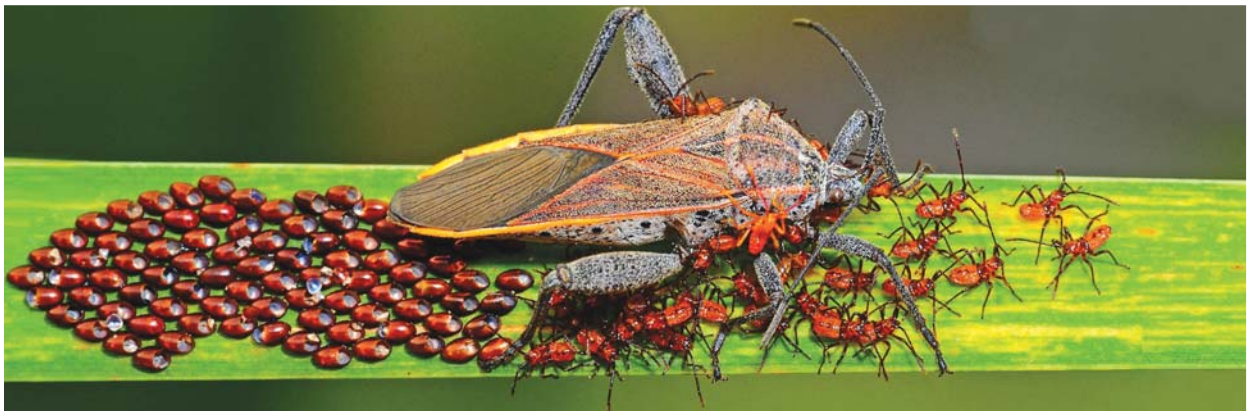
CBD Focal Area	Goals	Target
Protect the components of biodiversity	Goal 1: Promote the conservation of the biological diversity of ecosystems, habitats and biomes	1.1: At least 10% of each of the world's ecological regions effectively conserved
		1.2: Areas of particular importance to biodiversity protected
	Goal 2: Promote the conservation of species diversity	2.1: Restore, maintain or reduce the decline of populations of species of selected taxonomic groups
		2.2: Status of threatened species improved
	Goal 3: Promote the conservation of genetic diversity	3.1: Genetic diversity of crops, livestock and harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained
Promote Sustainable use	Goal 4: Promote sustainable use and consumption	4.1: Biodiversity-based products derived from sources sustainably managed, and production areas managed consistent with the conservation of biodiversity
		4.2: Unsustainable consumption of biological resources, or consumption that has an impact upon biodiversity reduced
		4.3: No species of wild flora or fauna endangered by international trade
Address threats to biodiversity	Goal 5: Reduce pressures from habitat loss, land-use change and degradation, and unsustainable water use	5.1: Rate of loss and degradation of natural habitats decreased
	Goal 6. Control threats from invasive alien species	6.1: Pathways for major potential invasive alien species controlled
		6.2: Management plans for major invasive alien species that threaten habitats, ecosystems or species in place
	Goal 7. Address challenges to biodiversity from climate change and	7.1: Resilience of the components of biodiversity to adapt to climate change maintained and enhanced
		7.2: Pollution and its impacts on biodiversity reduced
Maintain capacity of ecosystems to deliver goods and services and support livelihoods	Goal 8. Maintain capacity of ecosystems to deliver goods and services and support livelihoods	8.1: Capacity of ecosystems to deliver goods and services maintained
		8.2: Biological resources that support sustainable livelihoods, local food security and health care, especially of poor people, maintained
Protect traditional knowledge, innovations and practices	Goal 9. Maintain socio-cultural diversity of indigenous and local communities	9.1: Traditional knowledge, innovations and practices protected
		9.2: The rights of indigenous and local communities over their traditional knowledge, innovations and practices, including their rights to benefit sharing, protected
Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources	Goal 10. Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources	10.1: All transfers of genetic resources are in line with the Convention on Biological Diversity, the International Treaty on Plant Genetic Resources for Food and Agriculture, and other applicable agreements
		10.2: Benefits arising from the commercial and other utilization of genetic resources shared with the countries providing such resources
Ensure provision of adequate resources	Goal 11. Improve the financial, human, scientific, technical and technological capacity of Parties to implement the Convention	11.1: New and additional financial resources to allow for the effective implementation of commitments under the Convention, in accordance with Article 20, transferred to developing country Parties
		11.2: Technology to allow for the effective implementation of commitments under the Convention, in accordance with its Article 20, paragraph 4, transferred to developing country Parties

The goal of reducing the rate of biodiversity loss by 2010 is the subject of several other key international agreements. Each recognizes the rapid degradation of ecosystems and habitats, the increasing threat to many species and populations, and the urgent need to take action that will halt the decline in irreplaceable natural resources. The biodiversity target has been highlighted in the UN High Level Summit (2005) as essential in meeting the MDG, especially the targets to halve the incidence of poverty and hunger by 2015.

In political terms, this commitment represents a radical departure from previous approaches. For the first time, an overall conservation target was adopted rather than generally formulated objectives or specific measures that may or may not have the

Table 2. Headline indicators corresponding to the seven CBD focal areas

Focal Area	Indicator
Focal Area 1: Reducing the rate of loss of the components of biodiversity, including: (i) biomes, habitats and ecosystems; (ii) species and population; and (iii) genetic diversity	Trends in extent of selected biomes, ecosystems and habitats
	Trends in genetic diversity domesticated animals, cultivated plants, and fish species of major socio-economic importance
	Trends in the abundance and distribution of selected species
	Coverage of protected areas
	Change in the status of threatened species
Focal Area 2: Maintaining ecosystem integrity, and the provision of goods and services provided by biodiversity in ecosystems, in support of human well being	Marine Trophic Index
	Connectivity/fragmentation of ecosystems
	Water quality in aquatic ecosystems
Focal Area 3: Addressing the major threats to biodiversity, including those arising from invasive alien species, climate change, pollution and habitat change	Nitrogen deposition
	Trends in invasive alien species
	Impact of climate change in biodiversity
Focal Area 4: Promoting sustainable use of biodiversity	Area of forest, agricultural, fishery and aquaculture ecosystems under sustainable management
	Ecological footprint and related concepts
Focal Area 5: Protecting traditional knowledge, innovations and practices	Status and trends of linguistic diversity and numbers of speakers of indigenous languages
Focal Area 6: Ensuring the fair and equitable sharing of benefits arising out of the use of genetic resources	(Indicator to be developed)
Focal Area 7: Mobilizing financial and technical resources, especially for developing countries	Official development assistance provided in support of the Convention



A stink bug with her eggs and hatchlings. *Photo by Lim Fung Yenn*

Burmese children share a feast of vegetables, meat and rice. Biodiversity is a source of food for over 500 million people in the ASEAN region. *Photo by Zaw Min*

desired conservation effect. In this sense, the significance of the agreement cannot be overstated.

However, given the current rapid decline in biodiversity, both in the ASEAN region and worldwide, and the ever-increasing extent and intensity of many human activities, the objective of halting the decline in biodiversity by 2010 will require unprecedented efforts in adapting activities to the needs of natural systems.

The third edition of Global Biodiversity Outlook (GBO-3), published in 2009 by the UNEP and CBD, concluded that the 2010 Biodiversity Target was not met. The drivers and threats to biodiversity continue to intensify. Habitat loss, unsustainable use and overexploitation of resources, climate change, invasive alien species, and pollution have not been arrested and continue to affect biodiversity negatively.

However, the commitment by the world leaders as set out in the 2010 Biodiversity Target has stimulated a number of actions and, to some extent, progress in expanding the coverage of protected areas, in conserving species, and in tackling some of the direct causes of biodiversity.

This report, the ASEAN Biodiversity Outlook (ABO), presents a snapshot of some of the actions by ASEAN Member States in combating the loss of biodiversity. The ABO was based mainly from the ASEAN Member States' 4th National Reports (4NRs) to the CBD or similar national reports and action plans, as well as on global and regional datasets by the ACB and other international and regional organizations.

Conservation, sustainable use and equitable sharing of benefits: The challenges of biodiversity resource management

THE three major pillars of the Convention on Biological Diversity demonstrate a balance between conservation, the sustainable use of resources for future generations, and the alleviation of poverty through the fair and equitable sharing of resources.

First pillar: conservation. The establishment of protected areas remains as one of the key cornerstones of biodiversity conservation. Since 1950, the designated protected areas in the ASEAN region have increased by 98 per cent in terms of area and 89 per cent in terms of number. Overall, the target that at least 10 per cent of ecological areas are conserved in the ASEAN region has been achieved. However, the initial results of a gap analysis on terrestrial and marine protected areas conducted by the ACB in 2010 have shown that the existing system of protected areas is insufficient and did not cover all types of biomes and species requiring protection[1]. Many of those areas that are already established as protected areas

The establishment of vast protected areas is a key achievement of the ASEAN region. *Photo by John MacKinnon*

need to be further enhanced, effectively managed by elevating management standards, and sufficiently funded to fulfill stated objectives. ASEAN Member States should further exert efforts to support the CBD Programme of Work on Protected Areas (PoWPA), to complete the designation of ecologically-representative networks of protected areas, both on land and at sea, and to provide basic protection particularly on threatened and endemic species.

Second pillar: sustainable use of biodiversity. The second pillar of the CBD pertains to the sustainable use of biodiversity – *i.e.,* the use of its components in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations. To this end, measures to mainstream biodiversity concerns into national and sectoral development plans at national levels were pursued. National Biodiversity Strategy and Action Plans (NBSAPs) are being implemented in Cambodia, Indonesia, The Lao PDR, Malaysia, the Philippines, Singapore, Thailand and Viet Nam.

In the ASEAN region, the past decade has shown a fundamental shift to a people-centered approach in protected area and ecosystems management and stakeholders' engagement to address the root causes of biodiversity loss and poverty[2].

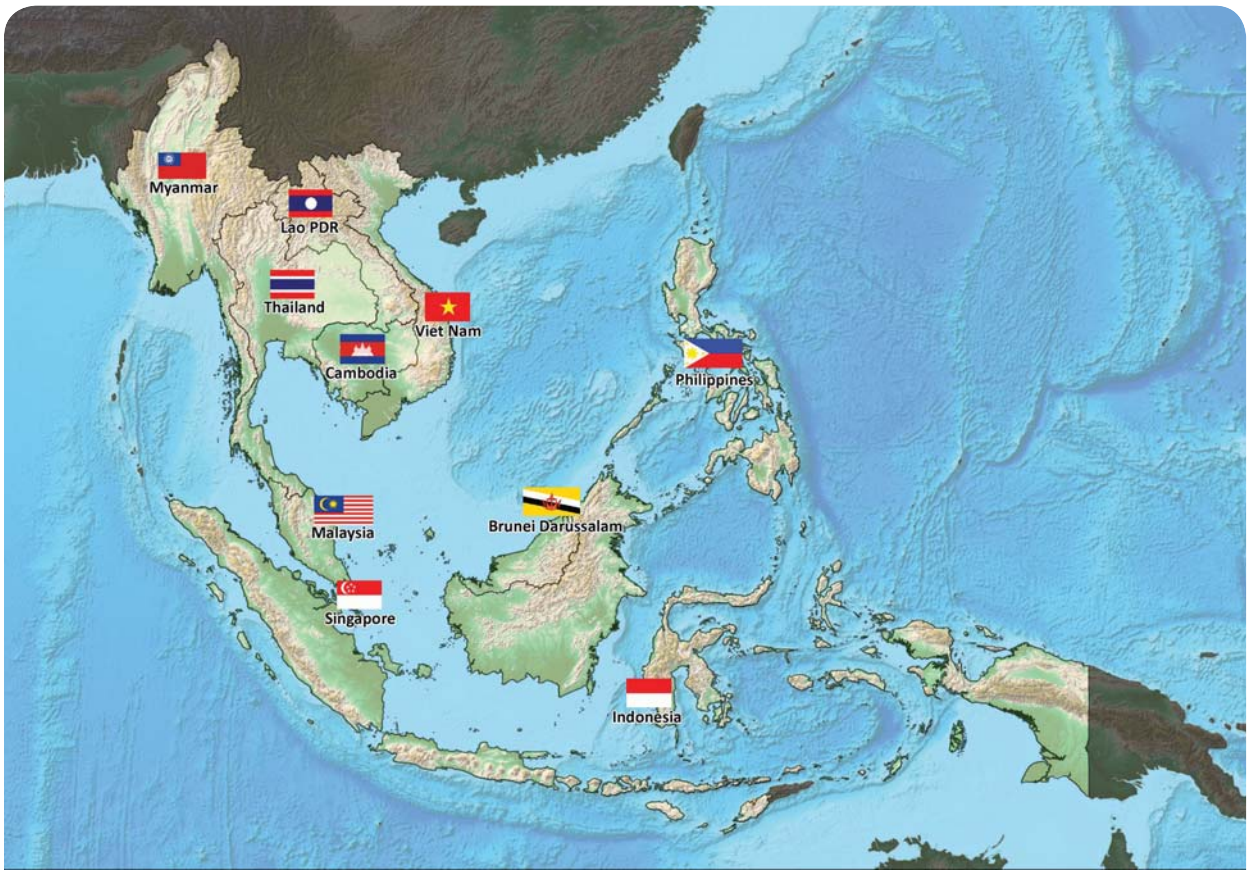
Much has yet to be done in terms of adopting an ecosystems approach in the overall management of biodiversity, and mainstreaming biodiversity into national sectoral development plans and programs.

Third pillar: the fair and equitable sharing of benefits arising out of the utilization of genetic resources. This objective addresses the sustainable development aspect of biodiversity. Article 15 of the CBD articulates the principles with respect to access to genetic resources. It states that "recognizing the sovereign rights of States over their natural resources, the authority to determine access to genetic resources rests with the national governments and is subject to national legislation".

ASEAN Member States have treated Access and Benefit Sharing (ABS) as a priority issue for regional collaboration and harmonization. In 2004, an *ASEAN Framework Agreement on Access to, and Fair and Equitable Sharing of Benefits Arising From the Utilization of Biological and Genetic Resources* was finalized. The Framework Agreement is intended to facilitate coordinated actions by the ASEAN Member States on ABS in the light of their shared biodiversity resources, help support national policies and regulations on ABS, and assist in capacity building. However, the approval of the Framework Agreement by some ASEAN Member States comes at a slow pace as the global community took an ardous process leading to the adoption of the ABS Protocol in the 10th Conference of the Parties (COP) to the CBD.

Indigenous communities hold traditional knowledge and practices crucial to conserving biodiversity.
Photo by Nilo Rivera

The CBD Target: How is ASEAN faring?



ESTABLISHED on 8 August 1967, the Association of Southeast Asian Nations, or the ASEAN, is a regional grouping of countries in Southeast Asia. The ASEAN has ten members to date: Brunei Darussalam, Cambodia, Indonesia, The Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam. With the motto "One Vision, One Identity, One Community", the ASEAN stands by its fundamental principles of mutual respect and effective cooperation.

The Southeast Asian region boasts of globally significant terrestrial and marine biodiversity. While it occupies only three per cent of the earth's surface, its natural habitats contain up to 18 per cent of all known species. It has the most diverse coral reefs in the world and includes the mega-diverse countries of Indonesia, Malaysia and the Philippines. The region also has several unique bio-geographical units such as Indo-Burma, Malesia, Sundaland, Wallacea and the Central Pacific. Its high species diversity and endemicity brings the region to the fore of the world's critical habitats that are of high importance to global environmental sustainability.

Southeast Asia is home to key major ecosystems upon which over 580 million lives depend. The 4,200 kilometer-long Mekong River, which straddles the five ASEAN Member States of Cambodia, The Lao PDR, Myanmar, Thailand, Viet Nam and the Yunnan Province of China, provides a rich natural resource base for over 250 million people[3].

The Coral Triangle in the six Indo-Pacific countries of Indonesia, Malaysia, the Philippines, Solomon Islands, Papua New Guinea and Timor-Leste harbors 600 species of hard coral and more than 1,300 reef-associated fish species which support livelihoods for over 120 million people. The value of well-managed reefs in Southeast Asia was estimated at USD 12.7 billion[4].

Borneo, the world's largest island, is one of the most important centers of biodiversity on earth. With thousands of species of plants and animals still waiting to be discovered, the

island has an estimated 15,000 plant species, a tree diversity of 1,175 species, about 6,000 endemic plant species, and 155 dipterocarp tree species. Borneo produces valuable timber, aromatic oils and resins, and provides habitat and food for a vast range of plants and animals. The Heart of Borneo (HOB) exemplifies a transboundary initiative to conserve the last remaining frontier forests in Southeast Asia involving Malaysia, Indonesia and Brunei Darussalam[5].

Capping the conservation agenda of ASEAN Member States is the implementation of its flagship biodiversity initiative: The ASEAN Heritage Park (AHP) Programme. AHPs are protected areas of high conservation importance, preserving a complete spectrum of representative ecosystems and species of the ASEAN region. The AHP Programme aims to instill greater awareness, promote conservation, and provide a sense of pride and enjoyment of the rich natural heritage sites among the ASEAN people.

These key life supporting major ecosystems have provided a common agenda and united the countries to better protect the environment and take responsibility and leadership for the sustainable management of their shared resources. A comprehensive discussion of the region-wide biodiversity conservation initiatives of the ASEAN may be found in Chapter IV.

The key drivers of biodiversity loss in Southeast Asia include ecosystems and habitat change, climate change, invasive alien species, over-exploitation (as a result of deforestation and land-use and water-use change, as well as wildlife hunting and trade for food), pollution and poverty. Detailed coverage of how the drivers of biodiversity loss are impacting on the ASEAN ecosystems is in Chapter III of this report.

Cognizant of the continuing loss of biological diversity and ecosystems degradation, the ten ASEAN Member States adopted in 1995

Southeast Asia's rich natural heritage is a source of pride for the peoples of ASEAN. *Photo from The ASEAN Heritage Parks - A Journey to the Natural Wonders of Southeast Asia*

the Vientiane Action Programme (2004-2010)[6] which promotes a clean and green ASEAN with fully established mechanisms for sustainable development to ensure the protection of the region's environment, the sustainability of its natural resources and the high quality of life of its people. In 2009, this action plan was revitalized to reflect the common vision of One ASEAN Community into the Blueprint for the ASEAN Socio-Cultural Community (2009-2015)[7]. The Blueprint aims to ensure that the ASEAN's rich biological diversity is conserved and sustainably managed toward enhancing social, economic and environmental well-being.

The ABO presents the ASEAN's assessment of progress towards the target to halt the loss of biodiversity by 2010. Using the 2010 CBD Biodiversity Target as the framework, the ABO takes stock of the state of biodiversity in Southeast Asia, covering the ten ASEAN Member States.

The ABO features the key initiatives of the ASEAN, as its response to the challenges and issues on biodiversity conservation. The ABO also provides insights into the ASEAN's further work to address the gaps to conserve and sustain the remaining but threatened wealth of natural resources and biodiversity in the region beyond 2010.

Southeast Asia contains 18 per cent of all species assessed by IUCN. *Photo from The ASEAN Heritage Parks - A Journey to the Natural Wonders of Southeast Asia*

Table 3 below presents a summary of the status of the ASEAN's progress in achieving the 2010 Biodiversity Target using the CBD indicators:

Table 3. Summary of progress in achieving the headline indicators under the 2010 Biodiversity Target in ASEAN

Status and trends of the components of biological diversity		
● ↓	Trends in extent of selected biomes, ecosystems and habitats	State and condition are becoming serious, moving towards tipping points. While efforts are being pursued to arrest declining trends in selected biomes, ecosystems and habitats, actions taken are deemed insufficient as over-exploitation continues, coupled with the slow but manifesting effects of climate change.
● ↓	Trends in abundance and distribution of selected species	Status remains an area of concern and declining trend of selected species and fragmentations of habitats remain unabated.
● ↔	Change in status of threatened species	The change in status is quite slow through the years and activities addressing these are inadequate.
● ↑	Trends in genetic diversity of domesticated animals, cultivated plants and fish species of major socio-economic importance	An emerging concern in the region especially with countries moving towards intensification of agricultural production. However, notable efforts are recorded for genetic improvement of native domesticated animals, and increasing genetic materials conserved in gene banks for plants. However, genetic diversity of fish species is still low and needs to be addressed.
● ↑	Coverage of protected areas	State and conditions are improving with notable increases and expansion of protected areas. However, efforts need to be focused on enhancing management effectiveness and revisiting management objectives.

Continued next page

Table 3. Summary of progress in achieving the headline indicators under the 2010 Biodiversity Target in ASEAN (continuation)

Ecosystem integrity and ecosystem goods and services		
	Connectivity – fragmentation of ecosystems	State and condition of ecosystems are becoming a matter of concern for the region. Fragmentation of ecosystems is increasingly associated with increase in development activities in many of the region. The biodiversity corridor approach has been applied in some key ecosystems but needs to be expanded and replicated in other key biodiversity areas.
	Water quality of aquatic ecosystems	The state and condition of aquatic ecosystem are a matter of concern. Freshwater eco-regions in Southeast Asia have manifested a declining water quality due to fragmentation of habitats and use of agrochemicals in agricultural production areas such as in plantations. Major rivers and some lakes in the region are silted due to soil erosion as a result of various activities taking place in upland areas and coastal areas. Trend is likely to continue unless current efforts are stepped up and undertaken in a strategic manner.
	Nitrogen deposition	Actual measurement of nitrogen deposition in a number of critical water bodies has not been uniform and consistent. Anecdotal evidence based on increasing reports of signs of water body eutrophication such as algal blooms have been noted especially in water bodies fed by agricultural areas. There is a need for comprehensive monitoring of this incidence in the region.
	Trends in invasive alien species (IAS)	Status and condition are not very much known due to limited information. As such, it is an emerging concern in the region. Although notable initiatives in IAS especially in the Mekong Subregion and some other ASEAN Member States are pursued, these efforts are deemed insufficient given the potential magnitude of impacts of these species. The absence of monitoring protocol adds to the seriousness of the issue.
Sustainable use		
	Area of forest, agricultural and aquaculture ecosystems under sustainable management	Related to the condition of agroecosystems where there is an emerging concern over the impacts of intensive and extensive agriculture. On a positive note, trend in conservation agriculture, sustainable agriculture, sustainable forest management, organic farming and the like are catching on in the region. However, the area coverage of these types of land uses is still insignificant to make an impact.
	Ecological footprint and related Concepts	Region-wide, the ecological footprint is rapidly increasing in the face of shifting consumption patterns associated with rising income and shifting demographic distribution. The situation is compounded by the effects of climate change. Although there are initiatives already implemented, the efforts are considered to be inadequate to cause significant shifts towards more sustainable consumption patterns.
Status of traditional knowledge, innovations and practices		
	Status and trends of linguistic diversity and numbers of speakers of indigenous languages	The region is known for its cultural diversity, maintaining its social and cultural rich heritage. Multiple languages are spoken in the region including the preservation of ethnic languages. Countries are taking efforts to preserve the language diversity especially those spoken by ethnic communities.

Continued next page

Table 3. Summary of progress in achieving the headline indicators under the 2010 Biodiversity Target in ASEAN (continuation)

Status of access and benefit sharing		
● ↑	Indicator of access and benefit-sharing to be developed	One indicator may be the development of national ABS framework. Capacity building activities to this end have been conducted among ASEAN Member States including consultations on the proposed International Regime on ABS.
Status of resources transfers		
● ↑	Official development assistance (ODA) provided in support of the Convention	Although acknowledged as insufficient, ODA funds have been increasing in the region for thepast 5 to10 years in relation to compliance to CBD requirements.

● State and condition are considered to be good but require efforts to maintain or expand them.

● State and condition are emerging to be concerns and need attention.

● State and condition considered to be critical and needing utmost attention.

↑ Trend is **increasing**, taking into account the positive (negative) influence of initiatives to address the situation over the period.

↓ Trend is **declining**, taking into account the positive (negative) influence pursued to address the concern over the period.

↔ **No change** in the trend over the period assessed in spite of the efforts pursued.

NB: Indicators such as Marine Trophic Index under ecosystem integrity and ecosystem goods and services were not included in the assessment due to lack of information.

End Notes

1 ASEAN Centre for Biodiversity. 2010. Technical Report on Gap Analysis on Coverage of Terrestrial and Marine Protected Areas. ACB, Los Baños, Philippines.

2 Brown, Katrina. 2003. Three challenges for a real people-centred conservation. Publication accessed on 23 December 2010 at www.aseanbiodiversity.info/Abstract/51012292.pdf.

3 Asian Development Bank and United Nations Environment Programme. 2004. Greater Mekong Subregion: Atlas of the Environment. ADB, Manila.

4 Coral Triangle Initiative (CTI) Secretariat. 2009. Regional Plan of Action: Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security, Interim CTI Regional Secretariat, Jakarta, Indonesia.

5 World Wildlife Fund – Indonesia. 2005. Borneo's Lost World: Newly Discovered Species on Borneo; WWF, Jakarta, Indonesia.

6 Vientiane Action Programme accessed on 27 September 2010 at www.aseansec.org/VAP-10th%20ASEAN%20Summit.pdf

7 ASEAN Socio-Cultural Community Blueprint accessed on 27 September 2010 at www.aseansec.org/5187-19.pdf

ASEAN Biodiversity Assessment

Mangroves play a significant role in providing flood protection in low coastal areas. With massive root systems, mangrove forests serve as buffer zones,regulating the impact of strong storm surges to coastal communities by absorbing the energy of strong waves and wind.
Photo by Leslie Ann Jose-Castillo

An Overview of Global Efforts Addressing Biodiversity Concerns

MANY perceive biodiversity merely as pertaining to the beauty of nature. Biodiversity, as against aesthetics, plays a primordial role in the survival of the human race and the planet itself. At least 40 per cent of the world's economy and 80 per cent of the needs of the poor are dependent and derived mainly from biological resources. Biodiversity is a major source of food, medicines, shelter, and other basic needs. Biodiversity provides ecological services: it protects water and soil resources, sequesters air pollutants and greenhouse gas emissions, and nourishes various ecosystems. Biodiversity indisputably plays a critical role in human and economic productivity.

While there may be numerous ways to value biological diversity, it has many functions that are not easily quantifiable, particularly that of ecosystem services and the social benefits derived from it. It is not difficult to assign a value to biological resources that are available on markets, such as rice, wood, medicines and other goods. But for those who rely on the services of ecosystems for daily subsistence, it would be difficult to designate monetary values on the services enjoyed, which are even mostly taken for granted.

Natural areas provide support systems for commercially valuable natural resources, e.g., fish spawning areas in flooded forests, mangroves and wetlands. Other habitats act as genetic reservoirs for commercial crops. Inasmuch as many of the species in the ASEAN region and elsewhere are yet only being discovered, it may be safely assumed that with an increase in knowledge, new biological resources for the improvement of human welfare will come to unfold as well.

Young girls enjoy the scenery in a field of sunflowers in Myanmar.
Photo by Aye Ko

Every ecosystem provides habitats for plants, animals and micro-organisms which may either be utilized or recognized to possess useful functions. The World Resources Institute calls ecosystems "the productive engines of the planet", providing us with everything from the water we drink to the food we eat, the fiber we use to clothe with, and the paper or wood we use as building materials[1]. Ecosystems also provide humankind with a wide range of services – from reliable sources of clean water to productive soil and carbon sequestra-

tion. Human society relies on these services for raw material inputs, production processes and climate stability[2]. Table 4 gives examples of the many goods and services provided by four broad ecosystem categories found in the ASEAN region.

The GBO-3, a flagship publication of the CBD, summarizes the latest data on the status and trends of biodiversity coming from national reports, biodiversity indicators information, scientific literature and other studies, including an assessment of biodiversity scenarios for the future. It presents in detail how we are nowhere near the targets set in 2002 towards averting biodiversity loss. Though the 2010 targets have helped intensify the actions being undertaken to safeguard biodiversity, such as the creation of more protected areas, species conservation and mobilization of financial resources directed towards these actions, ironically, the loss has worsened. As a result of human activities, biological diversity is being eroded at a rate that far exceeds natural processes. This accelerating decline in diversity threatens the ecological, economic, spiritual, recreational and cultural benefits that we currently derive from the earth's living resources.

Table 4. Examples of goods and services provided by ecosystems

Ecosystem	Goods Provided	Service Provided
Agro-ecosystems	Food crops Additional food items (*e.g.*, rice field fisheries) Fiber crops Genetic resources	Maintain limited watershed functions (*e.g.*, infiltration, flow control, partial soil protection); Provide habitat for birds, pollinators, soil organisms important to agriculture; Build soil organic matter; Bind atmospheric carbon; Provide employment
Forest Ecosystems	Fuel wood Fodder Timber and non-timber products Food (honey, mushrooms, fruits, other edible plants; game) Water for drinking and irrigation Genetic resources	Remove air pollutants, emit oxygen; Cycle nutrients; Protect water resources (e.g., infiltration, purification, flow control, soil stabilization); Maintain biodiversity; Bind atmospheric carbon; Moderate weather extremes and impacts; Generate soil; Provide employment; Contribute aesthetic beauty; Provide recreation
Freshwater Ecosystems	Water for drinking and irrigation Fish and other aquatic organisms Hydroelectricity Housing materials Medicines Genetic resources	Lessen or prevent the impact of flooding; Dilute and carry away wastes; Cycle nutrients; Maintain biodiversity; Provide transportation corridor; Provide employment; Contribute aesthetic beauty; Provide recreation
Coastal Ecosystems	Fish and shellfish Sea weeds (for food and industrial use) Salt Genetic resources	Moderate storm impacts (mangroves, barrier islands); Provide wildlife (marine and terrestrial) habitat; Maintain biodiversity; Dilute and treat wastes; Provide harbors and transportation routes; Provide employment; Contribute aesthetic beauty; Provide recreation

Source: Adapted from WRI 2000, Global Ecosystem Assessment.

The Relevance of Southeast Asia's Biodiversity

ALTHOUGH occupying only three per cent of the earth's total surface, the ASEAN region contains 18 per cent of the plants and animals assessed by the International Union for Conservation of Nature (IUCN). It is endowed with rich natural resources that sustain essential life support systems both for the region and the world. Apart from providing water, food and energy, these natural resources play an important role in sustaining a wide range of economic activities and livelihoods[3].

Biodiversity in the region significantly contributes to global environmental sustainability by providing foundations for ecosystem services to which the well-being of human societies are intimately linked[4]. The region is home to three of the 17 known mega-diverse countries (i.e., Indonesia, Malaysia and the Philippines), which are a group of countries that has less than 10 per cent of the global surface, but supports more than 70 per cent of the planet's biological diversity[5]. Several bio-geographical units (i.e., Malesia, Wallacea, Sundaland, Indo-Burma and the Central Indo-Pacific)[a] are areas supporting natural ecosystems that are largely intact and where native species and communities associated with these ecosystems are well represented. These are also areas with a high diversity of local endemic species; of those that are not found or are rarely found outside the hotspot[6]; and numerous centers of concentration of restricted-range bird, plant and insect species. Based on global estimates, has one-third, or 86,025 square kilometers, of all known coral reef areas in the world. Unique geological history, climate, and common land and water borders have allowed the ASEAN Member States to share many species that are biologically diverse from the rest of the world[7].

The region, however, is confronted by massive habitat and species loss. Drastic environmental changes brought largely by economic activities and irresponsible human practices are causing serious harm to plants, animals and its habitats. The observation of the United Nations Millennium Ecosystem Assessment of 2005 (MA)[8], which cited that "changes in biodiversity due to human activities were more rapid in the past 50 years than at any time in human history," has never been more aptly descriptive of the ASEAN region elsewhere in the world. Out of 47,915 species assessed, 2,517 are threatened due to deforestation; wildlife hunting for food, as pets and for medicinal use; climate change; pollution; population growth; and a host of other causes. While the region prides itself to have mega-diverse countries, it has, nonetheless, four of the world's 34 biodiversity hotspots[b], or areas known to have exceptional levels of endemism of spe-

[a] **Indo-Burma.** Covers the Lower Mekong catchment, eastern Bangladesh, and extends across north-eastern India, encompasses nearly all of Myanmar, part of southern and western Yunnan Province in China, all of the Lao People's Democratic Republic, Cambodia and Viet Nam, the vast majority of Thailand, and a small part of Peninsular Malaysia. The hotspot also covers the coastal lowlands of southern China and several offshore islands.

Philippines. The only country in the ASEAN region identified as a biodiversity hotspot. Geological movements, tropical weather and its once extensive forest cover have developed high species diversity in some groups of organisms with a very high level of endemism. There are five major and at least five minor centers of endemism, from Luzon Island (with at least 31 endemic mammal species) to the tiny island of Camiguin (at least two endemic mammal species). The Philippines has one of the highest rates of discovery in the world, with 16 new species of mammals having been discovered in the last ten years.

Sundaland. The Sundaland hotspot covers the western half of the Indo-Malayan archipelago, and is dominated by Borneo and Sumatra. It is bordered by three hotspots: Indo-Burma on the northwest, Wallacea on the east, and the Philippines on the northeast.

Wallacea. Wallacea encompasses the central islands of Indonesia east of Java, Bali and Borneo, and west of the province of New Guinea, and the whole of Timor Leste. The hotspot occupies a total land area of 338,494 square kilometers, including the large island of Sulawesi, the Moluccas, and the Lesser Sundas.

[b] To qualify as a hotspot, a region must meet two strict criteria: it must contain at least 1,500 species of vascular plants (> 0.5 per cent of the world's total) as endemics, and it has to have lost at least 70 per cent of its original habitat. CI 2009, visited http://www.conservation.org/explore/priority_areas/hotspots/Pages/hotspots_defined.aspx

The ASEAN region is home to an astonishing range of biodiversity. Its seas, forests and mountains cradle a treasure trove of plant and animal species. *Photo collage by Nanie Gonzales*

cies, but are facing serious losses of habitat[9]. These four hotspots cut across a wide area of the ASEAN region, and stress the significance of the region's rich biodiversity, as well as the rapid rate of biodiversity loss caused by wide-ranging threats. Biodiversity loss is one of the greatest threats to the ASEAN region, which could affect over 500 million people and undermine current economic progress.

Reducing the rate of loss remains to be a major challenge. While some notable successes were gained on various fronts – specifically in convincing governments to work together for biodiversity conservation, increasing awareness for the urgent need to save the region's biological diversity, and involving a good number of sectors in biodiversity-related initiatives – many critical issues still need to be addressed before the ultimate objective of significantly reducing the rate of biodiversity loss is accomplished.

It is therefore essential for the ASEAN to harness the benefits and services provided by biodiversity resources. However, the ASEAN itself should also ensure its sustainability, as its biodiversity is under tremendous threat and continues to be degraded. With the view of tapping enormous opportunities from biodiversity and responding to issues of sustainability, the ASEAN recognizes the need for greater regional cooperation for biodiversity conservation. Knowledge about biodiversity of the ASEAN region is one of the first steps toward creating effective conservation strategies.

Biodiversity of the ASEAN Member States: A quick glimpse

All ASEAN Member States were engaged to contribute to the ASEAN Biodiversity Outlook, directly via comment on earlier drafts, and indirectly through the submission of their 4NRs.

Brunei Darussalam[10]

Found in the northwest coast of the island of Borneo, Brunei Darussalam has a 130-kilometer coastline bordering the South China Sea, which consists of high-profile sandy beaches with a complex estuarine mangrove and mudflat zone in the northeast. The alluvial and often swampy coastal plain backed by low hills with swamps further inland characterizes the western part of the country. Meanwhile, the eastern part comprises a swampy coastal plain rising gradually to low hills to mountainous terrain inland. The natural vegetation throughout the country is tropical evergreen rainforest. Forests cover 81 per cent of the total land area, of which 22 per cent is secondary forest and plantations, and 59 per cent primary forest. Forest reserves cover 41 per cent of the total land area, of which a quarter has now been allocated strictly for conservation.

The range of biodiversity in the country includes an estimated 15,000 species of vascular plants and an estimated 2,000 species of trees. There are about 100 non-flying mammal species, of which nearly half are rodents. Meanwhile, out of 390 species of animals recorded for the entire island of Borneo, more than 300 resident species can be found in Brunei, and majority of these are exclusive forest dwellers. Coral species are estimated to number about 400. Amphibian species count up to 98,while there are 50 species of reptiles. Freshwater fish are estimated at 50 species and marine fish at 144 species.

Proboscis monkey *Photo from Wikimedia Commons*

Gaur *Photo from Wikimedia Commons*

Cambodia[11]

Cambodia, a small country in continental Southeast Asia bounded by the Gulf of Thailand, is home to 123 mammal species, 545 bird species, 88 reptile species, 2,308 vascular species, 874 fish species, 70 hard coral species, 8 seagrass species and 63 amphibian species. A total of 874 fish species have been recorded, of which 490 are freshwater fishes belonging to 64 families, 410 are saltwater fishes from 83 families, 22 are threatened; one is endemic; and 13 are introduced fish species. Furthermore, although over 500 bird species have been recorded, it is likely for this number to go easily over 600.

Cambodia's protected areas system include seven national parks (7,422 square kilometers), ten wildlife sanctuaries (20,300 square kilometers), three protected landscapes (97 square kilometers), three multiple-use areas (4,039 square kilometers), six protection forests (13,500 square kilometers), and eight fish sanctuaries (235 square kilometers).

Biogeographically, Cambodia is dominated by lowlands along the Mekong River and the Tonle Sap (Great Lake), which are the most populated sites and where most agricultural lands are situated. The three mountainous regions in the southwest, north and northeast are less populated and remain rich in forest resources.

The Tonle Sap provides a wealth of biological resources. Specifically, the seasonal flooding of the Tonle Sap supplies suitable conditions for growing rice and fish, the staple diet of Cambodians. The Tonle Sap ecosystem was, and still is, considered by many to be the heart of the country.

The Rafflesia is the world's biggest flower.
Photo from Wikimedia Commons

Indonesia

Indonesia covers a mere 1.3 per cent of the earth's surface, yet it harbors 10 per cent of all flowering plants, 12 per cent of the world's mammals, 16 per cent of the world's reptiles and amphibians, 17 per cent of all birds, and more than a quarter of all marine and freshwater fish. This wealth can be attributed to the fact that Indonesia spans two major biogeographical realms: Indo-Malaya and Australasia, and can be divided into seven distinct biogeographic regions. The 17,000 islands of the archipelago support a wide range and variety of habitats from lowland rain forests and mangroves to savanna grasslands, swamp forests and limestone hills; from montane forests to alpine meadows and snow-topped mountains. These varied habitats support a diverse flora and fauna.

In terms of species diversity, 55 per cent are endemic plants. Based on the results of a taxonomic assessment in 2007 carried out by the Research Centre for Biology of the Indonesian Institute of Sciences (LIPI), 31,746 different species of vascular plants have been recorded and described.

For fauna diversity, about 515 species of mammals may be found in Indonesia, 781 species of reptiles, 35 species of primates, 1,595 species of birds, and 270 species of amphibians.

Indonesia is a key player in global biodiversity, counting as one of the 17 countries with the richest biodiversity, or what is also known as megadiversity[12].

The Lao PDR

A land-bordered country, The Lao PDR is a country rich with diverse landscapes and ethnic populations. It is located in the heart of the Indochinese peninsula and is surrounded by China, Viet Nam, Cambodia, Thailand and Myanmar, providing potential for a strategic resource base and land-link to the Greater Mekong Subregion. Eighty per cent of the country is predominantly mountainous with cultivated floodplains. The country has an abundance of natural resources including mineral deposits and a wealth of forests, which cover more than 40 per cent of its total land surface.

Gibbon *Photo from Wikimedia Commons*

There are 21 National Biodiversity Conservation Areas (NBCAs), which also include two corridors. There are 44 Important Bird Areas (IBAs) identified within the country's protected areas where ornithological data are available.

The number of species of flowering plants found in the country is estimated at around 8,000 to 11,000. However, botanical documentation has been insufficient, and very few plant taxonomy studies have been carried out so far.

On the other hand, The Lao PDR's fauna are relatively well documented and monitored, consisting of 150 to more than 200 reported species of reptiles and amphibians, with at least 700 species of birds, over 90 known species of bats, over 100 species of large mammals, and about 500 species of fish.

Butterfly *Photo by John MacKinnon*

Malaysia

Malaysia consists of 13 states and three federal territories. Eleven states and two federal territories (*i.e.,* Kuala Lumpur and Putrajaya) are located in Peninsular Malaysia, while the two states of Sabah and Sarawak are located on the island of Borneo.

Malaysia is considered as one of the world's megadiverse countries and ranks 12th in the world, according to the National Biodiversity Index.

Located near the equator, its climate is ideal for supporting a vast and diverse range of ecosystems, habitats and species, from microscopic organisms such as bacteria, to mammals, birds and fishes.

Approximately 60 per cent of the total land area of Malaysia is still forested. This includes permanent reserved forests (PRF), stateland forests, national parks, and wildlife and bird sanctuaries. The remaining 40 per cent are covered by agricultural crops, rubber plantations, oil palm plantations, urban areas and other uses. The terrestrial biodiversity of Malaysia is concentrated in tropical rainforests that extend from coastal plains to mountain areas, with inland waters such as lakes and rivers. Marine biodiversity (*e.g.,* coral reefs and seagrasses) is found among its islands and marine and coastal ecosystems.

In 2007, 143,000 square kilometers, or 43.3 per cent of the total land area of Malaysia, had been published as permanent reserved forest and 19,000 square kilometers, or 5.9 per cent of the total land area, were published as national parks, wildlife and bird sanctuaries. In the same year, 2,357 square kilometers of marine protected areas were also managed.

In terms of flora, Malaysia has an estimated 15,000 species of vascular plants, of which about 8,300 are found in Peninsular Malaysia and about 12,000 species are in Sabah and Sarawak. There are 229 species of mammals found in Peninsular Malaysia and 221 species found in Sabah and Sarawak, of which 152 species are similar. A recorded total of 742 species of birds belonging to 85 families may also be found in the country. Out of these, 43 are endemic. There are also 242 known species of amphibians and 567 species of reptiles. There are 290 species of freshwater fish existing in Peninsular Malaysia. Although inventory figures for Sabah list 100 species, and 200 species for Sarawak, these are believed to be underestimates because inventories for these areas started later compared to that of Peninsular Malaysia. There are about 500 species of marine fish recorded in the country, with more than 400 species recorded in coastal areas and river estuaries, and more than 450 recorded offshore in Sabah and Sarawak alone. In relation to insect biodiversity, there are 936 species of butterflies found in Sabah and Sarawak, 1,031 butterfly species in Peninsular Malaysia, and approximately 1,700 species of beetles in Sabah. Moreover, there are 1,200 recorded ant species and more than 200,000 ant specimens available.

Myanmar

The Union of Myanmar is located northwest of the Indochina region. The country is bordered in the north and northeast by China, in the east and southeast by The Lao PDR and Thailand, in the south by the Andaman Sea and the Bay of Bengal, and in the west by Bangladesh and India.

Myanmar is endowed with striking and unusual forests. Plains alongside major rivers and plateaus running parallel to each other contain unique ecosystems supporting numerous organisms. The interaction between the varying climate and geo-physical components of the land accounts for Myanmar's rich biodiversity – a vital resource for the sustainable development of the nation.

There are about 11,800 species of vascular plants of gymnosperms and angiosperms. Mammal species are estimated at 251, while 1,056 bird species exist. There are 272 species of reptiles and 82 species of amphibians. In terms of marine species, there are 310 freshwater species and 465 marine water species. Recorded medicinal plant species is 841. There are 96 bamboo species and 37 species of rattan.

A total of 43 protected areas have already been established, 34 of which represent mountain biodiversity.

Takin *Photo from Wikimedia Commons*

The Philippine eagle is a critically endangered bird that is endemic to the Philippines. *Photo from Wikimedia Commons*

Philippines

The Philippines is located between the Philippine Sea and the South China Sea, east of Viet Nam and north of Indonesia and Malaysia. It is composed of 7,107 islands covering a total area of 300,000 square kilometers. Its major island groups are Luzon, Visayas and Mindanao.

Over 60 per cent of the population lives in coastal areas. Luzon, the largest island group, accounts for more than half of the entire population. The Philippines has vast natural resources that provide food, water, shelter and livelihood for its rapidly growing population. It is one of the world's 17 megadiverse countries, accruing to its geographical isolation, diverse habitats and high rates of endemism.

The Philippines ranks fifth in number of plant species, and maintains five per cent of the world's flora. Species endemism is very high, counting at least 25 genera of plants and 49 per cent of terrestrial wildlife. It also ranks fourth in bird endemism. In terms of fishes, there are about 3,214 species (incomplete list), with about 121 being endemic, 76 of which are rated as under threat. Unfortunately, the Philippines is also one of the world's biodiversity hotspots, with a large number of endangered and threatened species, thus, making it one of the top global conservation priority areas.

Singapore

A tropical island city-state, Singapore lies within the Malesian biogeographical region, consisting of one main island and about 60 smaller offshore islands. Located 137 kilometers north of the equator, it is separated from Peninsular Malaysia by the Straits of Johor and from the Indonesian Islands by the Strait of Singapore.

Singapore has 22 nature areas[c], which include four nature reserves. Through careful planning, Singapore was able to increase its green cover from 36 per cent in 1986, to 47 per cent in 2007, despite a population growth of 68 per cent from 2.7 million to 4.6 million in the same period. Currently, close to 10 per cent of the total land area is set aside for parks and nature reserves.

Its lush green cover and warm tropical climate make Singapore rich in biodiversity despite its small land mass. The island has more than 3,971 native vascular plant species, a total of 52 mammal species, 98 reptile species, 28 amphibian species, a total of 364 species of birds, and 295 species of butterflies.

Inter-tidal mangroves and mudflats are home to hundreds of fish species, which live in the root systems of more than 31 different true mangrove species. Seagrass meadows still exist, with 12 of the 23 Indo-Pacific species found within Singapore's waters. More than 200 species of sponges have been recorded, and many more are likely to be observed in the sub-tidal areas, along with 256 different species of hard corals.

Thailand

Thailand covers a total land area of 13,115 square kilometers. It lies in a hot and humid climatic zone, and hence supports a variety of tropical ecosystems. Its forests harbor a large portion of the country's biodiversity. Forest types range from rainforest, evergreen, deciduous and mangrove, to shrub forests and savannah forests. The freshwater ecosystem, which includes rivers, reservoirs, swamps and ponds, is where the endemic species of Thailand are found. For coastal ecosystems, the country's more than 2,000-kilometer coastline surrounding islands numbering over 200 are comprised by coral reefs, sandy beaches, muddy beaches and seagrass beds. Marine ecosystems are located on both sides of the peninsula. Agriculture ecosystems make up about one-fifth of the country, and while entirely man-made, these bear certain components of biodiversity nonetheless.

Thailand has approximately 15,000 species of plants, which accounts for eight per cent of the estimated total number of plant species found globally. The country is at the center of the India-Burma, Indochina and Malaysian regions. It is estimated that there are 12,000 species of vascular plants, which include 658 fern

Egrets *Photo from Wikimedia Commons*

Elephant *Photo from Wikimedia Commons*

[c] Nature areas are either terrestrial, marine or coastal areas that support natural ecosystems, recognized for their significant biodiversity, and are reflected in Singapore's Urban Redevelopment Authority's (URA) Master Plan 2008.

species, 25 uncovered seeds, 10,000 flowering plants and 1,140 orchids.

Vertebrate animals consists of at least 302 species of mammals, where 42 per cent originate from the southern part of the region, 34 per cent from the Indochinese and Indian sub-regions, and the remaining 24 per cent coming from all over the Asian continent. Six of these mammal species are endemic. There are at least 982 bird species, 350 reptile species and 137 semi-water animal species. Thai waters support about 2,820 marine fish species, accounting for 10 per cent of the total fish species worldwide. There is also a total of 720 freshwater fish species. Invertebrate animals consist of around 83,000 species, mostly insects, where only 14,000 of which have been identified.

Viet Nam

Viet Nam is a country rich in tropical rainforests and monsoon savannah, as well as marine life and mountainous sub-alpine scrubland. The lowland coastal zone is bisected by rugged limestone mountains which separate the generally wetter forest types of the east from the drier forests of the Mekong Basin in the west, creating habitat diversity favorable to a broad range of species compositions. One in ten of the world's mammals, birds and fish species is found in Viet Nam, and 40 per cent of the country's plants are endemic. The country grows important cash crops such as tubers, tea and rice – Viet Nam being the world's second largest rice exporter. It also abounds with domesticated animals such as chickens, pigs and ducks. This balanced diversity of natural and agricultural resources represents the wealth of a unique physical environment and thousands of years of adaptation and selective cultivation and breeding.

Red-tailed laughingthrush *Photo by John MacKinnon*

In the country's terrestrial ecosystems, more than 13,200 floral species and about 10,000 faunal species have been identified. Over 3,000 aquatic creatures have been listed in the interior wetlands. The tropical marine ecosystems, of more than 20 different types, are also home to more than 11,000 forms of sea life such as crustaceans, mollusks, among others. For the past two decades, many new floral and faunal species have been discovered and described. Many of them belong to new genera and species, particularly those of mammals and the Orchidaceae species. New organisms continue to be discovered in Viet Nam.

By 2006, Viet Nam's forest coverage, including natural forests and plantation forests, increased by 38.2 per cent. Forest proportion has become more rational, where 20,000 square kilometers of special-use forest, 50,000 square kilometers of protection forest, and 80,000 square kilometers of production forest now exist. A system of 128 protected areas has been established and developed in all eco-regions nationwide covering an area of 25,000 square kilometers, or about 7.6 per cent of the total territory. In late 2008, the country's Prime Minister approved a system of 45 interior protected wetlands. Another system of 15 marine protected areas has also been planned and submitted to the government for approval. Moreover, two World Natural Heritage Sites, four ASEAN Natural Heritage Sites, two Ramsar Wetlands Sites and six Biosphere Reserves have been internationally recognized.

The Ecosystems of the ASEAN Region: Current state, pressures and responses

Forests: An overdrawn natural wealth

Forests are vital ecosystems particularly for countries in the tropical and sub-tropical regions. These ecosystems are a primary source of natural wealth, supplying food and performing functions essential to the survival of human societies. Owing to the multiple uses and benefits derived from forest ecosystems, anthropogenic actions have modified much of the landscape, with but a few still remaining intact. In fact, many consider the modification of the forest ecosystems as one of the defining features in the progression of human societies[13]. Perhaps, this is where the most conspicuous threat posed by human activities on biodiversity is reflected. Covering a vast area of the earth's surface and supporting about two-thirds of the world's terrestrial biodiversity, these areas also suffer the most widespread form of conversion and degradation[14].

The Southeast Asian region has one of the most diverse forest ecosystems in the world. Several forest types are spread all throughout the region, the characteristics of which vary from country to country. Forests are generally defined based on their location, distribution, species composition, soil condition and climatic condition. These cover, among others, tropical rain evergreen forests, mixed dipterocarp forests (*i.e.*, dry and lowland), mountain forests (*e.g.*, montane and sub-alpine), hill and evergreen forests, heath forests, plantation forests, and limestone and mangrove forests (Table 5). Some countries use broad legal classifications, e.g., Malaysia refers to its forest ecosystems as permanent reserved forests, stateland forests and national parks, and wildlife and bird sanctuaries.

The transformation of forests in the region has been quite extensive especially over the last 50 years. Almost 8,000 years ago, the entire region was covered by forests[15]. As of 2000, only 47 per cent of the ASEAN was forested, with Brunei Darussalam, Cambodia, Indonesia, Malaysia and Myanmar at least having more than 50 per cent of their total land

Table 5. Types of forests in selected ASEAN countries

Countries	Types of Forest*
Brunei Darussalam	Mixed deciduous, mixed dipterocarps, heath, montane, limestone, mangrove
Cambodia	Evergreen, semi-evergreen, lowland evergreen, limestone
Indonesia	Mountain rain, conifer, wetland, limestone, mangrove
The Lao PDR	Decidous, natural high, dry dipterocarp, limestone
Malaysia	Lowland evergreen, lowland dipterocarp, hill dipterocarp, hill mixed dipterocarp, mixed diptercarp, heath, subalpine, mangrove
Philippines	Hill pine, dry dipterocarp, montane, limestone, mangrove
Thailand	Evergreen, lowland evergreen, dry evergreen, hill evergreen, hill pine, mixed deciduous, dry dipterocarp, montane, sub-alpine, limestone, mangroves

Sources: Global Forest Resources Assessment Country Reports. FRA 2005/182. Forestry Department. Food and Agriculture Organizations.
Country reports: 4th NR to the CBD, 2008.
Note: * Mangrove forest discussions is covered in a separate chapter.

The ASEAN region is known for its lush forests. These habitats, however, are not free from a host of threats such as illegal logging. *Photo by Leslie Ann Jose-Castillo*

area under forest cover. By 2007, the forest cover of the entire region was down by four percentage points, at 43 per cent. Between the period from 1980 to 2007, the ASEAN forests have decreased by a total of 555,587 square kilometers, an area roughly the size of Thailand; or by an annual average rate of 20,578 square kilometers, an area almost 29 times the size of Singapore (Table 6).

Reforestation and afforestation initiatives: Is it negating deforestation rates?

The ASEAN Member States have a good grasp of the implications of not addressing the issue of deforestation and forest degradation. While harvesting and the conversion of forests to other land uses continue, efforts to reforest and afforest have also been initiated. The initiatives are generally lauded where forest areas are being re-vegetated (reforested), or where new forest areas are being established (afforested), to counter the rapid conversion of forest ecosystems. In certain ways, the net loss of forests is reduced by way of these undertakings. But it is also clear that the effort is not enough to stem the tide of deforestation and degradation given the current magnitude and extent of forest loss. In the region, deforestation rates remain quite high despite having slowed down over the past decade. Compared to the other regions, the deforestation rate in Southeast Asia is still among the highest in the world. Conversely, reforestation efforts need to be aggressively pursued, as only Viet Nam has been acknowledged to have a net forest gain in the region[16]. It must also be stressed that looking at the rates of deforestation and net change alone do not convey the full impact to

Table 6. Forest area of the ASEAN region in 1980-2007.

ASEAN Member States	Land Area[a] (km^2)	Forest Area (km^2)				Annual Rate of Change (2000-2007)
		1980[b]	1990[c]	2000[d]	2007[d]	
Brunei Darussalam	5,765	4,830	3,130	4,430	4,380	-0.14
Cambodia	181,035	120,300	129,460	115,410	100,094	-1.66
Indonesia	1,890,754	1,246,220	1,165,670	978,520	847,522	-1.67
The Lao PDR	236,800	144,700	173,140	99,332	96,407	-0.37
Malaysia	330,252	217,220	223,760	201,600	196,630	-0.31
Myanmar	676,577	329,290	392,190	345,540	312,900	-1.18
Philippines	300,000	110,260	105,740	79,490	68,472	-1.73
Singapore	710	50	23	23	23	0.00
Thailand	513,120	180,930	159,650	148,140	144,024	-0.35
Viet Nam	329,315	106,380	93,630	117,250	134,134	1.80
ASEAN	4,464,328	2,460,180	2,446,393	2,089,742	1,904,593	-1.11

Sources:
[a] Fourth ASEAN State of the Environment Report 2009. Jakarta: ASEAN Secretariat, October 2009.
[b] Qiang Ma. 1999. Asia-Pacific Forestry Sector Outlook Study: Volume I - Socio-Economic, Resources and Non-Wood Products Statistics.Food and Agriculture Organization of the United Nations. Asia-Pacific Forestry Sector Outlook Study.Working Paper No: APFSOS/WP/43, accessed on April 21, 2010 at http://www.fao.org/docrep/x2613e/x2613e0r.htm#TopOfPage
[c] FAOSTAT 2010 accessed on 21 April 2010 at http://www.faostat.fao.org
[d] Fourth ASEAN State of the Environment Report 2009. Jakarta: ASEAN Secretariat, October 2009.

Tourists admire a giant tree *Photo by Tan Ai Bee*

forests over time. A net change in forest area may hide the fact that natural forests have been deforested in one part of a country, while forest plantations were established in another area. In some cases, natural forests and even undisturbed primary forests may have been converted into forest plantations or some other agricultural use. A vital yet often overlooked concern in biodiversity is the fact that changes in forest composition always takes place once natural vegetation is removed. For example, forest areas opened up to the logging of a particular timber species are likely to be colonized by a pioneer tree species, thus, changing the forest's composition. It is therefore important to focus not solely on factors such as deforestation rates or net change, but to also look at changes in the characteristics, composition and health of forest ecosystems[17].

The changing patterns of forest production and consumption

Changes in the patterns of forest production and consumption have been noted in the region over the past decades. While the demand for forest products in the ASEAN were projected to have increased following economic growth and increasing incomes, the globalization of trade, emergence of new markets, and product diversification are significantly influencing the pattern of production, consumption and trade in the region. The consumption per capita of selected wood products indicated changing patterns from 1990 to 2009 (Table 7). There has been a declining trend on the consumption of roundwoods, but an increasing demand for processed wood products such as wood-based panels. In a related manner, there have been significant increases in the consumption of paper, pulp for paper and wood pulps (Table 8). These trends in the

Table 7. Per capita consumption of selected forest products, in solid volume, ASEAN region, 1990-2009.

Forest Product	Per capita consumption (cu.m/person)				
	1990	1995	2000	2005	2009
Roundwood	0.701	0.601	0.580	0.482	0.392
Industrial roundwood	0.181	0.182	0.132	0.139	0.128
Sawnwood	0.038	0.034	0.027	0.026	0.029
Wood fuel	0.520	0.419	0.447	0.342	0.264
Wood-based panels	0.005	0.011	0.011	0.016	0.022

Source: FAOSTAT 2010, accessed on 25 September 2010 at http://www.faostat.fao.org

Table 8. Per capita consumption of selected forest products, ASEAN region, 1990-2009.

Forest Product	Per capita consumption (kg/person)				
	1990	1995	2000	2005	2009
Paper and paper board	10.15	17.46	21.24	25.41	27.21
Pulp for paper	3.08	6.79	9.41	11.54	10.85
Wood pulp	2.87	6.38	9.30	10.85	10.37

Source: FAOSTAT 2010, accessed on 25 September 2010 at http://www.faostat.fao.org

consumption and production of forest-derived products signify an inclination towards value adding and processed products.

The emergence of new markets is also defining the production outputs from forests in the region. While traditional trading partners, particularly the developed countries from Europe, USA and Japan have remained, the emergence of China as a new and proximate trading partner is changing the trade landscape.

Species richness and biodiversity of forest ecosystems in ASEAN

Species richness and diversity in forest ecosystems are acknowledged as vital resources. It is estimated that two-thirds of terrestrial biodiversity are found in forest ecosystems. But the threats posed by deforestation, forest degradation and illegal wildlife trading are exerting tremendous pressure on biodiversity resources. In the ASEAN, a number of endemic plant and animal species that are dependent on the health of forest ecosystems are at risk owing to the pressure exerted on its habitat. The fragmentation of forests following the construction of roads, agriculture and human settlement development has had dire impacts on wildlife, reducing the corridors in which they can move or migrate. For example, forest clearances in Indonesia, exacerbated by illegal logging in 37 national parks, have affected many orangutan populations, driving the species towards extinction[18]. The hotspot countries of Indonesia, Malaysia and the Philippines harbor more endemic species, but also a considerable number of threatened species of amphibians, birds, mammals and reptiles.

The ASEAN has a higher number of native species compared to the rest of Asia, which includes China, India, Japan and Korea. In 2010, as reported by the IUCN, the Philippines had the highest number of critically endangered and endangered native species. Indonesia has the highest number of vulnerable native species, followed by Malaysia and Viet Nam. In terms of threatened native plant species, the ASEAN ranks third in Asia, with China and Japan being first and second, respectively.

Critical pressure points for forest ecosystems

Southeast Asian forest ecosystems are subjected to multiple threats coming from several points. For the past decades, the primary threat to forests has been deforestation attributed largely to logging and timber harvesting. Illegal logging has exacerbated the situation. Until the last decade, however, the conversion of forest areas for agricultural use, in particular for oil palm plantations, has become the largest factor in the loss of forest ecosystems. These conversions occurred largely in Indonesia and Malaysia, but the conversion to plantations is also on-going in other countries for other agricultural commodities. In the Philippines, a number of montane forests are being opened up for the production of organic vegetables that command higher prices in urban areas.

Other forest types are also subjected to pressures. Fires in Indonesia's peat swamps have been particularly damaging due to the high carbon content they contain. It was estimated that Southeast Asian peat lands may contain up to 21 per cent of the terrestrial surface organic carbon of the world, and, therefore, fires in this ecosystem can significantly contribute to pollution and green house gas emissions. Mangrove areas are suitable sites for shrimp farms or rice cultivation, and are thus being converted. Other prominent threats include converting forest areas for human settlement and infrastructure development, mining and mineral resource extraction, the introduction of invasive alien species, poaching/wildlife trade and other illegal activities, and slash-and-burn farming. Pests and diseases are also causing increased damage to forests in some ASEAN Member States.

National Responses

The key to addressing the issues of forest ecosystems depends largely on effective governance focused on three major areas, namely: the effective enforcement of binding laws and forest policies, engagement of public (particularly communities and local government units) and private stakeholders, and comprehensive programs for the capacity building of institutions involved in the enforcement of laws.

Rows of trees on a mountain side in Bohol, Philippines. *Photo by Rolando A. Inciong*

There exist efforts being continuously pursued under conventional programs such as reforestation and afforestation, social forestry and community-based forest management. The challenge of government is to find resources that would expand the coverage of these programs. The establishment of more conservation areas and better forest management practices are critical initiatives in saving forest ecosystems in the region. Some of these efforts are covered in the succeeding chapters of this report.

While current respective national responses are considered to be sufficient in design, but probably insufficient in resources for sustained implementation, two key programs merit support: the implementation of forest certification programs under the ambit of sustainable forest management (SFM) and the Action Plan on Forest Law Enforcement, Governance and Trade (FLEGT). Sustainable forest management and the formulation of a forest certification program are initiatives that involve close partnerships between government and the private sector. Fundamentally, forest certification is a market-based mechanism designed to promote an environmentally sustainable and socially responsible forestry practice. The program involves a third party auditor that certifies the environmental and social soundness of a forestry operator and the products that are produced. Malaysia has adopted this initiative and has created the Malaysia Timber Certification Council. Indonesia has the Indonesian Ecolabelling Institute, a non-profit constituent-based organization that develops forest certification systems[19]. The Philippines is following suit; work on developing its certification system that subscribes to international standards is currently being undertaken. The FLEGT, on the other hand, involves partnership agreements between the producer and the consumer countries aimed at combating illegal timber trading.

Photo by Sharizan Bintiramli

A summer paddy field in Yangon. Agriculture depends highly on biodiversity and the whole range of ecosystem services that it offers. When life forms essential to agriculture are destroyed, it will have catastrophic effects on agricultural production and the food security of the global population *Photo by Sai Kham Lynn*

Agro-ecosystems: An emerging hotspot

Agriculture is a critical sector for most developing countries, given its significant contribution to development as a major economic activity, source of livelihood and provider of ecosystem services[20]. For most ASEAN Member States, the agriculture sector is a key contributor to national development (Table 9), connecting to issues that address poverty alleviation and food security. Population growth, coupled with shifting demographics from rural to urban areas, expansion of demand for food associated with evolving consumption patterns, conversion of agricultural lands for other uses, globalization of markets, and climate change are integral factors that affect agriculture as an industry. Faced with these pressures, the intensification of agricultural productivity has become a cornerstone strategy in national development plans. The approach translates generally to the use of high-yielding varieties of crops and livestock, more expansive irrigation, and the application of agro-chemical inputs. While the pursuit of this strategy has enabled many ASEAN Member States to meet the expanding demand for food, it has nonetheless significantly impacted biodiversity, the environment and human health.

There is a need to address food production through an approach that would promote, rather than go up against, the conservation of natural resources, protection of the integrity of the environment and the promotion of human

Table 9. Profile of the agriculture sector among the ASEAN Member States

Agricultured based economies	Transforming economies	Highly urbanized economies
Average share of agriculture sector to the GDP > 21%	Average share of agriculture sector to the GDP Between 5% - 20%	Average share of agriculture sector to the GDP <5%
Cambodia The Lao PDR Myanmar	Indonesia Malaysia Philippines Thailand Viet Nam	Brunei Darussalam Singapore

Source: Uriarte, 2009

well-being. This need has never been imperative to the ASEAN region more than it is today. The methods to be explored must underpin the conservation of biodiversity in existing agricultural landscapes, or agrobiodiversity, and the adoption of biodiversity-based agricultural practices (Box 1)[21]. It is also essential to link agrobiodiversity with ecosystem goods and services and their net benefits to communities and society as a whole.

Crops and livestock genetic diversity in the ASEAN: A dwindling resource

Industrialization, higher incomes and expanding urbanization are triggering a nutritional transition dictating the kind of agricultural commodities that are to be produced. Contemporary Asian diets are turning away from staples, such as rice and grain, to a growing demand for animal-sourced food (ASF), such as meat and dairy products, and

Box 1. Functions of Biodiversity in Agriculture

AGROBIODIVERSITY is defined as the full diversity of organisms living in agricultural landscapes, including biota (i.e., soil microbes, farm weeds, herbivores and carnivores). Agrobiodiversity has two components: planned agrobiodiversity and associated biodiversity. Planned agrobiodiversity is the diversity of crops and livestock; those which are managed by farmers. Associated biodiversity pertains to the biota in the agro-ecosystem that survives according to local management and environmental conditions. Croplands and fields are also included, as well as habitats and species outside of farming ecosystems that benefit agriculture and support ecosystem functions. Agrobiodiversity in a mostly tropical region like the ASEAN is least understood. It is thus essential to recognize the value and function of biodiversity in agro-ecosystems, which are summarized as follows:

Genetic Bases of Agricultural Crops

Genetic diversity within each species of crop, encompassing its wild progenitors as well as its cultivated varieties and strains, is of obvious and immediate importance to agriculture. Traditional methods of plant breeding, based on the selection and cross-breeding (i.e., hybridization) of genetically distinct strains, are still the most commonly used. These have been and continue to be employed, for instance, in efforts to improve crop resistance to fungal diseases and insect infestations, as well as to environmental stresses such as heat, dry spells and excess salinity.

The preservation of genetic diversity among wild plants can be best achieved in the natural setting, within native habitats and natural ecosystems (in situ), while that of agricultural cultivars can most effectively be accomplished in designated fields and greenhouses. When such methods of living-plant preservation are neither practical nor sufficient, seed stocks of numerous species and varieties must be preserved in specially organized and carefully maintained collections (ex-situ). Such collections can serve as genetic pools, from which plant breeders may draw genes that can impart new varieties with superior tolerance to pests, diseases and weather anomalies.

Disease Control

Genetic diversity reduces the odds of crop failure and contributes to the stability of production – benefits that are also found in the mixed-species and multispecies cropping systems common to subsistence farms. The vulnerability of monocultures to disease illustrates this particular value of genetic diversity. Pathogens spread more readily and epidemics tend to be more severe when the host plants, or animals, are more genetically uniform, numerous and crowded. Owing to high densities and the large areas over which they are grown, both crops and livestock are repeatedly threatened from the evolving infestations of pests and diseases. Existing pests and diseases are continually modifying into strains that overcome the innate defences of particular crop varieties and livestock breeds, as well as the chemical applications introduced by farmers.

Many historical examples can be cited to prove that monoculture stands, or concentrations of crops and livestock with uniform genetic traits, though productive in the short run, entail higher risks of inevitably succumbing to changing environmental conditions. Catastrophic outbreaks of disease, invasions of insects, and climatic anomalies have caused plenty of wholesale crop and livestock annihilations in the past. Such episodes have resulted in famine, especially where, in the absence of sufficient diversity, no varieties or breeds were present that could withstand the devastating outbreaks.

Insect Pest

Small-scale farmers in the tropics have long used crop diversification as a way of minimizing the risk of crop failure for various reasons, including pest infestations, among others. Experiments have demonstrated that the differences in pest abundance between diverse and simple agricultural systems can be explained, in part, by the ability of non-host species to disrupt pests from attacking its main hosts effectively. This phenomenon applies largely to the so-called "specialist herbivores" – or insects that have specific host targets.

Several mechanisms appear to be involved in diverse systems that interfere with an insect's host-seeking behavior. These include camouflage, where the host plant is guarded from insect pests by the pres-

for vegetables, fruits, fats and oils[22]. This nutritional transition affects the genetic diversity of crops and livestock being produced. By concentrating on crop strains and breeds that are characterized by high yields and shorter economic cycles, production alternatives have been narrowed down. In effect, scores of less productive varieties and breeds are being driven towards extinction – a term which the Food and Agriculture Organization (FAO) describes as genetic erosion (Box 2). Developed countries that have been practicing intensified food production have long lost the genetic diversity of their agro-ecosystems. Developing countries are now moving towards that same direction: a concern that is raising international attention given its serious implications on food security and its impact on smallholder farmers who are most vulnerable.

ence of other plants that conceal it; crop background, where certain pests prefer a specific background of a particular color and/or texture; masking or the dilution of attraction stimuli, where the presence of some non-host plants mask or dilute the attractant stimuli of the host plant, leading to a breakdown or reorientation of the feeding pattern and reproduction of the insect pest; and repellant chemical stimuli, which pertain to aromatic odors given off by certain plants that disrupt the insect's host-finding ability.

Some mechanisms interfere with pest populations as a whole, including mechanical barriers (e.g., companion crops that block herbivores from moving across polycultures). There are also microclimate influences that cause insects to experience difficulty in locating and remaining in suitable microhabitats.

Pollinators

There are considered to be more than 100,000 different pollinator species on earth. Decline in numbers, reaching up to 70 per cent in some places, has been reported in every continent, except Antarctica. The consequences of such steep declines in pollinators for the world's food supply are potentially enormous. While the majority of the world's staple crops (i.e., wheat, rice, maize, potatoes, yams and cassavas) are either wind- or self-pollinated, or propagated vegetatively (i.e., by stolons or by rhizomes), many other important agricultural species rely on pollinators. For instance, more than 80 per cent of the 264 species grown as crops in the European Union depend on insect pollination. Moreover, the yield of tomatoes, sunflowers, olives, grapes, and soybeans – all major crops, is optimized by regular pollination. Fruit trees and legumes may be particularly hard hit by the loss of pollinators, especially as these are grown intensively.

Soil Biodiversity

Soil remains among the least known habitats on earth. It is unfortunately all too easy to take it for granted. Yet evidence indicates that soil may be one of the most species-rich habitats on the planet. Almost every phylum known above ground is represented in soil, and each has a wealth of species diversity. Nonetheless, it is estimated that perhaps only a mere ten per cent of these species have already been identified and described.

Species in the soil are directly involved in ecological services that sustain human populations. Saprophytic organisms are those that obtain their nutrients from dead and decaying plant or animal matter. Actinomycetes are bacteria that possess the ability, like fungi, to form mycelium-like, branching filaments. Diazotrophic means nitrogen-fixing. The rhizosphere is the region surrounding the roots of plants. These organisms perform the following ecosystem services:

- Maintaining soil fertility though the decomposition of organic matter and the recycling of nitrogen, carbon and other nutrients;
- Modifying soil structure and the dynamics of water storage and flow;
- Mixing organic matter and microscopic life throughout soils for the redistribution of nutrients;
- Influencing carbon storage in soils and the flow of trace gases;
- Contributing to air and water purification by degrading pollutants;
- Enhancing the amount and efficiency of how vegetation acquires nutrients; and
- Affecting plant community diversity and plant fitness through numerous associations.

These associations can be mutualistic, where both species benefit from each other; or parasitic, where one species benefits at the expense of the other. Through these myriad interrelationships, soil biota have essential and intimate links to ecosystem function, not only within the soil itself (including freshwater and marine sediments), but also in aboveground terrestrial and aquatic systems.

Source/Adapted from:

1. Kontoleon, A., Unai Pascual, Melinda Smale (eds.), 2008. *Agrobiodiversity Conservation and Economic Development,* Routledge, U.K.
2. Chivian, Eric and Aaron Bernstein (eds.), 2008. Sustaining Life: *How human health depends on biodiversity*, Oxford University Press, New York, U.S.A.

Box 2. Genetic erosion defined

THE FAO defines genetic erosion as "the loss of genetic diversity, including the loss of individual genes and the loss of particular combinations of genes such as those manifested in locally adapted landraces". Its primary cause is the replacement of local varieties by improved or exotic varieties and species. In the ASEAN region, the replacement of indigenous varieties of crops and breeds of livestock, habitat destruction and infestation by pests and diseases are considered to be direct threats to genetic erosion.

Source: FAO. 1997. The State of the World's Plant Genetic Resources for Food and Agriculture accessed on 4 June 2009 at http://www.fao.org/ag/AGP/AGPS/PGRFA/pdf/swrfull.pdf

Crops. The ASEAN is home to a diversity of economically important crops (Table 10). Food crops, which include cereals, fruits and vegetables, account for 21 per cent of the total number of species listed in the same Table. Similarly, the production and consumption of major commodity food groups have been increasing over time, corresponding to the steady rise in their demand (Table 11). As ASEAN societies move steadily towards modernization, consumption preferences may change, but its dependence on food crops will continue. With progressively increasing demands, dependence on high yielding crops is projected to intensify further. This trend forebodes serious implications on the crop genetic diversity of the region.

Livestock. Protein is a vital component of the human diet derived generally from the consumption of meat. According to the FAO, meat production from the global livestock sector is projected to increase by more than double over the next 50 years[23]. Developing countries shall carry the bulk of this increase, with a notable rise in the consumption of previously unaffordable foods such as meat, milk and eggs (Table 12). The response to the escalating demand was to focus on a narrow range of high-output breeds and intensify production in order to supply a uniform product within a shorter cycle. However, the intensification of livestock production is slowly eroding genetic variability by way of excluding some stocks that may have unique and valuable genetic attributes such as disease and pest resistance and tolerance to weather extremes. Within-breeding, which is being practiced more and more because of a preference for a few highly popular sires for breeding, further narrows down the genetic diversity of stocks.

Table 10. Number of species of economically important crops extant in Southeast Asia, by major commodity group.

Major commodity group	Known number of species	Percentage
Food crops	1,026	21
Medicinal plants	1,182	24
Ornamental plants	539	11
Fiber plants	252	5
Bamboo	58	1
Timber trees	328	7
Rattan	170	3
Other crops	1,442	29
Total	4,997	

Source: FAO. 1995. Conservation and Sustainable Utilization of Plant Genetic Resources in Southeast Asia: Sub-Regional Synthesis Report accessed on 2 April 2010 at http://www.fao.org/ag/AGP/agps/PGRFA/pdf/pacific2.pdf

Table 11. Trends in the production and consumption of major crop products, ASEAN, 1990-2005

Commodity group	Total Production (M Tons)			Average Consumption (kg/person/day)		
	1990-1992	1995-1997	2003-2005	1990-1992	1995-1997	2003-2005
Cereals	395	463	579	0.42	0.43	0.45
Vegetables	55	73	90	0.11	0.13	0.18
Fruits	83	98	130	0.15	0.16	0.17

Source: FAOSTAT accessed on 7 April 2010 at http://www.faostat.fao.org

Table 12. Trends in the production and consumption of selected livestock products, ASEAN, 1990-2005

Commodity group	Total Production (M Tons)			Average Consumption (kg/person/day)		
	1990-1992	1995-1997	2003-2005	1990-1992	1995-1997	2003-2005
Eggs	6.46	8.08	9.79	0.01	0.02	0.02
Milk	4.26	5.41	8.57	0.05	0.07	0.08
Meat	20.50	26.54	56.60	0.06	0.07	0.08

Source: FAOSTAT accessed on 7 April 2010 at http://www.faostat.fao.org

The FAO's Domestic Animal Diversity Information System (DAD-IS) lists a total of 558 major livestock breeds in the ASEAN (Table 13). Almost a quarter, at 22 per cent, of the world's breed population of buffaloes is found in the region. Ducks (i.e., both domestic and Muscovy), chicken and cattle account for 14 per cent, 5 per cent and 4 per cent of the world total, respectively.

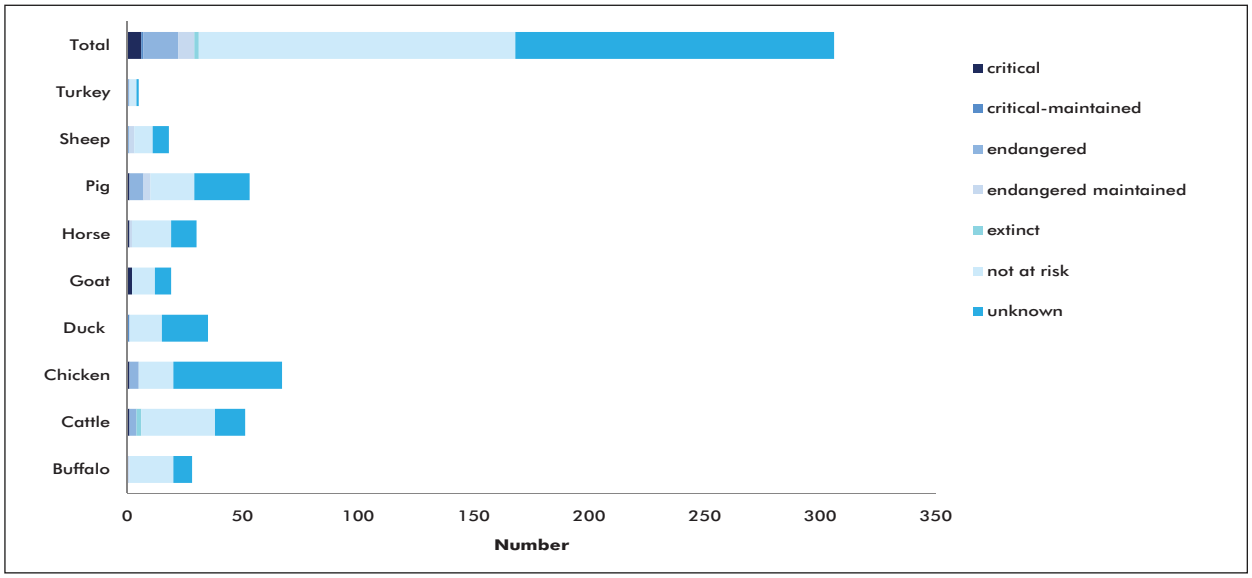
A total of 23 of the major livestock breeds recorded extant in the ASEAN region, or eight per cent, are at risk. Two breeds of cattle were reported extinct in Malaysia and the Philippines (Figure 1). In Viet Nam, the percentage of indigenous sows declined from 72 per cent to 26 per cent of the total population in only eight years[24]. Other livestock species, particularly those endemic to the countries, are most likely facing the same situation. The region is in the throes of a progressive contraction of genetic diversity of livestock.

Table 13. Number of livestock breeds extant in ASEAN, with per cent share to world totals

Livestock	Number of breed populations		
	ASEAN	World	% Share of ASEAN
Buffalo	38	173	22
Cattle	131	3,041	4
Chicken	125	2,286	5
Duck (domestic and Muscovy)	57	353	14
Goat	52	1,178	4
Horse	35	1,391	3
Pig	84	1,368	6
Sheep	31	2,385	1
Turkey	5	177	3

Source: FAO.2010. Domestic Animal Diversity Information System (DAD-IS) accessed on 6 April 2010 at http://dad.fao.org/

Figure 1. Risk status of major livestock breeds extant in the ASEAN Region



Source: FAO.2010. Domestic Animal Diversity Information System (DAD-IS) accessed on 6 April 2010 at http://dad.fao.org/.

Critical pressure points for genetic diversity

Replacement of indigenous varieties/ breeds. There is a logical explanation as to why the agricultural genetic resources of Southeast Asia are under pressure from modern agricultural production. In this era where national development strategies are zeroing in on food sufficiency, intensified food production through the use of fast growing species and high yielding varieties (HYV) has been the norm.

Rice, a main staple in the Asian diet, provides a straightforward illustration of this trend. Under the Green Revolution, modern or hybrid rice varieties have been introduced, which undeniably contributed to the ability of countries to stave off hunger and fuelled national growth over the past several decades. However, serious concerns have been raised about the ability of current HYV strains of rice to endure environmental stresses, such as pest and diseases, drought and floods, and more particularly, the projected impacts of climate change. The preference for hybrid varieties rapidly replaced the use of traditional and wild varieties which possess genetic characteristics that are known to be more resilient[25]. The International Rice Research Institute (IRRI) cited that in the 1980s, only two HYVs occupied 98 per cent of the entire rice growing area of the Philippines[26]. Similar patterns have been reported in Cambodia, Myanmar, Thailand and Viet Nam. Such widespread uniformity now finds the region's rice crops in an extremely vulnerable position, especially in the advent of climate change.

A farmer carries rice seedlings ready to be planted in the rice terraces in Mountain Province, Philippines. *Photo by Edgan M. Castañeda*

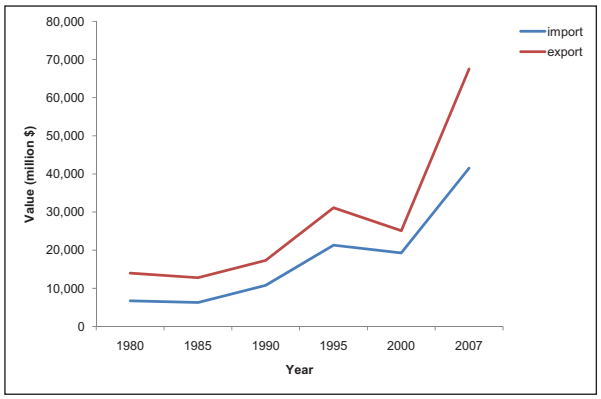
While it is true that a myriad species of plants valuable to humans exist, there are, however, only a few hundred being cultivated or have been domesticated. The FAO cites that merely 12 species provide approximately 75 per cent of the entire human food supply[27]. Nonetheless, what is generally unacknowledged is that the productivity of these relatively few species vitally depends on hundreds of thousands of other plant and animal species, which include insects and birds that pollinate crops and flowers and feed on deleterious pests.

In livestock raising, the intensification of production have also led to the introduction and adoption of exotic, high-yielding breeds, imported mostly from developed countries such as the US, Australia and New Zealand. Most ASEAN Member States, particularly Indonesia, the Philippines and Thailand, have come to depend heavily on these imported breeds, displacing most of the native stock[28].

One of the least acknowledged impacts of intensive livestock-raising is related to its high level input requirements, particularly for feedstock. High yielding breeds are usually raised with feedstock manufactured and processed from grains, so unlike their wild variety counterparts which can survive on free-range feeding. Agricultural food production has come to a juncture not devoted to meeting direct human consumption needs alone. The shift in human consumption that has given rise to the demand for meat, fish and dairy products ushered a demand for the cultivation of grains now meant directly for the consumption of livestock instead. It is estimated that as much as 36 per cent of cereal now being manufactured is intended for animal feed[29]. Such patterns of consumption have ramifications on the production of certain agricultural commodities, which could lead not only to food insecurity, but would impact on environmental sustainability as well.

Globalization of agricultural products. The globalization of the market for a number of agricultural products has added pressure to the intensification of agricultural production in the ASEAN region (Figure 2). With more products of the region finding its way to international markets, there is the incentive to expand production, and eventually, the growth base of the economy. Admittedly, the economic gains from exporting agricultural products cannot be underrated. On the other hand, there is a burgeoning need to address the economics of conserving genetic resources of wilds crops and livestock for a more sustainable existence.

Figure 2. Trends in values of import and export of agricultural products, 1980-2007



Source: FAOSTAT accessed on 5 February 2010 at http://www.faostat.fao.org

Habitat destruction. The intensification of food production has also induced the promulgation of policies allowing the conversion of agricultural areas for non-agriculture use. Since yield per unit of land is understood to appreciate with the use of modern varieties of crops and application of contemporary methods, productive agricultural areas are being opened up to land markets, leading to its conversion for non-agricultural uses.

A case in point is the Philippines. In response to pressures from the reality of urban sprawl, more and more portions of agricultural land are being converted to meet the demands of urban use, *e.g.*, residential, industrial and recreational. The impact of this phenomenon has resulted in the fragmentation of natural agricultural landscapes – breaking up grazing lands and natural waterways for marshes, rivers and inland waters that have ecosystem functions to perform. The conversion of agricultural lands to non-agricultural uses has also displaced wild varieties of crops from its natural habitats.

The impact of such conversions also extends to livestock-raising. Conventional livestock production in the region has been severely affected by the attenuation of grassland areas.

Furthermore, the practice of modern agriculture is associated with the intensive application of fertilizers and pesticides. These have been known to cause nitrification and the pollution of waterways, which have detrimental consequences to the environment. Chapter 3 discusses further the impacts of nitrification and pollution on biodiversity.

Pest infestation and diseases. The occurrence of various pests and diseases, both endemic and epidemic in nature, is capable of wiping out the genetic diversity of crops and livestock. Some instances that may be cited are the infestation of the banana bunchy top virus and the banana mosaic virus, which threatened the diversity of local banana and abaca (Manila hemp) in the Philippines[30]. Livestock in The Lao PDR was affected to a considerable extent by various diseases such as hemorrhagic septicaemia, foot-and-mouth disease, swine fever and the New Castle disease, which also affected chickens in Myanmar to a massive extent. The outbreak of avian influenza caused massive deaths and the culling out of avian species in Cambodia, Indonesia, The Lao PDR, Malaysia, Myanmar, Thailand and Viet Nam[31]. Such vulnerability becomes prominent with a narrowed down genetic diversity of the agro-ecosystems.

National responses

International Treaty on Plant Genetic Resources for Food and Agriculture. Seven out of the ten ASEAN Member States are parties to this treaty[32], which is an international agreement in accord with the Convention on Biological Diversity. The treaty, which entered into force in 2004 primarily to address global food security, provides approaches for easy access to the genetic resources of major food crops, and ensures the fair and equitable sharing of benefits in using these genetic resources. It also promotes the protection of farmers'

rights and traditional knowledge in farming. Just as importantly, it encourages the sustainable use of minor, under-utilized food crops that may provide food and the nutritional needs of a number of people. Once ratified by a country, the creation of commissions and committees that will take charge of the treaty's implementation in accordance with its national laws follows.

International Plant Protection Convention (IPPC). The genetic diversity of important crops continues to be threatened by various pests and diseases. In most cases, the introduction of diseases is brought about by the transfer of plants and plant products from one country to another. Thus, the role of an international binding agreement such as the IPCC is essential. The main objective of this agreement is the prevention of pest and disease infestations by regulating the trade of plants and plant products. As a member of this convention, a country takes an active role in formulating international standards in the trade of its goods[33]. Currently, eight ASEAN Member States are parties to this convention, of which three have already ratified.

Without proper management, some key functions of agrobiodiversity may be lost. The erosion of agrobiodiversity has negative impacts on the long-term sustainability of agricultural systems and on food security, especially of poor populations living in marginal lands. Global environmental change and the daunting possibility of irreversible loss of biodiversity have provided the imperatives for biodiversity conservation, regardless of landscape and ecosystem.

Agriculture depends on biodiversity – as a source of food security for the present and in being an insurance policy for the future. As emphasized in the earlier discussions, genetic diversity, particularly in the wild, can protect crops from future outbreaks of pests and diseases and the looming consequences of climate change, by serving as a pool for the natural and guided selection of new and better strains

Box 3. Mainstreaming Biodiversity in the Agricultural Sector: The Case of Myanmar

IN being an agriculture-based country, Myanmar regards highly the value of plant genetic resources (PGR) to food security. Myanmar's Ministry of Agriculture and Irrigation, through the Department of Agricultural Research, is responsible for collecting and conserving plant genetic resources. Over 3,000 accessions of local rice varieties, along with the germplasms of other crops such as oilseeds, maize and other cereals, have been collected and conserved since the 1980s.

- Several legislations were enacted to raise awareness on conserving agricultural biodiversity. The Pesticide Law, enacted in 1990, created the National Pesticide Registration Board, which serves as the advisory body in pesticide registration. The Plant Pest Quarantine Law was enacted in 1993 to prevent the entry of pests into the country. The Fertilizer Law was enacted in 2002 to manage the country's use of organic and inorganic fertilizers, as well as bio-fertilizers.Moreover, the Seed Law and the Law on Biosafety are currently being drafted, to maintain the quality of seeds and manage its use; and to manage genetically modified organisms as well.

To protect agricultural biodiversity, the following measures are being done:

- Myanmar's Land Use Division promotes soil conservation through the construction of check dams and hedge-row terracing; provides extension education for water harvesting; and forms income generation groups for on-farm, off-farm and non-farm activities to decrease pressure on the land.
- Its Department of Agricultural Research established research stations for the in-situ and on-farm conservation of local plant genetic diversity, wherein a number of researches have already been conducted. To date, a total of 10,108 accessions are preserved in short-term storage, and 9,905 are in medium- to long-term storage.
- Farmers are being encouraged to adopt sustainable agricultural practices, such as organic farming.

Myanmar's Ministry of Livestock Breeding and Fishery is responsible for enacting legislations for the protection of animal genetic diversity. The Animal Health and Development Law, enacted in 1993, contains provisions for preventing dangers to animal feeds, as well as provisions for protection from infectious diseases and cruelty to animals.

Source: Government of the Union of Myanmar. 2009. Fourth National Report to the United Nations Convention on Biological Diversity accessed on 25 May 2010 at http://www.cbd.int/doc/world/mm/mm-nr-04-en.pdf

Box 4. Conserving Agricultural Biodiversity in The Lao PDR

AGRICULTURE is considered as The Lao PDR's most important economic sector, accounting for 44 per cent of the country's GDP. At present, 85 per cent of The Lao PDR's total population relies on agriculture for employment, as cited in The State of Animal Genetic Resources 2007 of the Lao Country Report. Residents from both rural and urban areas rely on the diverse wild species of plants and animals for their daily nutritional needs. It was in this light that conserving the country's agricultural biodiversity became a priority of the Lao Government. In 2004, the National Agricultural Biodiversity Programme (NABP) was endorsed. Furthermore, the country was supported by funds from the FAO/Netherlands Partnership Programme to carry out activities relating to the conservation of its agricultural biodiversity.

The Ministry of Agriculture and Forestry (MAF), through its National Agriculture and Forestry Research Institute (NAFRI) and its research centers, undertook several activities.

- Accession to the International Treaty on Plant Genetic Resources for Food and Agriculture (IPGRFA), a legally-binding treaty that aims to conserve plant genetic resources for food and agriculture and encourage the sustainable use and fair and equitable sharing of its benefits in accordance with the Convention on Biological Diversity. Activities to promote awareness on the importance of conserving agricultural biodiversity and arriving at a better understanding of the IPGRFA were undertaken among concerned government officers and policymakers.
- In recognition of the importance of pollination in agriculture, technical officers of NAFRI were trained and equipped with knowledge on the basics of pollination management, hence, promoting awareness up to the level of individual farmers and extension agents.
- De-worming treatment for local goats, planting Guinea grass and Stylosanthes 184 as forage crops, and training for goat keepers have been provided to improve goat productivity. A curriculum for goat production was produced to enhance the skills and livelihood of goat raisers.

Another important component of the NABP is the sustainable management plan for non-wood forest products (NWFPs). Poor families rely on NWFPs (e.g., tubers, roots and bamboo shoots) for food, as a substitute for rice. The unsustainable management of Lao's forests, its conversion for agricultural use, and the expansion of tree plantations pose a serious threat. In this respect, field activities were conducted employing a participatory management approach in the harvesting, processing, marketing, domestication and cultivation of NWFPs.

Finally, the integration of agricultural biodiversity conservation concerns into an Environmental Impact Assessment procedure has been another notable feature of the NABP.

Sources:

1. FAO. 2008. Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e00.pdf
2. FAO. 2008. The International Treaty on Plant Genetic Resources for Food and Agriculture in Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e01.pdf
3. FAO. 2008. Pollination in agriculture in Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e02.pdf
4. FAO. 2008. Livestock diversity in The Lao PDR in Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e05.pdf
5. FAO. 2008. Enhancing food security through sustainable management plan for non-wood forest products in Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e06.pdf
5. FAO.2008. Environmental impact assessment: integrating agricultural biodiversity in Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e08.pdf

of organisms. The diminution of such diversity not only endangers agriculture *per se.* More critically, it poses a threat to all living organisms on earth[34].

Wetland Ecosystems

Wetlands, as one of the most biologically productive natural ecosystems, are comparable to coral reefs in vibrancy. These are areas where water primarily controls the environment and its associated flora and fauna. Wetlands serve as a habitat for myriad plants and animals, including many endangered and threatened species. The presence or absence of water in wetlands during seasonal changes impacts considerably on the life cycle of native organisms. Scientists now realize the value of this ecosystem in moderating global climate, as it naturally stores carbon within plant communities and the soil.

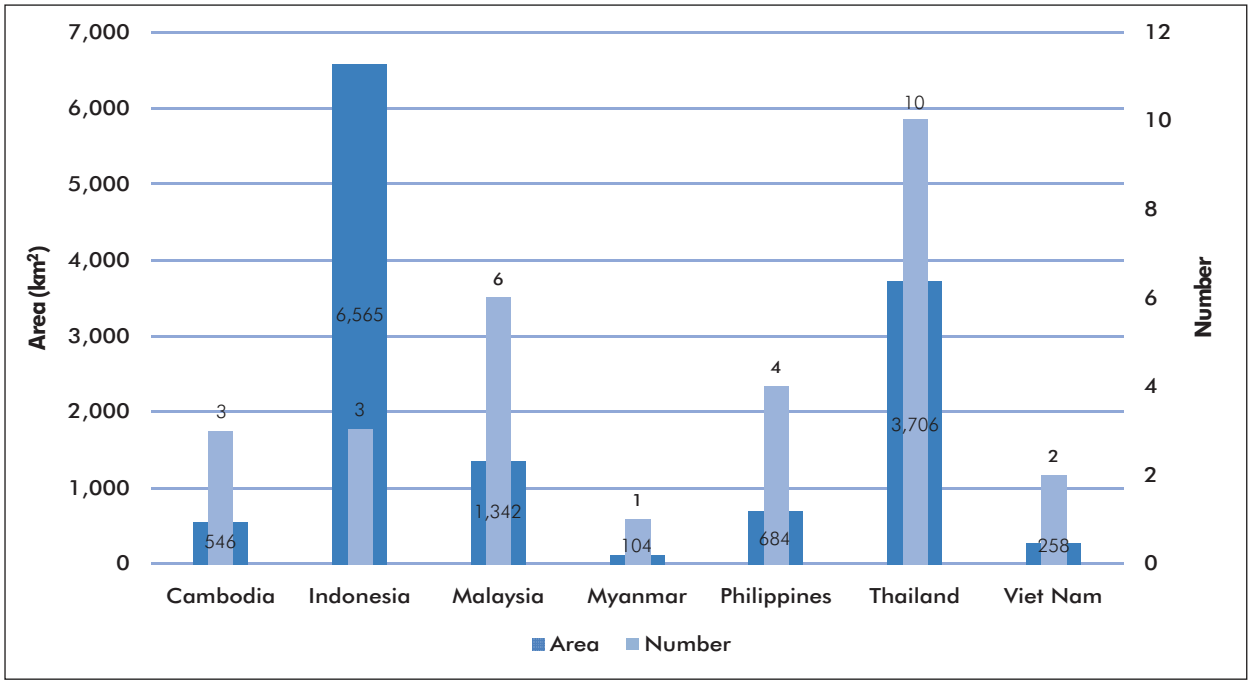
Due to an increasing awareness and understanding of the wetlands' multiple roles and benefits to humanity, national and global initiatives have been intensified to restore the lost or degraded hydro-biological functions of wetlands. The Convention on Wetlands of International Importance, especially as Waterfowl Habitat (Ramsar Convention) of 1971 has set the stage for globally recognizing the value of the wetlands ecosystem. The Ramsar Convention is "an intergovernmental treaty that embodies the commitments of its member countries to maintain the ecological character of their Wetlands of International Importance and to plan for the wise use, or sustainable use, of all of the wetlands in their territories." Article 1.1 of the Convention defines wetlands as "areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water, the depth of which at low tide does not exceed six meters".

In the ASEAN region, eight of the ten member states are parties to the Ramsar Convention and have given due recognition to the special attributes of wetlands. From 26 Ramsar sites in 2005, three more wetlands from Malaysia and Indonesia were added to the list. As of 2008, Ramsar sites within the ASEAN Member States numbered up to 29, with a total area of 13,204 square kilometers. Thailand, Malaysia and the Philippines are the top three countries with the most number of Ramsar sites in the region (Figure 3). In terms of total area, however, Indonesia has the largest, at 6,565 square kilometers; followed by Thailand with 3,706 square kilometers; and Malaysia with 1,342 square kilometers (Figure 4).

Of the 29 Ramsar sites in the region, eight are marine (*i.e.,* coastal lagoons, rocky shores and coral reefs), seven are estuarine (*i.e.,* deltas, tidal marshes and mangrove swamps), six are lacustrine (*i.e.,* lake-associated), five are riverine (*i.e.,* found along rivers and streams), and three are palustrine (*i.e.,* swamps and bogs).

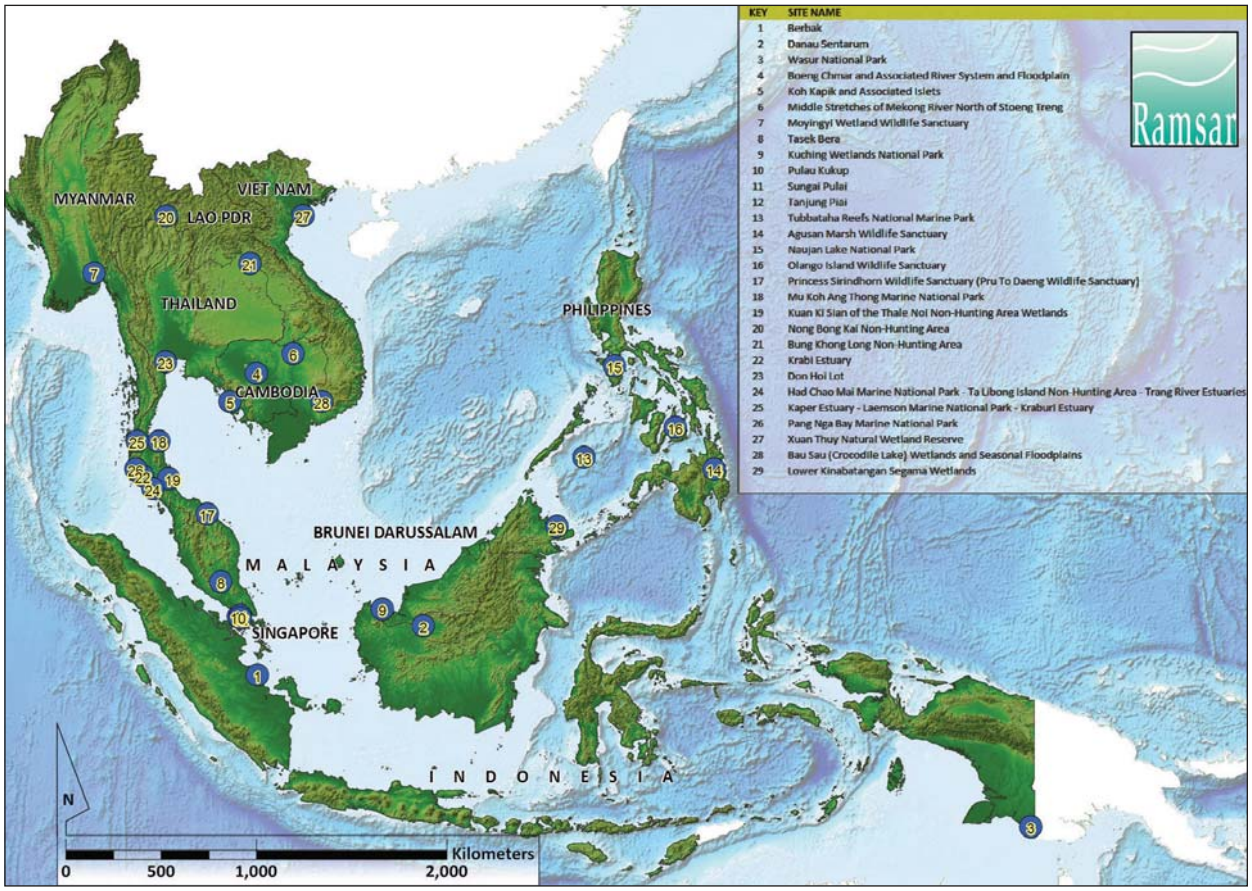
Through the years, the establishment of Ramsar sites has been sporadic (Figure 5). Southeast Asia began establishing Ramsar sites from a total of 120 square kilometers in 1988 to 1,627 square kilometers in 1992. A lull in establishing new sites was experienced from 1995 to 1998, during which only a mere five square kilometers were additionally recognized. From 1999 to 2008, Southeast Asia increased its Ramsar sites to 29, covering a total

Figure 3. Distribution and number of Ramsar sites in Southeast Asia, 2008



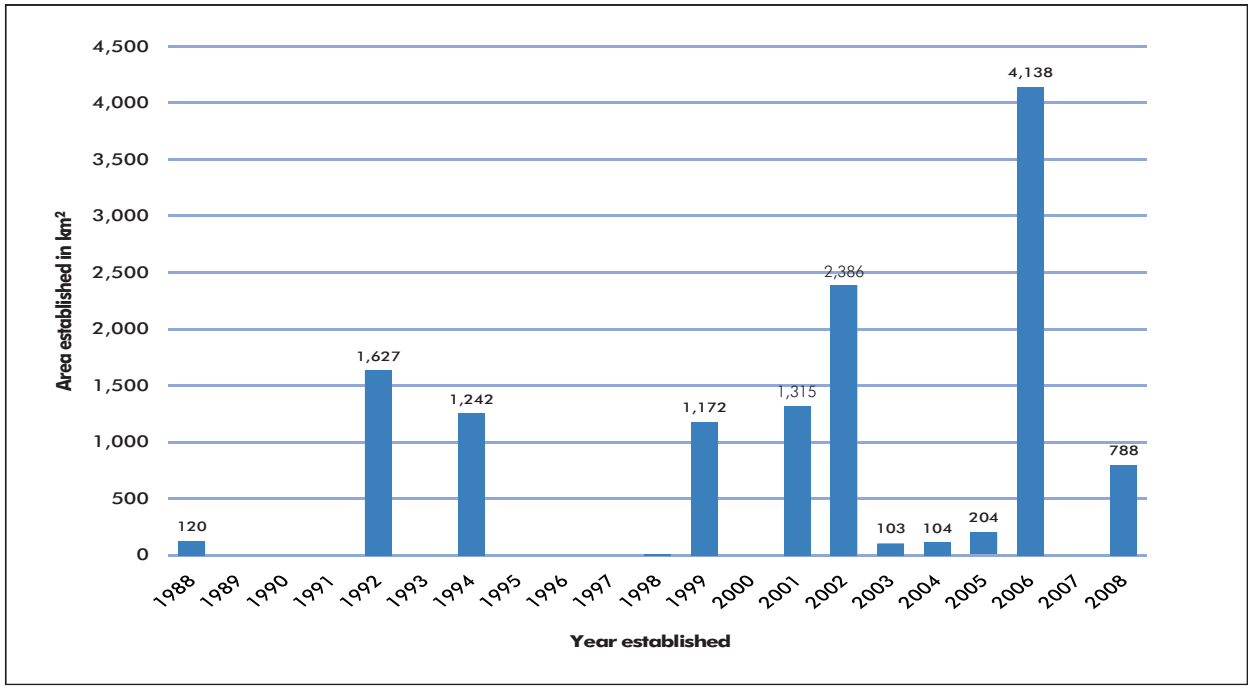
Source: The Ramsar Convention on Wetlands accessed on 1 March 2009 at http://www.ramsar.org

Figure 4. Ramsar sites in Southeast Asia, 2008



Source: The Ramsar Convention on Wetlands, accessed on 1 March 2009 at http://www.ramsar.org

Figure 5. Recorded area coverage of Ramsar sites in the ASEAN region, 1988-2008



Source: The Ramsar Convention on Wetlands, accessed on 1 March 2009 at http://www.ramsar.org

of 13,000 square kilometers. Figure 5 shows the trend in site establishment from 1988 to 2008 and the location of the 29 wetlands of the ASEAN Member States. The three sites added to the RAMSAR list after 2005 are the following: 1) Wasur National Park, Indonesia; 2) Lower Kinabatangan-Segama Wetland; and 3) Kuching Wetlands National Park, both in Malaysia.

Wetlands in the ASEAN region are under extreme pressure by factors originating from human activities. Urban expansion (e.g., land reclamation), wetlands conversion (i.e., for aquaculture), pollution, sedimentation and siltation are among the most common factors affecting wetland ecosystems.

The Kinabatangan Wetland Reserve in Sabah, Malaysia has long been at risk from the cultivation of oil palm. Declared as a Ramsar site in November 2008, the wetlands continue to be under pressure from the expansion of agricultural plantations. Not only are the wetlands being marginalized morphologically in terms of size, but likewise chemically, as agricultural fertilizers and pesticides borne by surface run-off get deposited in the wetlands, polluting the habitats and nesting areas of the flora and fauna.

Global warming and climate change have become the immediate global threat[35]. Changing climate patterns have reduced rainfall in many wetlands, resulting to lower water levels, even to the point of parchment of some areas. Other areas experience excessive rainfall, resulting to higher water levels and flooding. Either way, the life cycles and reproductive patterns of many organisms are affected. In higher latitudes in Asia, the migration of avifauna has been commencing uncharacteristically earlier, and the early onset of reproduction has likewise been observed. The timing of the nesting season *vis-à-vis* the period of food availability is also becoming a problem for more and more species.

Still, the largest threat to the resilience of intertidal wetlands to climate change is the presence of barriers that would prevent its landward migration[36, 37]. Barriers to the landward migration of intertidal communities may be imposed by natural features (*e.g.*, steep slopes). However, urbanization, agriculture and other human activities that build berms, bunds, seawalls and roads on coastal plains impose significant threats on intertidal commu-

A mother gives her child drinking water amid a parched land. The rapidly changing climate patterns have reduced rainfall in many wetlands in the ASEAN region and elsewhere in the world. *Photo by Tun Aung*

Wetlands are among the most biologically productive natural ecosystems. *Photo by Harazek*

nities such as mangroves, salt marshes and salt flats. Barriers also reduce connectivity between ecosystems and overall productivity[38].

Peatlands: An increasingly valuable ecosystem

Peatlands are unique, complex ecosystems of global importance for biodiversity conservation. At the species and genetic level, peatlands play a special role in maintaining biodiversity as a result of habitat isolation. At the ecosystem level, its value lies in its ability to self-organize and adapt to different physical conditions.

Peatlands develop sophisticated self-regulation mechanisms over time, resulting in high within-habitat diversity, such as forest vegetation gradients in domed peat swamps. These ecological units are important for biodiversity far beyond their borders by maintaining the hydrological and microclimate features of adjacent areas and providing temporary habitats or refuge areas for dryland species[39].

Many species found either only or mainly in peatlands are adapted to its special acidic, nutrient-poor and water-logged conditions. The organisms are vulnerable to changes resulting from direct human intervention, to the external impacts of changes in their river basins and to climate change, which may lead to loss of habitats, species and associated ecosystem services.

Peatlands are often the last remaining natural areas in degraded landscapes and thus mitigate landscape fragmentation. It also supports adaptation by providing habitats for endangered species and those displaced by climate change.

The importance of peatlands for maintaining global biodiversity is usually underestimated right from the basic level of local conservation planning and practices, up to the crafting of national policies and development plans, and international convention deliberations and decisions. Its unique attributes require special consideration within conservation strategies and land-use plans[40].

The total area of peatlands in Southeast Asia is estimated to be about 250,000 square kilometers, which is 60 per cent of the world's tropical peatlands[41], and about a tenth of the total global peatland resource[42]. Majority of the peatlands in the region are located in Indonesia, which has over 70 per cent of the total peatland cover of Southeast Asia[43]. Other major peatland areas are found in Malaysia, Brunei Darussalam, Thailand, Viet Nam and the Philippines. Peatlands are usually found in low altitude, sub-coastal areas extending inland to distances of up to 300 kilometers. The depth of peat varies from 0.5 to more than 10 meters. Accelerated development, land conversion and degradation caused by land and forest fires have reduced the region's peatland resources significantly over the past few years[44, 45].

Ecosystem diversity and species diversity within peatlands. A diversity of peatland ecosystems are found within Southeast Asia due to bio-physical and geographic factors that influence their existence. There is a need for systematic description, classification and registration at the regional level. Natural peatland ecosystems in the region are mainly peat swamp forests and associated marshes[46, 47].

Peat swamp forests are considered to be an ecological succession of freshwater swamp forests, where conditions are such that forest debris accumulate into a peat layer which may raise the soil into a convex mound[408, 49]. Some of the most highly developed peat swamps occur in northern Borneo, distinguished into six phasic communities in the development of the peat swamp forest[50]. But it is also not clear that the peat of one floristic region is identical or ecologically equivalent to that of another[51]. The region contains a diversity of peatland ecosystems, each with its own distinctive characteristics, including variations in plant and animal communities[52, 53]. Each area of a swamp forest, therefore, needs its own particular investigation. The ecological and floristic heterogeneity of peat swamp forests has vital implications in biodiversity conservation.

Factors that influence peatland ecosystem diversity include the following: bio-geographical location, elevation (*i.e.*, lowland or highland), local climate, topographical situation (*e.g.*, coastal domed swamps, riverine swamps, etc.), underlying soil types, the depth of the peat layer, and finally, its nutrient status[54, 55].

Representative areas of the different peatland ecosystems should be included in national protected area systems, as well as in international site networks similar to the Ramsar Convention's List of Wetlands of International Importance.

But the diversity of ecosystems is of equal significance to species diversity in this ecosystem. Tropical peat swamp forests generally support a less rich flora than comparable areas of dryland forest, owing to their challenging growing conditions which, in most cases, entail permanent or frequent flooding, unstable soil and low nutrient availability.

As an example, in Peninsular Malaysia, while most of the tree families of the lowland evergreen dipterocarp forest are found in peat swamp forests, species are restricted in number and only in this habitat. The shrub layer is sparse with ground flora comparatively poor, the canopy height is lower than lowland forests thriving on mineral soils, and structural adaptations occur such as buttresses, stilt roots, and kneed pneumatophores – or protruding roots[56].

Some commercially important tree species are mainly restricted to peat swamp forests, notably the Ramin *(Gonystylus bancanus),* now listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) as a consequence of over-exploitation; the Kempas *(Koompassia malaccensis),* one species of Durian *(Durio carinatus)* and some species of Meranti *(Shorea uliginosa, S. teysmanniana,* and *S. platycarpa).* Globally-threatened tree species occurring in Southeast Asian peat swamp forests include *S. platycarpa, Dipterocarpus chartaceus* and *Hopea mengerawan* (all listed as Critically Endangered), *S. albida* (listed as Endangered) and *G. bancanus* (listed as Vulnerable)[57, 58].

The wildlife conservation values of peat swamp forests are also immense. Populations of some globally threatened species in the peat swamp forests of Southeast Asia include the following: orang-utan *(Pongo pygmaeus),* proboscis monkey *(Nasalis larvatus)*, leopard *(Panthera pardus),* tiger *(Panthera tigris),* flat-headed cat *(Prionailurus planiceps),* otter *(Civet Cynogale bennettii),* Sumatran rhinoceros *(Dicerorhinus sumatrensis),* Malayan tapir *(Tapirus indicus),* Asian elephant *(Elephas maximus),* Malayan false gharial *(Tomistoma schlegelii),* Asiatic softshell turtle *(Amyda cartilaginea)*, painted terrapin *(Callagur borneoensis),* Bornean river turtle *(Orlitia borneensis),* Storms stork *(Ciconia stormi),* lesser adjutant *(Leptoptilos javanicus),* wrinkled hornbill *(Aceros corrugatus),* Asian bony-tongue *(Scleropages formosus),* and several others.

Peat swamp forests support specialized species and communities, such as the diverse blackwater fish communities, the *Betta spp.* which is an endemic species of Malaysia, and a number of others only recently discovered in peat swamp forest waters. Rare species such as the *Chaca bankanensis* have also been recorded[59, 60].

Peat swamp forests are heterogeneous in terms of both flora and fauna, thus, different

Protecting natural resources helps ensure that future generations will continue to benefit from the bounty of biodiversity. *Photo by Ariebasuki*

areas support different species assemblages. The distribution of peat swamp forests also cover a large geographical area, therefore, bio-geographical differences in flora and fauna occur across the region[61, 62].

Conversion of peatlands for human activities*. For thousands of years, humans have directly utilized peatlands to support their existence, leading to differing and varying degrees of impact. Generally, peatlands have been used for agriculture, both as grazing lands and for growing crops. However, as societies have grown, the value and use of peatlands have changed correspondingly. Large areas of tropical peatlands have in recent years been cleared out and drained off for food crops and cash crops, such as oil palm and other plantations. Many peatlands are exploited for timber or drained off for plantation forestry. Peat is being extracted for industrial and domestic fuel, as well as for use in horticulture and gardening. Peatlands also play a key role in water storage and supply, and in flood control[63, 64].

Many indigenous cultures and local communities, such as the Desa Bantayan Villages in the Riau Province of Sumatra, Indonesia, the Pyin Oo Lwin township in the central flatlands and the Shan Plateau of Myanmar, and the U Min Ha Peatland Forest communities in Viet Nam depend heavily on peatlands for their survival. Peatlands also provide a wealth of valuable goods and services to industrial societies, such as livelihood support, carbon storage, water regulation and biodiversity conservation[65].

The ecological value of peatlands is inadequately recognized, which is one of the root causes of degradation and conflicts about its uses. The deterioration of peatlands resulted in major economic losses and social impacts, and has created tension among key stakeholders at local, regional and international levels[66, 67].

Peatlands are also the last expanses of undeveloped land that remain unbound by private ownership, so much so that these are increasingly being targeted by development projects that seek large tracts of land for airports, plantations, windfarms and reservoirs[68].

Vulnerability of peatlands from fires. Draining peatlands for agriculture, logging operations, land reclamation for housing and industry, and flood mitigation dramatically increases its vulnerability to fire – one of the most significant causes of peat degradation and Green House Gases (GHG) emissions. Fire does not normally occur continuously, but when burning does take place, it may lead to the emission of up to 40 tons of carbon dioxide/km2 in the tropics, and 20 tons of carbon dioxide/km2 in temperate regions[69, 70].

* The systematic analysis of threats to biodiversity is an important foundation for the design of conservation strategies and plans at various levels. Some tools are available to assist in the classification of threats and processes of threat analysis. For a classification of direct threats, the International Union for Conservation of Nature's Conservation Measures Partnership (IUCN-CMP, 2006) identified 11 direct threats and these are: 1) residential and commercial development; 2) agriculture and aquaculture; 3) energy production and mining; 4) transportation and service corridors; 5) biological resource use; 6) human intrusions and disturbance; 7) natural systems modifications that include fire and fire suppression, dams and water management use, and other ecosystems modification; 8) invasives and other problematic species and genes; 9) pollution; 10) geological events such as earthquakes, volcanic eruptions, tsunamis, landslides; and 11) climate change and severe weather.

Peatland fires are becoming more frequent in Southeast Asia. These are generally the result of accelerated rates of land clearings as well as the large-scale drying up of peatlands. About two-thirds of peatlands in the region are over-utilized or degraded. Fires have been persistent, with many keeping ablaze between one to three months, leading to massive carbon emissions[71].

Indonesia is now considered to have the third highest carbon emissions globally, primarily as a result of recurrent peatland fires[72].

Periods of high vulnerability are during regional dry spells or droughts, usually associated with the El Niño Southern Oscillation. Huge fires, engulfing enormous areas of peatlands as well as dryland forests, took place during the extreme El Niño period in 1981 to 1982 and 1997 to 1998, affecting particularly the peat swamp forests in the islands of Borneo and Sumatra[73]. More than 30,000 square kilometers of Southeast Asia's peatlands were burnt in the past ten years, causing economic losses of USD800 million in 1997/98[74] and generating smoke clouds covering the equivalent of up to five countries, triggering major health and environmental concerns[75, 76].

However, accidental fires as well as widespread smaller fires have recently become frequent occurrences during the dry season owing to land clearings for agriculture and plantation development. Significant conflagration with associated transboundary haze took place in the relatively dry years of 2002, 2005 and 2006[77, 78].

Effects of climate change. Climate strongly influences the form and function of peatlands and the distribution of peatland species. Natural peatlands were typically resilient to climate changes in the past because of their adequate vegetation cover. However, the rate and magnitude of predicted future climate changes and extreme events (*e.g.*, drought, fires, flooding and erosion) may push many peatlands over their threshold for adaptation[79] due to the degraded condition of the peatland ecosystem.

Vegetation clearing, the draining-off of water, and grazing on peatlands have increased their vulnerability to climate change.

The strong relationship between climate and peatland distribution suggests that future climate change will exert a strong influence on this ecosystem. Predicted climate change outcomes of particular relevance to peatlands include rising temperatures; changes in the amount, intensity and seasonal distribution of rainfall; and reduced extent of snowfall in high latitudes and mountain areas. These changes will have significant impacts on peatland carbon stores, greenhouse gas fluxes and biodiversity. The projected impacts of climate change on the region's peatlands are as follows:

- Increasing temperatures will affect peatland primary productivity in the form of lengthened growing seasons.
- Decay rates of peat will increase as a result of rising temperatures, potentially leading to increased methane (CH4) and carbon dioxide release. Changes in rainfall and water balance will affect peat accumulation and decay rates. Peat swamp forests in Southeast Asia store an average of 20 tons of carbon/km2. Malaysia, with more than 25,000 square kilometers of peatlands, may have a peatland carbon store of more than five billion tons, making peatlands the most important ecosystem carbon store in the country.
- Increased rainfall intensity may increase peatland erosion. This may likewise be amplified by the anthropogenic draining off and overgrazing of peatlands.
- Greater drought will lead to an increase in fire frequency and intensity, notwithstanding that human activity is expected to remain as the primary cause of fire.
- Hydrological changes, combined with temperature rise, will have far-reaching effects on greenhouse gas exchange in peatlands. Drier surfaces will emit less methane, more nitrogen, and more carbon dioxide; and conversely for wetter surfaces.
- The inundation of coastal peatlands may result to losses of both biodiversity and habitats, as well as to increased erosion, but local impacts will depend on rates of surface uplift.
- The combined effect of changes in climate and resultant local changes in hydrology will have consequences on

Box 5. ASEAN Peatland Management Strategy: 2006-2020

THE ASEAN Peatland Management Strategy (APMS) was endorsed by the Tenth Meeting of the ASEAN Ministers on Environment in 2006. This regional strategy provides a framework for all those with responsibilities for/commitments to: the sustainable management of peatlands, its wise use, the prevention of fires, and its rehabilitation.

The four general objectives of the strategy are as follows: 1) enhancement of awareness and capacity building; 2) addressing transboundary haze pollution and environmental degradation; 3) promotion of the sustainable management of peatlands; and 4) promotion of regional cooperation.

The ASEAN Member States adopted the APMS in November 2006 to act as a framework guide for the sustainable management of peatlands in Southeast Asia. Responding to this, the ASEAN Member States are currently undertaking assessments of and/or developing national action plans for their respective peatland resources. At present, Indonesia, Malaysia, the Philippines and Thailand have identified peatlands in some of their respective Ramsar wetland sites.

The activities in addressing transboundary haze pollution and environmental degradation are guided by the ASEAN Agreement on Transboundary Haze Pollution signed in June 2002 and the Guidelines for the Implementation of the ASEAN Policy on Zero Burning done in 2003.

An International Meeting on the Rehabilitation and Integrated Management of Tropical Peatlands was held on 25 November 2009. The meeting discussed the draft Handbook for the Conservation and Management of Peatland Biodiversity in Southeast Asia, and specific issues and gaps that relate to peatland biodiversity conservation in: 1) regional development and land use planning; 2) forestry, agriculture, plantations and fisheries; and 3) water management and fire control. The final recommendations consist of three main steps: 1) make slight revisions to the draft document and put this up in the peat portal to invite further comments; 2) produce awareness materials for the various target audiences; and 3) set a deadline for the submission of comments and finalize the document.

the distribution and ecology of plants and animals that either inhabit or use peatlands to a significant degree in their life cycles.

On top of all these, human activities will increase peatland vulnerability to climate change in many areas. In particular, the draining, burning and over-grazing of this ecosystem will increase the loss of carbon from oxidation, fire and erosion[80].

Inland Waters: The next flashpoint

Freshwater ecosystems, as McGraw Hill[81] defines it, are bodies in which the waters of streams, rivers, ponds or lakes play an influencing and defining role. These are also the habitat of many aquatic (*e.g.,* fish, freshwater shrimps, *etc.*) or amphibious (*e.g.,* frogs, dragonflies, mosquitoes, *etc.*), reptilian (*e.g.,* turtles, snakes, crocodiles, *etc.*) and vegetative species that depend on the availability of freshwater to survive.

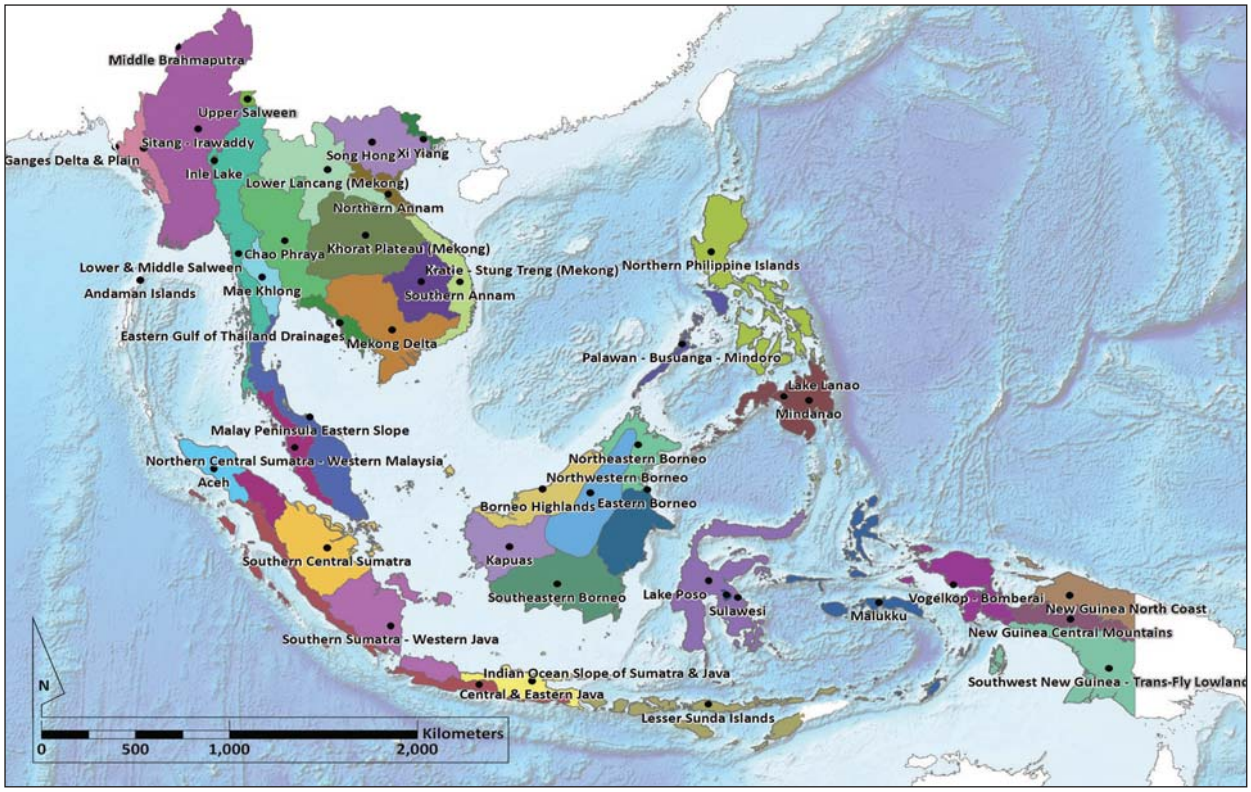
Freshwater species and habitats worldwide are more imperiled than their terrestrial counterparts. The lack of attention to this ecosystem may largely be attributed to the absence of a comprehensive and integrated data on the distributions of freshwater species[82]. Compared to better-studied terrestrial taxa, existing global species-level data have covered only the largest river basins or select hotspots, rather than all inland waters. Additionally, these data integrations are not enough to describe biogeographic patterns[83].

Currently, the Freshwater Ecoregions of the World (FEOW) database provides the only collateral and comprehensive information on freshwater ecosystems. Efforts are ongoing to populate the current database in order to establish the characteristics of each identified ecoregion.

The FEOW is a collaborative project involving the World Wide Fund for Nature (WWF), The Nature Conservancy, the Fishbase of the World Fish Centre, and the IUCN, providing the first biogeographic regionalization of the world's freshwater biodiversity.

A freshwater ecoregion is a large area encompassing one or more freshwater systems that contains a distinct assemblage of natural freshwater communities and species. The FEOW synthesizes data on both biodiversity and threats for areas that will eventually be identified as freshwater ecoregions. The freshwater species, dynamics and environmental conditions within a given area, in together being notably similar as compared to other areas, will form a freshwater

Figure 6. Freshwater ecoregions of Southeast Asia

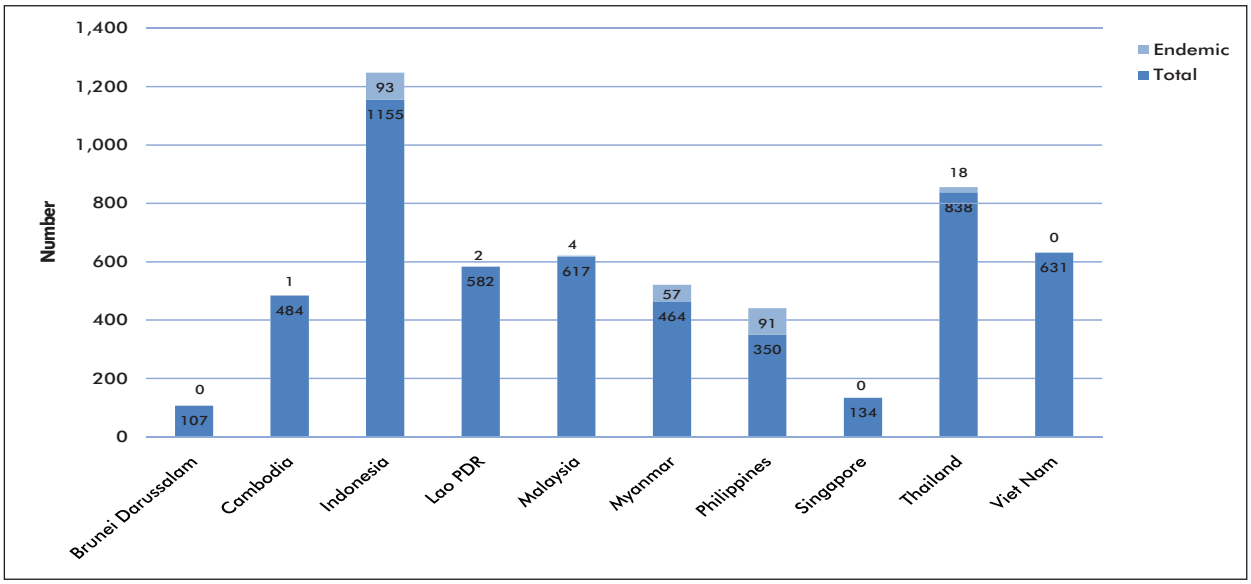


Source: Freshwater Ecosystems of the World (www.feow.org).

conservation unit. Figure 6 shows the different freshwater ecoregions in Southeast Asia.

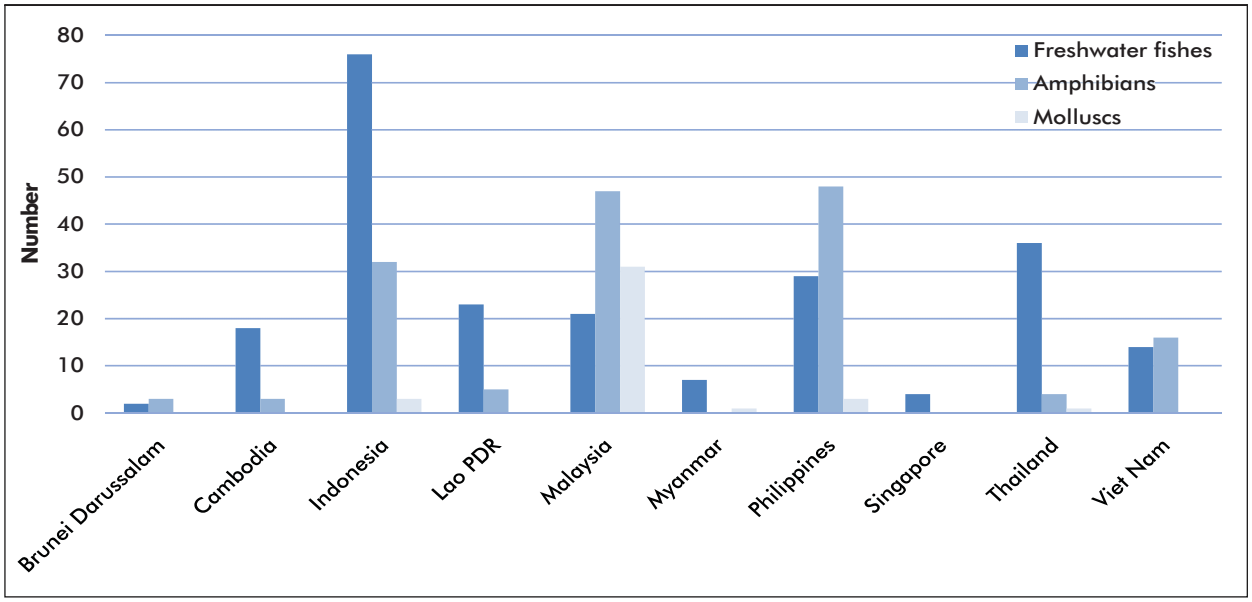
Endemic freshwater fishes make up a small proportion of the total number of freshwater fish species in South East Asia. Indonesia has the highest percentage of endemicity (35 per cent), followed by the Philippines (34 per cent), and Myanmar (21 per cent). The rest of the countries have an endemicity ranging from 7 per cent to zero (Figure 7).

Figure 7. Proportion of endemic fish species in the freshwater ecosystems of Southeast Asia



Source: FishBase accessed on 12 August 2010 at http://www.fishbase.org

Figure 8. Distribution of threatened species in Southeast Asia (by taxa)



Source: IUCN Red List of Threatened Species version 2010.1 accessed on April 29, 2010 at http://www.iucnredlist.org
Note: Species include critically endangered, endangered and vulnerable.

Similarly, in the three major taxonomic groupings of amphibians, fish and molluscs, freshwater fish species remain among the most threatened (Figure 8). Indonesia tops the ASEAN Member States in having the most number of threatened species, followed by Thailand and the Philippines. Amphibians, on the other hand, are more at risk in Malaysia and Philippines. Only a few species of amphibians are threatened in the Indonesia, Viet Nam and the other ASEAN Member States. Molluscs are most threatened in Malaysia.

Freshwater ecoregions. In the Southeast Asian Freshwater Ecoregion may be found the Indo-Malaya Realm and the Australasia Realm[84]. The Indo-Malaya Realm has 29 freshwater ecoregions comprised of four major habitat types, namely: 1) tropical and subtropical coastal rivers; 2) montane freshwater; 3) tropical and subtropical floodplain rivers and wetland complexes; and 4) tropical and subtropical upland rivers. On the other hand, the Australasia Realm has three freshwater ecoregions, with only one habitat type. Its tropical and subtropical coastal rivers are located in Sulawesi and the East Timor subregion, nearer the northern part of the Australian subcontinent (see Box 6).

In describing the biodiversity of the freshwater ecoregions, the FEOW relied only on the

Box 6. Australasia Realm

THIS REALM is composed of the three freshwater ecoregion island groups of the Lesser Sunda Islands (Indonesia and East Timor), the Malukku (Indonesia) and Sulawesi. It has only one habitat type – the tropical and subtropical coastal rivers.

The species richness of this subregion comprises 66 freshwater fish, two species of crocodiles, four species of turtles and a high variability of amphibians ranging from 20 to 35 species. In Southeast Asia, the most common crocodiles are the *Crocodilus porosus* (also known as the saltwater crocodile) and the *Crocodilus mindorensis*. A freshwater crocodile once common in Southeast Asia, but which is now extinct in 99 per cent of the areas it once roamed, is the Siamese crocodile *(Crocodylus siamense)*. However, some Siamese crocodiles of pure-breed were discovered to be in captivity in Cambodia[85].

There are about 27 species of freshwater fish that are endemic to the subregion, a single endemic species of turtles and 14 endemic species of amphibians.

species richness of four freshwater organisms as indicators: fish, crocodile, turtles and amphibians. The dearth of information and lack of an accurate inventory is constraining efforts for a comprehensive conservation planning of the ecosystems in those areas. Clearly, increased attention in the assessment of freshwater biodiversity is an imperative for the region.

The Millennium Ecosystem Assessment (MA) considers freshwater ecosystems to be among the most threatened on earth, even while noting that quantitative information on species richness and responses to anthropogenic pressures are still largely unknown[86]. The report takes into account the impacts on freshwater ecosystem biodiversity of eutrophication, acidification and the changing nature of river discharge. It is projected that 70 per cent of the world's rivers, especially those at higher latitudes, will experience increasing amounts of flowing water as precipitation intensifies from climate change. Consequently, it is anticipated that such an occurrence will heighten the potential for the production of fishes adapted to higher flow habitats, which, although of low certainty, could involve non-indigenous species.

The remaining 30 per cent of rivers worldwide will receive decreasing amounts of flowing water from the combined effects of climate change and water withdrawal[87]. Although current information will need further enhancement, estimates using present levels of data would lead to eventual loss of fish species from these basins ranging (at equilibrium) from 1 - 55 per cent by 2050 (or 1 - 65 per cent by 2100)[88]. The projections also assert that climate change, rather than water withdrawal, shall be the major driver of species losses from most basins (80 per cent), accounting to 1 - 30 per cent by 2050 (or 1 - 65 per cent by 2100) from climate change alone[89].

It is important to note that projected loss of fish biodiversity on the basis of declining water availability alone will be underestimated. The discussion below on threats will support this view. However, most likely to be affected by biodiversity loss shall be rivers and lakes in drying regions where vulnerability would worsen stemming from increasing temperatures, eutrophication, acidification and intensifying invasions by non-indigenous species[90]. The combined impact of these factors will exert tremendous pressure on native biodiversity. Furthermore, higher declines in freshwater biodiversity are likely to come from drivers that are difficult to monitor, *e.g.*, local overfishing, the construction of dams and impacts of alien invasive species[91]. Rivers forecasted to lose fish species shall be among the developing tropical and subtropical countries' most affected, where the needs for human adaptation are most likely to exceed governmental and societal coping capacities. The current average GDP in countries with declining water availability is about 20 per cent lower than in countries whose rivers are not drying up[92].

Six parameters of threat were used in determining the degree of stress in freshwater ecoregions[93]:

1. Human Footprint (HF) is an index that combines and averages the values of three factors: population pressure, land use with infrastructure and human access;
2. Urban Land Cover (ULC) is the percentage of area covered by urban settlements;
3. Irrigation (Irrig) is the percentage of land equipped with irrigation structures;
4. Large Cities (LC) pertain to number of cities with over a 1,000,000-population;
5. Converted Lands (CL) is the percentage of land converted to other uses; and
6. Surface Water Abstraction (SWA) is water stress defined as the ratio of water use to water availability.

Table 14 summarizes the impacts of these threats.

Note that Surface Water Abstraction (SWA) pertains to pressure on a river or lake. At present, all freshwater ecoregions are not suffering from this threat factor, implying that there is still a huge supply of freshwater in the region. It must be noted that in specific locations along a freshwater body, there may be some extraction activities. However, water use may not be enough to stress the entire length of the river. This is also true with respect to irrigation facilities. The Central and Eastern Java ecoregion has the highest percentage of land area equipped with irrigation facilities, at

Table 14. Freshwater ecoregions showing the different threat impacts in the Indo-Malaya Realm in Southeast Asia (higher number = larger impact)

Major Habitat Type	Ecoregion	HF (average value)	ULC (%)	LC (number)	Irrig (%)	CL (%)	SWA
Montane fresh water	Northwestern Borneo (Brunei Darussalam, Indonesia, Malaysia)	19.3	2.3	0	0.2	26.1	no stress
	Eastern Gulf of Thailand (Cambodia, Thailand)	26.4	3.5	0	2.2	33.5	no stress
	Kapuas (Indonesia)	22.7	0.4	0	0.1	48.7	no stress
	Southeastern Borneo (Indonesia)	22.6	0.6	0	0.1	37	no stress
	South-Central Sumatra (Indonesia)	27.5	1.2	0	1.1	47.3	no stress
	Southern Sumatra - western Java (Indonesia)	33.3	4.9	5	5.7	75.5	no stress
	Western Sumatra and Java (Indonesia)	32.4	2.5	0	8	46	no stress
	Northern Central Sumatra - Western Malaysia (Indonesia, Malaysia, Thailand)	30.8	10.1	2	4	64.3	no stress
	Borneo Highlands (Indonesia, Malaysia)	14.8	0.1	0	0.1	5	no stress
	Northeastern Borneo (Indonesia, Malaysia)	24.1	1.6	0	0.2	34.7	no stress
	Northern Annam (The Lao PDR, Viet Nam)	27.4	0.6	0	4.9	27.4	no stress
	Malay Peninsula Eastern slope (Malaysia, Myanmar, Indonesia, Thailand, Singapore)	26.8	5.5	1	3.9	55.9	no stress
	Lake Inle (Myanmar)	17.8	0	0	4.7	25.4	no stress
	Lake Lanao (Philippines)	30.7	4.6	0	16.3	67.5	no stress
	Mindanao (Philippines)	32.5	2	0	3.4	66.1	no stress
	Palawan-Busuanga-Mindoro (Philippines)	28.8	0.5	0	2.9	61.5	no stress
	Northern Philippine Islands (Philippines, Indonesia)	35.3	3.8	2	6.1	70.6	no stress
	Southern Annam (Viet Nam)	27.1	1.2	0	3	33.1	no stress
Tropical and sub-tropical coastal rivers	Large River Delta, Mekong (Cambodia, Thailand, Viet Nam)	25.9	1.8	2	10.2	54.3	no stress
	Aceh (Indonesia)	27.3	2.1	0	2.5	34.1	no stress
	Central and Eastern Java (Indonesia)	41.3	15.9	3	21.6	69.3	no stress
	Eastern Borneo (Indonesia)	19.6	0.5	0	0.1	18.2	no stress

Continued next page

Table 14. Freshwater ecoregions showing the different threat impacts in the Indo-Malaya Realm in Southeast Asia (higher number = larger impact) (continuation)

Major Habitat Type	Ecoregion	HF (average value)	ULC (%)	LC (number)	Irrig (%)	CL (%)	SWA
Tropical and sub-tropical floodplain rivers and wetland complexes	Kratie-Stung Treng Mekong (Cambodia, The Lao PDR, Viet Nam)	19.1	0.4	0	0.5	14.5	no stress
	Song Hong (The Lao PDR, Viet Nam, China)	27.1	2.2	1	5.6	46.1	no stress
	Lower Lancang Mekong (Myanmar, The Lao PDR, Thailand, Viet Nam, China)	19.7	0.7	0	2.1	25	no stress
	Sitang-Irawaddy (Myanmar, China, India)	20	1.1	1	3.8	32.6	no stress
	Chao Phraya (Thailand)	23.9	7.1	1	15.7	50.4	no stress
	Mae Khong (Thailand)	22.5	4.9	0	13.8	37	no stress
Tropical and sub-tropical upland rivers	Khoret Plateau Mekong (The Lao PDR, Thailand)	23.9	2.8	0	4.5	61.1	no stress

Source: Freshwater Ecoregions of the World accessed on 11 January 2009 at http://www.feow.org

about 22 per cent; followed by the Lake Lanao ecoregion in the island of Mindanao, Philippines, with 16 per cent. In terms of irrigation and extraction of water for rice production and other crops, many of the ecoregions identified here bear only a minor percentage, hence, the potential for expanding such facilities and increasing production is great.

On the other hand, land conversion for other uses all have double-digit values, suggesting that land masses surrounding the freshwater bodies are under great pressure – subsequently affecting freshwater through siltation and agricultural pollution. Freshwater ecoregions with the highest pressure are mostly in Indonesia and the Philippines, having values of over 60 per cent, in some reaching highs of 70 per cent, of land converted for some other use.

Large cities affecting freshwater bodies are less in number, as most ecoregions do not have large cities along rivers, except for the southern part of Sumatra and the western side of Java in Indonesia, where five large cities are located within the freshwater ecoregion. Not surprisingly, it has the highest land conversion value, with a small value for irrigation facilities. On the other hand, its value under urban land cover is only 4.9 per cent of the total land area of the ecoregion. This suggests a highly dense population in a compact urban area, unlike other ecoregions with a higher urban land cover but no large cities that apply pressure on the water resource.

In terms of human footprint, the Northern Philippines ecoregion (*i.e.,* the major islands of the Visayas and Luzon) has the highest value at 35.3 – suggesting that many of its freshwater resources are under threat. Other ecoregions in the Philippines also have values of over 30.

Of the ASEAN Member States, the Philippines ranks as the country with freshwater resources under the gravest threat from population pressure and infrastructure development.

Marine and Coastal Ecosystems

The territory occupied by the ASEAN Member States houses a third of the world's coral reefs, mangroves and seagrass areas. The region is home to 30 per cent of coral reefs[94], 35 per cent of mangroves[95], and at least 33 per cent of all seagrass environs on earth. Nine out of ten ASEAN Member States are endowed with extensive coastlines, providing an aggregate total of some 173,000 kilometers of shore. These ecosystems support the highest biodiversity of coastal and marine fauna and flora in the planet. An estimated 600 million people depend directly on these resources for food and income, which also forms the economic base for the fishing and tourism industries of the region.

A school of barracuda in Sipadan, Malaysia. The ASEAN region's rich marine resources are prime sources of livelihood for millions of people. *Photo by Lee Chin Yong*

Mangroves: A critical support ecosystem

Mangroves are tropical, salt-tolerant plants that straddle inter-tidal zones around estuaries and lagoons. Most are found between latitude 25 degrees north and south of the equator. Mangrove forests, classified as estuarine wetlands, are valued for their diverse ecosystem services. With massive root systems, mangrove forests serve as buffer zones in coastal areas. These ecosystems regulate the impact of strong storm surges to coastal communities by absorbing the energy of strong waves and wind. As forests, mangroves serve as carbon sinks that mitigate pollution, as carbon dioxide stores that improve the fertility of the land, and as soil erosion checks that capture and accumulate rich sediments in its roots. These same roots attract marine species that may be harvested, sold or consumed by local inhabitants. Despite the direct and indirect provisioning and regulating services from mangrove ecosystems, their degradation and conversion to less ecologically sound uses continue on a widespread scale.

Mangroves in the ASEAN region occupy an area of over 60,000 square kilometers[96]. In the last few decades, mangroves in many parts of the region have suffered significant levels of deforestation, mainly due to conversion to fishponds. Presently, the region has the largest extent of mangroves in the world, with Indonesia accounting for almost 62 per cent of the ASEAN territory's total. In 1980, the esti-

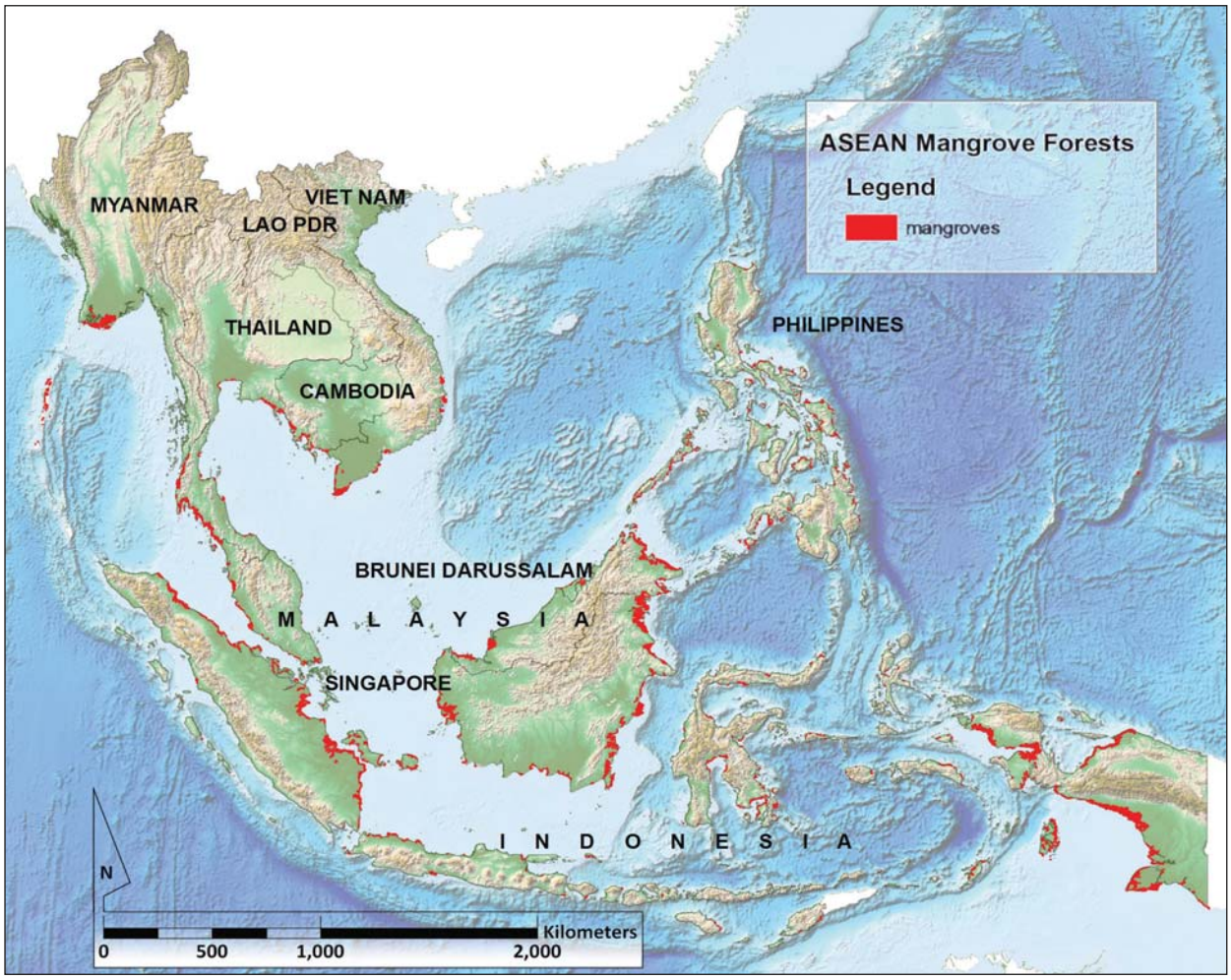
Deforestation is one of the pressures causing the decrease of mangrove areas in the region. *Photo by Rhia Galsim*

Table 15. Area coverage of mangroves in the ASEAN region

ASEAN Member States	1980 (km^2)	2005 (km^2)	1980 and 2005 Difference		Percentage to ASEAN Total Remaining Mangrove Area
			(km^2)	%	
Brunei Darussalam	184.0	184.0	–	–	0.4
Cambodia	912.0	692.0	(220.0)	(24.1)	1.5
Indonesia	42,000.0	29,000.0	(13,000.0)	(34.1)	61.7
The Lao PDR	–	–	–	–	–
Malaysia	6,740.0	5,650.0	(1,090.0)	(16.2)	12.0
Myanmar	5,555.0	5,070.0	(485.0)	(8.7)	10.9
Philippines	2,950.0	2,400.0	(550.0)	(18.6)	5.11
Singapore	17.9	5.0	(12.9)	(72.1)	0.01
Thailand	2,800.0	2,400.0	(400.0)	(14.3)	5.11
Viet Nam	2,691.5	1,570.0	(1,121.5)	(41.7)	3.34
TOTAL	63,850.4	46,971.0	(16,879.0)	(26.4)	~100%

Source: Food and Agriculture Organization 2007. The World's Mangroves 1980-2005, FAO Forestry Paper 153, Food and Agriculture Organization of the United Nations, Rome, 2007, accessed on 20 April 2010 at http://www.fao.org/docrep/010/a1427e/a1427e00.htm.

Figure 9. Map showing the concentrations of mangrove in Southeast Asia



Source: World Conservation Monitoring Center. Mangroves of the World data set. Relief: USGS GTOPO30
Note: Mangrove areas are enhanced for visibility. Data quality varies by country.

mated regional total mangrove area was 63,850 square kilometers. As of 2005, this whittled down to 46,971 square kilometers[97], for an aggregate decline of about 26 per cent within a 25-year period (Table 15).

Globally, mangrove biodiversity is highest in the Indo-Malay-Philippine archipelago, where 36 to 47 species of the world's 70 known mangrove species may be found[98]. Southern New Guinea, including West Papua, has the greatest diversity of mangroves in the world, being at the center of the Indo-Malayan mangrove center of diversity[99]. Figure 9 shows the distribution of mangroves in Southeast Asia

There are about 52 true mangrove species in Southeast Asia. Of these, 48 species are found in Indonesia, and 42 species in Malaysia (Appendix 1).

Of special concern to the ASEAN region are two mangrove species listed recently as Critically Endangered, the highest probability of extinction being applied under the IUCN Red List. The rare *Sonneratia griffithii* is distributed in parts of India and Southeast Asia, where a combined 80 per cent loss of all mangrove areas occurred over the past 60 years. The species was reported to be locally extinct in a number of areas within its range, primarily due to clearing for rice farming, shrimp aquaculture and coastal development. Bruguiera hainesii, a very rare mangrove species, made it to the Critically Endangered category very recently, and is now only known to exist in a few fragmented locations in Indonesia, Malaysia, Thailand and Myanmar[100].

Camptostemon philippinense has been listed recently as Endangered, with only an estimated 1,200 or fewer remaining, due to the extensive depletion of mangrove areas for aquaculture and fuelwood. The Endangered *Heritiera globosa* has the most restricted distribution in Southeast Asia (i.e., extent of occurrence <5,000 square kilometers), as it exists only in western Borneo in Indonesia, where its sporadically distributed and primarily riverine habitat had been extensively impaired by logging activities and the creation of timber and oil palm plantations[101].

Biodiversity in the mangrove ecosystem also includes crustaceans and molluscs. There

Mudskipper *Photo from Wikimedia Commons*

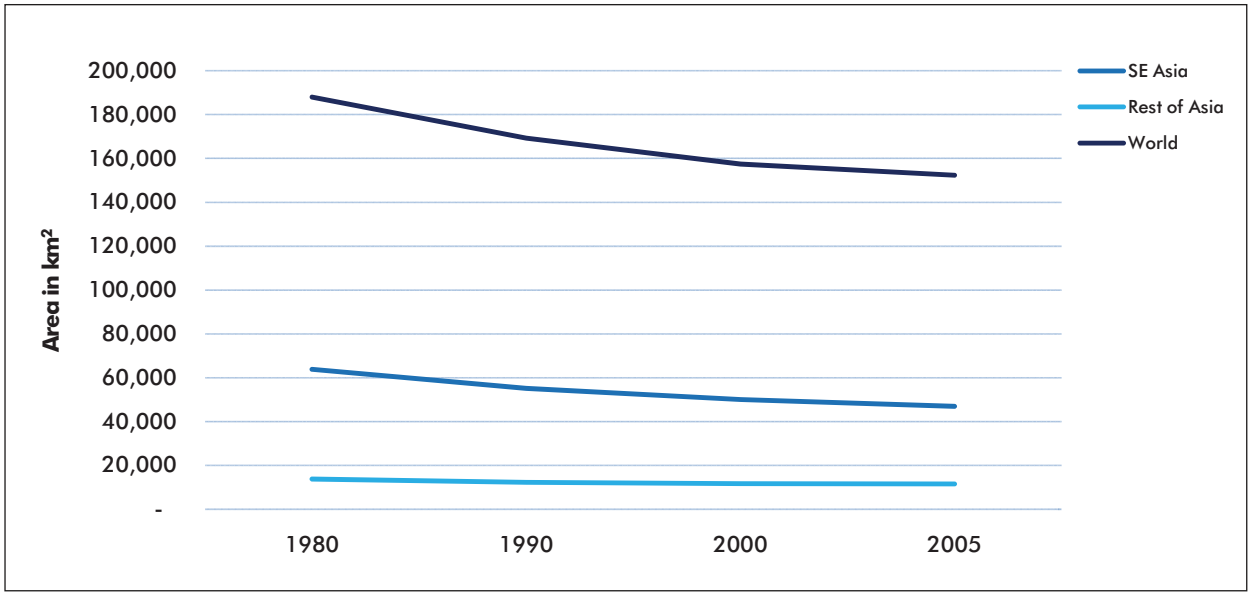
is often a high population density of these animals in mangrove areas due to the high deposits of silt and detritus (*i.e.,* accumulated debris) brought down by the rivers. Leaves and branches shed by mangrove vegetation also add to the organic richness of the soil[102]. Being detritovores, crustaceans and molluscs find mangroves a suitable environment. The mud crab *(Scylla serrata),* often found in mangrove areas, is classified as a threatened species because of its high commercial value[103]. Another animal that could easily be found in this ecosystem is the fiddler crab *(Uca sp.),* so-called because of its enlarged and colorful pincer[104].

Fish, on the other hand, come to mangroves either to lay eggs or for protection against predators. The mass of intertwining roots of mangrove vegetation makes an ideal nursery for juvenile fish. Some common fish species visit mangroves occasionally for breeding or for protection. Some examples are scats, milkfish, mudskippers, mullets and catfish[105].

Other vertebrate fauna that inhabit mangroves are reptiles, including the salt water crocodile *(Crocodilus porosus),* sea turtles and the water monitor lizard *(Varanus salvator)*[106].

While the ASEAN region is bestowed with immense mangrove resources, it nonetheless suffers the highest rates of mangrove losses in the world. An area of 628 square kilometers of mangrove got stripped away each year throughout the last couple of decades.

Figure 10. Mangrove areas in Southeast Asia, the rest of Asia, and the world, 1980-2005.



Source: Food and Agriculture Organization 2007. The World's Mangroves 1980-2005, FAO Forestry Paper 153, Food and Agriculture Organization of the United Nations, Rome, 200,7 accessed on 20 April 2010 at http://www.fao.org/docrep/010/a1427e/a1427e00.htm.

There is a decreasing trend in the size of mangrove areas all over Southeast Asia, the other parts of Asia, and the world – with significant decreases of 9.7 per cent, 5.6 per cent and 6.7 per cent, respectively, in a span of 15 years (Figure 10).

The chief cause of mangrove depletion in the ASEAN territory has been the conversion of mangrove inter-tidal areas to mariculture ponds, most commonly for shrimps. Pond culture is responsible for 50 per cent of mangrove losses in the Philippines, and from 50 to 80 per cent of Southeast Asia's. Other forms of indirect damage from the practice of conversion extenuate to coastal resources, such as the discharge of nutrients by rich waters, or what is known as eutrophication; the associated depletion of natural stocks of fish and crustaceans; and the accumulation of toxins at mariculture facilities that render it unusable after a short span of time, leading to eventual abandonment and further degradation to the ecosystem, yet setting off the conversion of more mangrove areas elsewhere. The direct clearing of mangroves for coastal development, aquaculture and resource use, as well as the escalating population within coastal zones, have exacerbated widespread impairment to mangrove ecosystems. Over-exploitation for fuelwood and timber production accounts for 26 per cent of mangrove forest degradation[107].

Inasmuch as data used in these assessments preceded the 2004 Asian Tsunami, the main reason may be attributed conclusively to the harsher reality of human impacts[108], essential as mangrove forests may be to coastal communities. Human activities have caused severe reduction in mangrove ranges, and recently, the risk to its biodiversity has become increasingly apparent.

Pressures affecting the decrease of mangrove areas include deforestation due to the domestic demand for fuel and materials for housing by nearby communities, and conversion of mangrove forests to either fish or prawn ponds for commercial consumption. In some mangrove areas in Southeast Asia, shore erosion is a very serious concern (Table 16).

While mangrove biodiversity is already in a badly degraded state, climate change is not going to make it any easier. The impact of climate change to which mangrove ecosystems are particularly sensitive is raising sea levels. On a possibly positive note, however, global warming could promote the migration of mangrove species to higher latitudes[109]. This

Table 16. Summary of presence of mangrove threats in Southeast Asia

Threat	CAM	IND	MAL	MYA	PHI	SIN	THA	VIE
Timber extraction	●			●				
Fuelwood	●			●	●		●	
Tanning								
Commercial logging		●			●			
Illegal logging		●			●			
Aquaculture	●	●	●	●	●		●	●
Coastal erosion		●		●				
Land reclamation	●	●	●			●	●	
Coastal development			●	●	●	●		
Agriculture		●	●	●	●		●	
Military defoliants								●
Housing/settlements			●		●	●		
Salt pan construction	●							
Industrial development					●			
Mining					●			

Legend: ● - Indicates presence of threat in the country.

Sources:
Burke, Loretta, Elizabeth Selig and Mark Spalding. 2002. Reefs at Risk in Southeast Asia. World Resources Institute. 2002 accessed on 5 April 2010 at from http://pdf.wri.org/rrseasia_full.pdf .
Giesen, Wim , Stephan Wulffraat, Max Zieren and Liesbeth Scholten. 2006. Mangrove Guidebook for Southeast Asia, RAP Publication 2006/07. FAO and Wetlands International 2007, pp 7-8, accessed on 9 April 2010 at ftp://ftp.fao.org/docrep/fao/010/ag132e/.
Ministry of Environment, Cambodia. 2009. Report on National Marine Gap Analysis for Cambodia. Kingdom of Cambodia. November 2009.
National Parks Board Singapore 2010. 4th National Report to the Convention on Biological Diversity. Singapore. September 2010.

would be added protection to the coastlines of the higher latitude areas and, once established, would serve as breeding and nursery grounds for many species of fish. This would, theoretically, expand fishery resources to the higher latitudes.

There is such a wealth of learning and experience in mangrove restoration and replanting in many countries of the ASEAN[110] that, if continuously supported, can improve strongly the region's adaptive capacity to climate change. The earlier objectives of mangrove replanting included timber production or silviculture (*i.e.*, in Malaysia, Bangladesh and Pakistan), and the enhancement of coastal protection (*i.e.*, in Thailand). More recently, it has been mainly for the restoration of degraded areas[111].

There is urgency in taking action that will better protect mangrove ecosystems. Mangrove communities are spread across the world's tropical coastlines, mostly in localities with limited funds for conservation or research, and with only modest technical capacities for assessing biodiversity threats and developing conservation strategies.

To date, despite the lack of recent climate change vulnerability assessments focused on sustaining the biodiversity of mangroves, there are several projects, both past and current, which focus on the conservation and sustainable management of this resource. Much of the work had been confined to Southeast Asia, owing initially to the use of mangroves as forestry resources in countries like Malaysia

and Thailand. Several in-country projects have addressed mangrove restoration and climate change (Table 17).

Furthermore, the ASEAN Member States have established Ramsar sites which are mangrove-based, such as Malaysia's Tanjung Piai National Park and the Pulau Kukup. Others more were declared as ASEAN Heritage Parks, like the Sungei Buloh Wetland Reserve in Singapore.

Table 17. Mangrove reforestation projects in Southeast Asia

Country	Reforestation Area (km^2)	Year	Project Title	Funding/Implementing Agency
Indonesia	262.15[1]	2002-2006	Mangrove Rehabilitation Program	Ministry of Forestry, Indonesia
	15.00[2]	1994-1996	Mangrove Rehabilitation and Management Project in Sulawesi	Ministry of Forestry, Indonesia, with ADB
	6.00[3]	2005-2007	Rehabilitation of Coral Reef and Mangrove Resources in the Special Province of Nanggroe Aceh Darussalam Project	Japan Fund for Poverty Reduction
Malaysia	13.02[4]	2005-2008	Mangrove Replanting Project	Forestry Department Peninsular Malaysia
	0.80[5]	2006-2008	Malaysia Community-led Mangrove Regeneration Project	PETRA-UNDP
Philippines	10.00[6]	1984-1992	Central Visayas Regional Project-I	World Bank
	0.20[7]	2007	Isugod Mangrove Reforestation Project	Palawan Council on Sustainable Development
	0.90[7]	2007	Albay Action on Climate Change – Mangrove Plantation Project	Local Government of Albay
	1.07[8]	2007-2008	Community-Based Mangrove Conservation	San Antonio Farmers Association/GEF-SGP
	0.06[8]	2010-2011	Improvement of Bataan Coastal and Marine Biodiversity: Mangrove Nursery, Mangrove Reforestation and Improvement of Existing Fish Sanctuary	Samahan at Ugnayan ng Pangisdaan ng Orion-SUGPO Community-based Organization and UNDP/SGP
Singapore	0.92[9]	2010-2011	Pulau Tekong Coastal Protection and Restoration Project	National Parks Board of Singapore
Thailand	400.00[6]	1991-1996	Mangrove Replanting Program	Thai Government with ADB support
	0.82[10]	1999	Mangrove Replanting Project	Japan Keidanran Natural Conservation Fund
	51.33[10]	2004-2008	Mangrove Forest Reforestation Campaign for Queen Sirikit	Thai Government
Viet Nam	5.80[6]	1989-1993	Mangrove Replanting in Muddy Tidal Flat	Various NGOs

Sources:
1 Ministry of Environment – Indonesia. 2009. Fourth National Report to the Convention on Biological Diversity, Indonesia Government 2009. pp 19, 21.
2 Asian Development Bank. 1993. Report of the President to the Board of Directors on TA Loan for the Mangrove Rehabilitation and Management Project in Sulawesi, ADB RRP-INO 24385 August 1993 accessed on 21 April 2010 at http://www.adb.org/Documents/RRPs/INO/24385-INO-RRP.pdf .
3 Asian Development Bank. 2005. Rehabilitation of Coral Reef and Mangrove Resources in the Special Province of Nanggroe Aceh Darussalam Project. ADB JPFR:INO 39115 accessed on 22 April 2010 at http://www.adb.org/Documents/JFPRs/INO/jfpr-ino-39115.pdf.
4 Ministry of National Resources and Environment – Malaysia. 2009. 4th National Report to the Convention on Biological Diversity. Government of Malaysia 2009. p 28.
5 Malaysia Community-Led Mangrove Regeneration Project accessed on 21 April 2010 at http://www.undp.org.my/uploads/Petra-UNDP_mangrove_project_PDfinal.pdf.
6 Erftemeijer, Paul and Robin R. Lewis III. Planting Mangroves on Intertidal Mudflats: Habitat Restoration or Habitat Conversion? accessed on 21 April 2010 at http://www.fao.org/forestry/10558-1-0.pdf.
7 Department of Environment and Natural Resources – Protected Areas and Wildlife Bureau – Philippines. 2009. Assessing Progress Towards the 2010 Biodiversity Target: The 4th National Report to the Convention on Biological Diversity. Republic of the Philippines 2009, pp 52 & 64.
8 GEF Small Grants Programme website accessed on 21 April 2010 at http://sgp.undp.org/web/projects/7015/community_based_mangrove_conservation.html.
9 News article accessed on 23 December 2010 at http://www.channelnewsasia.com/stories/singaporelocalnews/view/1055878/1/.html.
10 Office of Natural Resources Environmental Policy and Planning - Ministry of Natural Resources and Environment, Thailand. 2009. Thailand National Report on the Implementation of the Convention on Biological Diversity (4th National Report on 2009). Kingdom of Thailand. 2009.

Coral Reefs: The marine forest

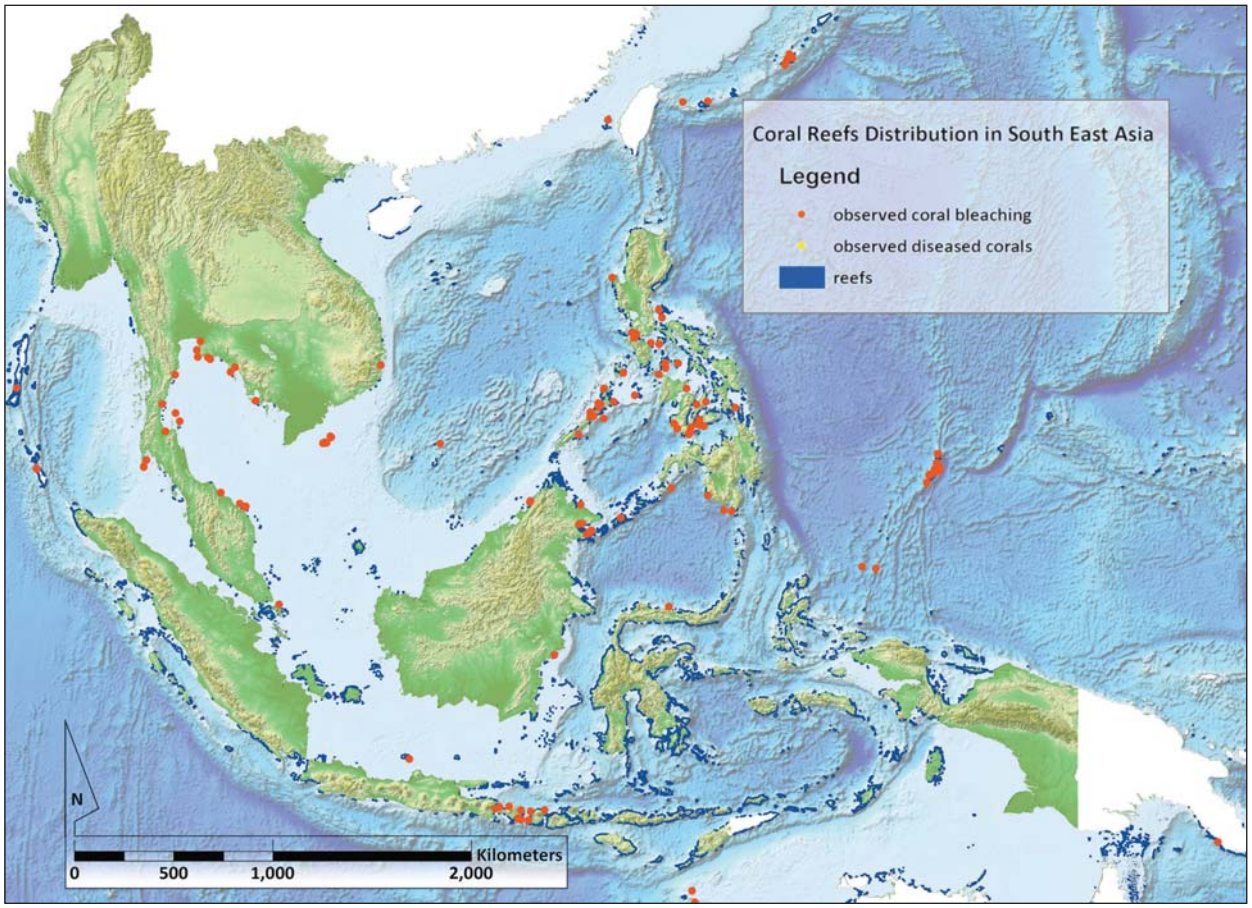
Coral reefs are complex marine ecosystems found in shallow tropical waters that provide refuge to approximately 25 per cent of all marine species[112]. Comparable to tropical rain forests in having the highest biological diversity on earth, coral reefs serve as the physical framework of critical habitats that support the nursery needs of fish and invertebrate larvae.

Reefs protect coastlines from storm surges, support productive fishery industries and provide the main source of protein and income[113] for millions of coastal families in Southeast Asia. Coral reef-dependent species have scientific, pharmaceutical and educational value, and are extremely valuable as tourist destinations.

The fifth global report on the Status of Coral Reefs of the World, published in 2008, indicates that the coral reef area of Southeast Asia spans 86,025 square kilometers (Figure 11), but reports that 40 per cent of it has effectively been lost. Moreover, country estimates based on various reports (*e.g.*, national reports to CBD and marine gap analysis report) revealed a significantly lower aggregate coral

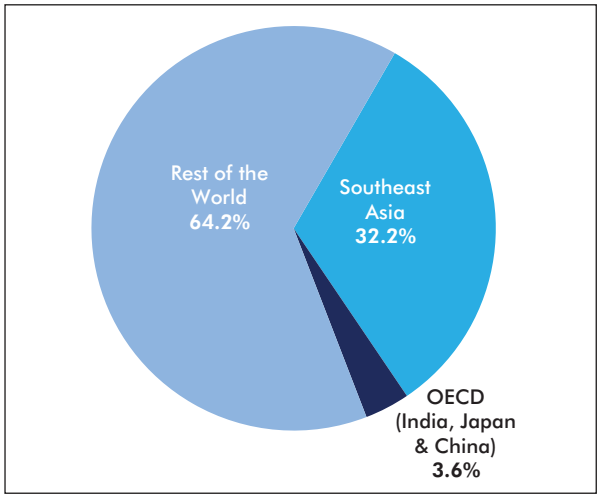
The ASEAN region has 34 per cent of the world's coral reefs. Indonesia, Malaysia and the Philippines are part of the Coral Triangle – home to 75 per cent of the world's reef-building corals. But 88 per cent of the region's coral reefs are at risk due to destructive fishing practices and coral bleaching. *Photo from Wikimedia Commons*

Figure 11. Distribution of coral reefs in Southeast Asia



Source: World Fish Centre ReefBase Project, undated. Coral Reef MPAs of East Asia and Micronesia.

Figure 12. Distribution of coral reef areas in the world, 2001



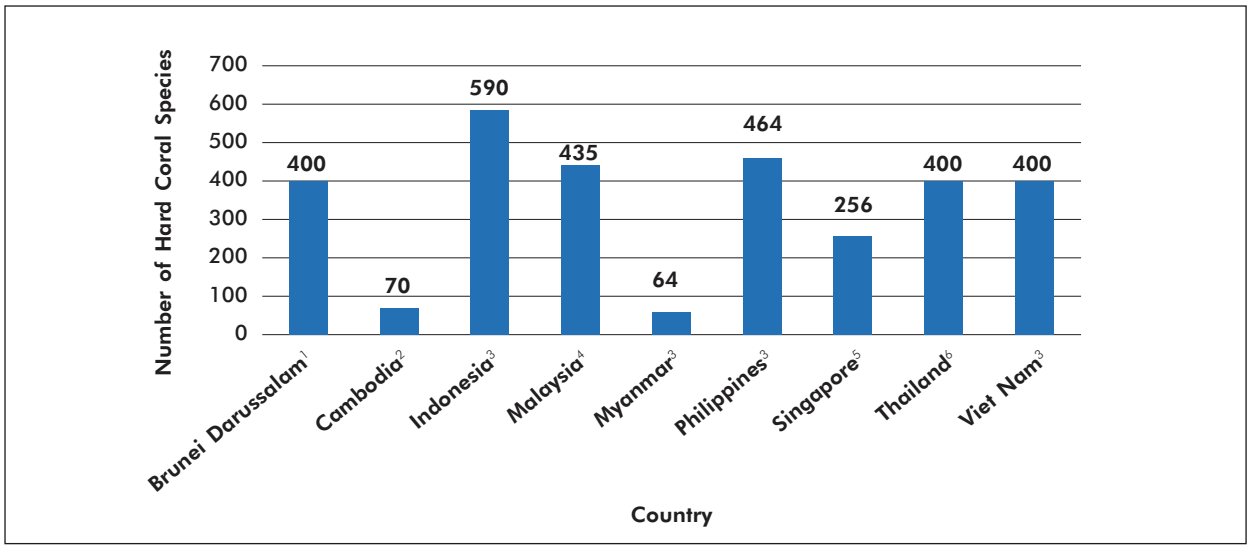
Source: UNEP. 2001. World Coral Reef Atlas 2001 accessed on 22 February 2010 at http://coral.unep.ch/atlaspr.htm#Coral%20Reef%20Area%20Statistics.

reef area for the region at 69,734.5 square kilometers. The same document reports that global coral reef figures may be overestimated as these include sea areas surrounding the coral reefs and lagoons and not just the coral growth areas. For instance, the more recent figures reported by Thailand and Singapore include GIS assessments and these are 10 times lower than published in the global estimates as shown in Appendix 2[114].

The region's total coral reef area according to global estimates accounts for a third of the global total, which is 11 times larger than the aggregate coral reef area of China, India and Japan (Figure 12). Based on country estimates, however, the aggregate coral reef area of Southeast Asia is over one-fourth of the world's total (Appendix 2).

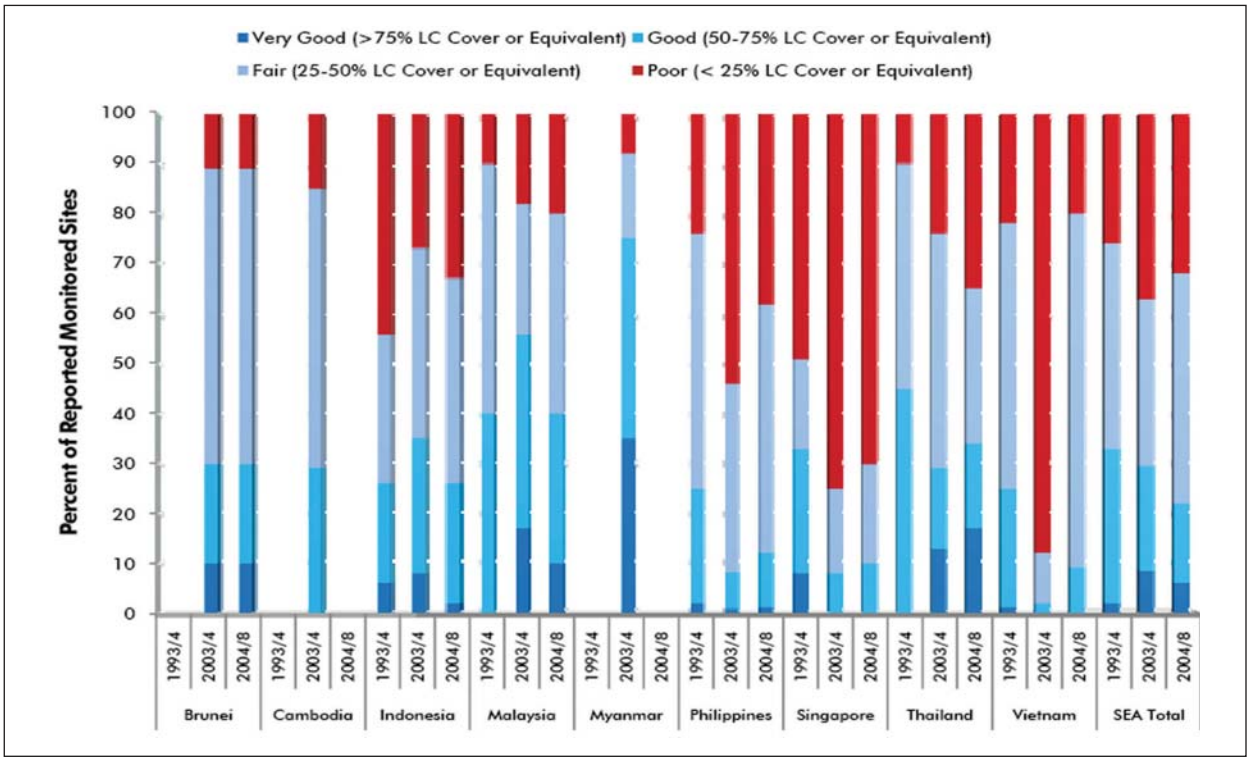
The World Coral Reef Atlas[115] ranks Indonesia (1st) and the Philippines (3rd) as two of the top three countries with the most coral reef areas in the world, accounting for 18 per cent and 9 per cent, respectively, of the world's total coral reef area of 284,845 square kilometers (Appendix 2). The other ASEAN Member States of Brunei Darussalam, Cambodia, Malaysia, Myanmar, Singapore, Thailand and Viet Nam, in aggregate, support less than five per cent of the world's total reef area but up to 400 reef-building coral species (Appendix 2). OECD countries like India, Japan and China account for 2.03 per cent, 1.02 per cent

Figure 13. Estimates of hard coral species in Southeast Asia, 2004



Sources:
[1] Forestry Department, Ministry of Industry and Primary Resources, Brunei Darussalam, undated. 4th National Report to the Convention on Biological Diversity, Government of Brunei Darussalam.
[2] Ministry of Environment, Cambodia 2009. Report on National Marine Gap Analysis for Cambodia. GDANCP-Ministry of Environment, Government of Cambodia. pp4.
[3] Tun, Karenne, Ming Chou, Annadel Cabanban, Vo Si Tuan, Philreefs, Thamasak Yeemin, Suharsono, Kim Sour and David Lane. 2004. Status of Coral Reefs, Coral Reef Monitoring and Management in Southeast Asia, 2004. Global Coral Reef Monitoring Network 2004, accessed on 25 February 2010 at http://www.reefbase.org/download/download.aspx?type=10&docid=9535 .
[4] Ministry of Natural Resources and Environment, Malaysia. 2007. 4th National Report to the Convention on Biological Diversity. Government of Malaysia. 2009. pp5.
[5] National Parks Board, Singapore. 2010. Singapore – 4th National Report to the Convention on Biological Diversity. September 2010. pp19.
[6] Ministry of Natural Resources and Environment, Thailand. 2010. Marine Gap Analysis for Thailand. Bangkok, Thailand.

Figure 14. Live coral cover in Southeast Asia, 1994-2008



Source: Redrawn from Tun, Karenne, Chou Loke Ming, Thamasak Yeemin, Niphon Phongsuwan, Affendi Yang Amri, Niña Ho, Kim Sour, Nguyen Van Long, Cleto Nanola, David Lane, Yosephine Tuti, 2008. Status of Coral Reefs in Southeast Asia. Global Coral Reef Monitoring Network, accessed on 22 February 2010 at http://www.reefbase.org/download/gcrmn_download.aspx?type=10&docid=13321.

and 0.53 per cent of the world total, respectively, (Appendix 2). However, national level estimates removes Indonesia from the top rank and places it next to Australia (48,960 km^2). Based on Indonesia's Fourth National Report, its coral reef area totals 35,664 km^2 or 13.3 per cent as adjusted. The Philippines remains at number three with 10 per cent area contribution (Appendix 2). Thailand is now at 67th place from its original 26th ranking due to availability of recent GIS data which records a coral reef area of 153.5 km^2 for the country compared to global estimates of 2,130 km^2 (Appendix 2).

Hard coral diversity remains high in Indonesia, Malaysia, Philippines and Viet Nam, where altogether, a total of almost 600 species may be found (Figure 13). Allen (2003)[116] estimates that there are 3,764 reef-associated fish species in the entire Indo-Pacific region, where the extensive coral reef area of Indonesia, the region's largest, accounts for some 2,057 reef fish species[117]. Appendix 2 presents the estimated number of nearshore fish species per country.

Information generated from monitoring surveys integrated by the Reefs at Risk Project in Southeast Asia in 2004 and 2008 reflects a general decline in coral reef condition, where some improvements were noted only in Viet Nam.

Figure 14 shows the differences in live coral cover (in percentage) at reported monitoring sites in the Southeast Asian region between 1994 and 2008. There has been a general decline in reefs rated previously with the status of "Very Good" and "Good" coral cover, with a parallel increase among those rated with "Fair" cover[118].

The estimated annual total benefits of healthy coral reefs in the region ranges from USD 23,100 to 270,000 (Table 18).

The potential economic value of coral reefs in Southeast Asia is estimated at USD12.7 billion, or 42.5 per cent of the world's total USD29.8 billion-value (Table 19).

Pressure Points on Coral Reefs

Although Southeast Asia hosts the largest coral reef areas in the world, it also has the highest rate of loss, which today stands at 40 per cent. Further compounding that dilemma

Table 18. Potential sustainable annual economic net benefits (per km²) of a healthy coral reef in Southeast Asia

Resource Use (Direct and Indirect)	Production Range	Potential Annual Benefits (USD)
Sustainable Fisheries (local consumption)	10 – 30 tons	12,000 – 36,000
Sustainable Fisheries (live fish export)	0.5 – 1.0 tons	2,500 – 5,000
Coastal Protection (erosion prevention)		5,500 – 110,000
Tourism and Recreation	100 – 1,000 persons	700 – 111,000
Aesthetic/Biodiversity Value (willingness to pay)	600 – 2,000 persons	2,400 – 8,000
Total (fisheries and coastal protection only)		20,000 – 151,000
Total (including tourism potential and aesthetic value)		23,100 – 270,000

Source: White, A.T., H.P. Vogt, and T. Arin. 2000. "Philippine Coral Reefs under Threat. The Economic Losses Caused by Reef Destruction," Marine Pollution Bulletin 40,7: 598-605.
White, A.T. and A. Cruz-Trinidad. 1998. The Values of Philippine Coastal Resources: Why Protection and Management are Critical (Cebu City: Coastal Resource Management Project) p.28.
Cesar, H.S.J. 1996. "Economic Analysis of Indonesian Coral Reefs, "Working Paper Series Work in Progress" (Washington, DC: World Bank).

Note: Data are based on estimates for Indonesia and the Philippines only.

Table 19. Basic demographic statistics of Southeast Asian coral reefs vis-à-vis global values, 2004

Coral Reef Statistics	Global	Southeast Asia (Sea)	Sea % of Global
Coral Diversity (no. of species)	Approx 800	>600	>75
Reef Fish Diversity (no. of species)	Approx 4000	>1300	>33
Potential Economic Value of Well-managed Coral Reefs (USD billion)			
Sustainable Coral Reef Fisheries	5.7	2.2	38.5
Coastal Protection	9.0	5.0	55.5
Coral Reef Tourism/Recreation	9.6	4.8	50.0
Biodiversity (Pharmaceuticals)	5.5	0.5	9.9
Total	29.8	12.7	42.5

Source: Tun, Karenne, Chou Loke Ming, Thamasak Yeemin, Niphon Phongsuwan, Affendi Yang Amri, Niña Ho, Kim Sour, Nguyen Van Long, Cleto Nanola, David Lane, Yosephine Tuti. 2008. Status of Coral Reefs in Southeast Asia, pp.140, accessed on 10 April 2010 at http://02cbb49.netsolhost.com/gcrmn/2008/9.%20South-East%20Asia.pdf.

is the fact that the rest of Asia, namely South Asia and East and North Asia, are not faring any better – with current rates of losses and threats being also greater than world figures (Table 20). The only reason why the "reefs at low threat" percentages are lower than the world total is because the rest of the reefs of the region are in the more badly damaged categories.

The Reefs at Risk in Southeast Asia summaries of 2002 and 2008 indicate that 88 per cent of Southeast Asia's coral reefs face medium to high overall threats. Over-fishing (63 per cent) and destructive fishing (56 per cent) are the two leading threats to coral reefs. The same reports have likewise identified that physical threats, in aggregate (52 per cent), such as sedimentation, marine-based pollution and coastal development, are significant contributors to coral reef threat (Figures 15 and 16, and Table 21).

Anthropogenic Causes. Over-fishing has threatened 64 per cent of Southeast Asia's reefs, while destructive fishing practices have endangered up to two-thirds of the coral reefs of the Philippines, Malaysia and Taiwan, and one-half of Indonesia's.

About 20 per cent of the region's total reef areas have also been under threat from sedimentation and pollution due to human-induced causes such as deforestation and agricultural activities.[119]

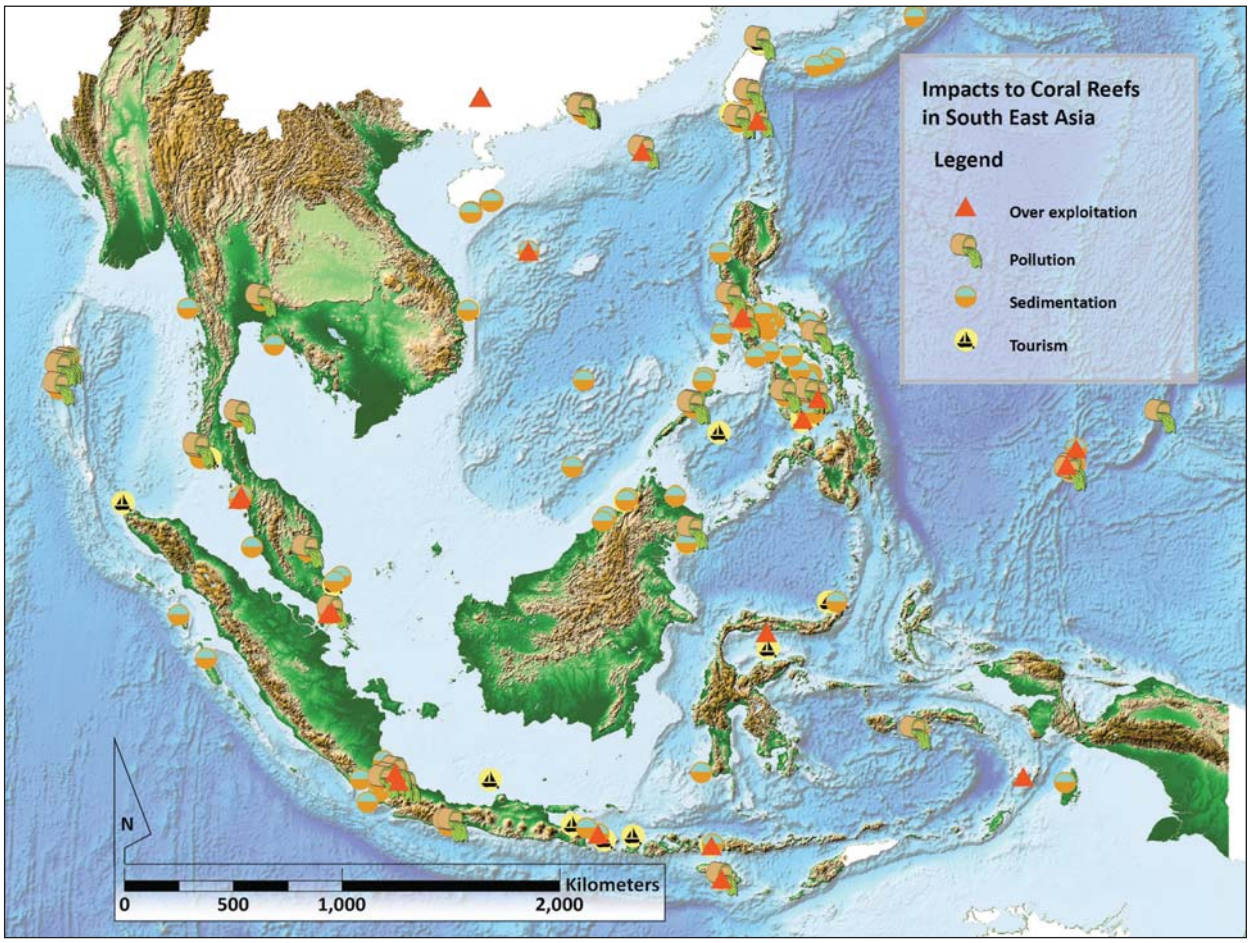
Table 20. Risk status of coral reefs in Southeast Asia vis-à-vis the rest of Asia and the world, 2001

Region	Coral Reef Area km² [1]	Per cent of coral reef areas to world total	Effectively Lost Reefs (%)[2]	Reefs at Critical Stage (%)[3]	Reefs at Threatened Stage (%)[4]	Reefs at Low Threat level (%)[5]
South Asia	19,210	6.7	25	20	25	30
SE Asia	91,700	30.0	40	20	25	15
E & N Asia	5,400	1.9	20	22	18	40
World Total	284,803	100.0	19	15	20	45

Notes:
[1] Coral reef area, from the World Atlas of Coral Reefs (UNEP 2001).
[2] Reefs effectively lost, with 90 per cent of the corals lost and unlikely to recover soon.
[3] Reefs at a critical stage, with 50 to 90 per cent of corals likely to join Category 2 in 10 to 20 years.
[4] Reefs threatened with moderate signs of damage: 20-50 per cent loss of corals and likely to join Category 1 in 20-40 years.
[5] Reefs under no immediate threat of significant losses (except for global climate change).
Categories 3 and 4 are based on the very high to high risk, and the medium risk categories of the Reefs at Risk process.

Source: Wilkinson, Clive. 2008. Status of coral reefs of the world: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia, pp 296, accessed on 6 April 2010 at http://www.reefbase.org/download/gcrmn_download.aspx?type=10&docid=13312.

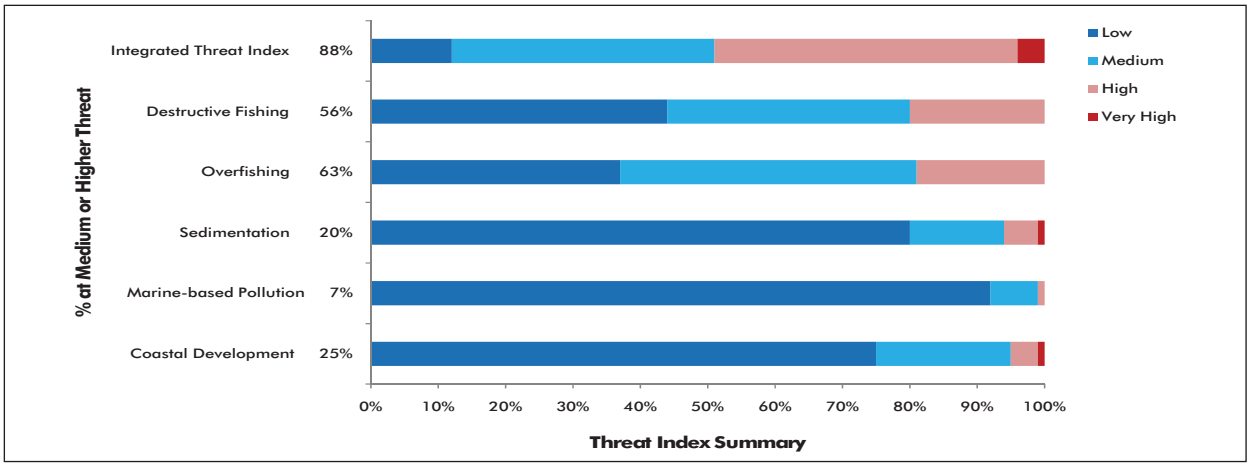
Figure 15. Coral reef health in Southeast Asia



Source: ReefBase and ReefCheck. ReefBase and Reef Check are constantly adding information (observations) on coral reefs. For more up-to-date information, visit the ReefBase and ReefCheck web sites at: www.reefbase.org and www.reefcheck.org. Relief: USGS GTOPO30

Damage to coral reefs in Indonesia has been reported to reach 40 per cent in 2006. Causes of these threats have been attributed to: a) destructive means of fishing, such as the use of poisons like cyanide, bombing with the use dynamite, and muro ami - a fishing method

Figure 16. Comparative figures of Reefs at Risk from 2002 to 2008



Source: Redrawn from Chou, L. M. 2009. Status of Marine Protected Areas in the ASEAN Region, powerpoint presentation to the Regional Technical Workshop on Gap Analyses for Marine and Terrestrial Protected Areas, Yogyokarta, Indonesia, 2009.

Table 21. Summary of coral reef threats in the ASEAN region

Location/Country	BRU[1 & 2]	CAM[1]	IND[1]	MAL[1]	MYA[1]	PHI[3]	SIN[1&4]	THA[1&5]	VIE[1]
Overfishing	●	●	●		●	●		●	●
Destructive Fishing			●	●	●	●		●	●
Muro Ami						●			
Blast Fishing		●	●	●		●			
Cyanide Fishing			●	●	●	●			
Trawling								●	
Sedimentation from land-based sources	●		●	●	●	●	●	●	●
Coastal Development					●	●	●	●	●
Agriculture			●	●		●			
Aquaculture						●			
Land-cover change/ Development	●		●		●	●			
Deforestation			●						
Bleaching*/Climate Change	●	●	●			●	●	●	
Domestic Wastes						●		●	
Industrial Wastes/ Pollution						●			
Encroachment	●								
Tourism								●	
Storms								●	

Legend: ● - Indicates presence of threat in the country.

Sources:
[1] Burke, Loretta, Elizabeth Selig and Mark Spalding. 2002. Reefs at Risk in Southeast Asia. World Resources Institute. 2002 accessed on 5 April 2010 at http://pdf.wri.org/rrseasia_full.pdf.
[2] Forestry Department, Ministry of Industry and Primary Resources, Brunei Darussalam, undated. 4th National Report to the Convention on Biological Diversity, Government of Brunei Darussalam.
[3] Bureau of Fisheries and Aquatic Resources. 2000. Philippines, 2000 accessed on 30 March 2010 at http://www.bfar.da.gov.ph/infocorner/fast_facts.htm.
[4] National Parks Board, Singapore. 2010. Singapore – 4th National Report to the Convention on Biological Diversity. September 2010. pp18.
[5]Ministry of Natural Resources and Environment, Thailand. 2010. Marine Gap Analysis for Thailand. Bangkok, Thailand.

where corals are roughly knocked to scare fish out of their hiding places; b) sedimentation from land sources and from mining activities; and c) physical damage from boat anchors and reef walking from tourists.

Similar threats are present in Philippine reefs. Additionally, these may be worsened by escalating incidences of biological outbreaks of such organisms as the crown-of-thorns starfish. Reefs in this country were noted to be in a steady state of decline, although healthy reefs can still be found in the Celebes Sea, Southern Philippine Sea, Sulu Sea and the Visayas Bio-geographic regions[120].

In Thailand, eco-tourism activities were reported to have caused significant damage to its coral reefs[121].

Uncontrolled human population growth has been one of the major factors of pressure build-up in coastal areas in the last 40 years. In turn, such pressures have caused widespread resource exploitation and degradation, particularly in South Asia, Southeast Asia and China, where a significant portion of the population depends on viable fisheries for livelihood[122].

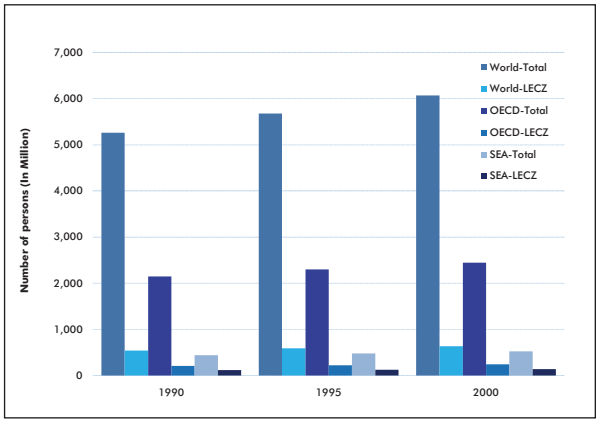
From 1990 to 2000, populations in the coastal areas of Southeast Asia, the OECD countries and the world have all exhibited an upward trend (Figure 17). Over the ten-year period, the coastal population in Southeast Asia averaged 125.8 million, ranging from a low of 115.4 million in 1990, to a high of 135.7 million in 2000 (Figure 17). In the same period, the average coastal population of 223.2 million of the OECD member nations (*e.g.*, China, India, Japan and South Korea) was almost twice that of Southeast Asia.

In 1995, population density in the low elevation coastal zone (LECZ) areas was three to five times higher than in non-LECZ areas and total areas (LECZ + non-LECZ), indicating that majority of the population tended to concentrate in the coastal zones. For instance, coastal areas in Southeast Asia registered a 328 persons/km^2 density, compared to 87 persons/km^2 in non-LECZ areas, and 108 persons/km^2 in the total combined areas. The same was true in the OECD countries, where coastal zones posted a higher population density of 754 persons/km^2, compared to 165 persons/km^2 and

A girl attends to her family business of drying star fish in Cebu City, Philippines. *Photo by Ferdinand M. Singh*

179 persons/km^2 in its non-LECZ and total areas, respectively. Across regions, the population densities in the OECD countries were two to four times higher than in Southeast Asia

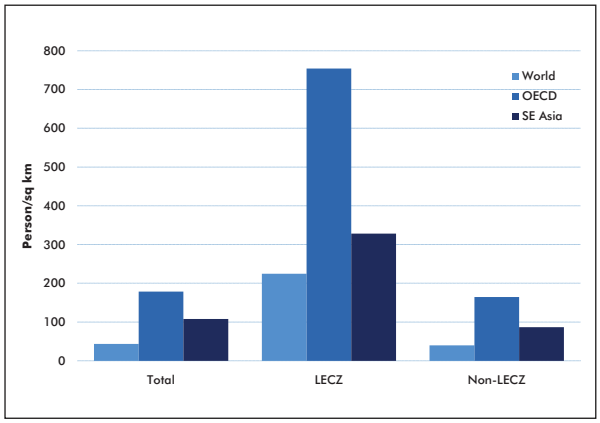
Figure 17. Number of Low Elevation Coastal Zone (LECZ)* population vs total population in Southeast Asia, the OECD countries and the world (1990, 1995 and 2000)



Source: Centre for International Earth Science Information Network (CIESIN), Columbia University. Low Elevation Coastal Zone (LECZ) Urban-Rural Estimates, Global Rural-Urban Mapping Project (GRUMP), Alpha Version. Palisades, NY: Socioeconomic Data and Applications Centre (SEDAC), Columbia University accessed on 2 April 2010 at http://sedac.ciesin.columbia.edu/gpw/lecz.

* LECZ estimates from digital elevation model (DEM) by selecting all land contiguous with the coast that was 10 meters or less in elevation. Zonal statistics were generated for total population and land area for the country as a whole and within the LECZ.

Figure 18. Population density of coastal areas compared to non-coastal and total areas in Southeast Asia, the OECD countries and the world, 1995



Source: Centre for International Earth Science Information Network (CIESIN), Columbia University. Low Elevation Coastal Zone (LECZ) Urban-Rural Estimates, Global Rural-Urban Mapping Project (GRUMP), Alpha Version. Palisades, NY: Socioeconomic Data and Applications Centre (SEDAC), Columbia University accessed on 2 April 2010 at http://sedac.ciesin.columbia.edu/gpw/lecz.

[1] LECZ estimates from digital elevation model (DEM) by selecting all land contiguous with the coast that was 10 meters or less in elevation. Zonal statistics were generated for total population and land area for the country as a whole and within the LECZ.

and the world, in all areas (i.e., LECZ, non-LECZ and total area) as shown in Figure 18.

Response: A comprehensive approach to the issues

From both the fishers' and scientists' points of view, it has become undeniable that the era of plenty, in terms of fisheries resources, has ended; and the means must soon be found to ensure sufficient fisheries for the future.

Through the years, the ASEAN Member States have attended to the degradation of coastal resources by undertaking initiatives that promote conservation and the sustainable use of these resources. Appendix 3 presents a compilation of coastal resource-related projects implemented by the ASEAN Member States.

Responses to coral reef threats in the region are characterized by a host of programs, projects and activities in various forms and sizes, with a broad range of donors and implementers. The diversity of threats appears to dictate the type of responses, which may be categorized into the following:

- Biodiversity conservation: for critical areas and marine biodiversity hotspots
- Rehabilitation of reefs: where these are degraded
- Establishment of Marine Protected Areas (MPA) and MPA networks: where a geographic (*i.e.*, local, national) need was identified (*e.g.*, need to set aside, protect areas or allow for their natural regeneration, a tool for fisheries management, conservation of reef resources, exclusion of destructive means of fishing, conservation of highly vulnerable species and habitats, need to maintain ecological processes, and status of community structure, and marine biodiversity conservation)
- Establishment of social and enforcement networks: where stakeholders have taken

A green turtle in Sipadan, Malaysia. The region's seas are home to the world's most amazing species.
Photo by Lee Chin Yong

up an active participation in managing their coastal and marine areas
- Compliance to regional and international commitments (National Biodiversity Strategies and Action Plans)
- Capacity-building on resource management to enhance capacities of local stakeholders and managers (*e.g.,* integrated coastal management, enforcement of policies, plan preparation, *etc.*)
- Policy development and/or reform to respond to changing marine environment circumstances, address threats, and institute a proactive approach to marine environment management
- Development of sustainable financing mechanisms to perpetuate the above initiatives

Among the responses identified above, the establishment of MPAs has been recognized as the popular strategy in Southeast Asia to address the threat of over-exploitation. Of the 1,451 MPAs in the region, 403 have coral reefs (Table 22).

Table 22. Total number and area of MPAs, and MPAs with coral reefs in Southeast Asia

Country	Number of MPAs	Total Area Covered by MPAs (km^2)	Number of MPAs with Coral Reefs	MPA Management[1]
Brunei Darussalam	6[1]	182.53[1]	3[1]	• Coral reef MPAs are managed at the national level • Majority were established two decades ago
Cambodia	7[2]	3,887.00[2]	1[1]	• Established 15 years ago and managed at the national level with no known information on the 'no-take' zone.
Indonesia	76[3]	135,290.70[3]	38[1]	• Administered at the national level but managed at the district level, and some at village level
Malaysia	128[4]	• 5,249 km^2 of coral reefs[4] • 6,891 km^2 of mangrove reserves[4]	43[1]	• MPAs in Peninsular Malaysia are managed at the national level, while those in Sabah and Sarawak are managed by the state government.
Myanmar	6[5]	No available data	2[1]	• Administered and managed at the national level
Philippines	1,169[6]	7,565.97[6]	294[1]	• Many MPAs are considered non-functioning paper parks; majority are managed at the municipal level.
Singapore	2[5]	1.4[7]	1	• Established over 10 years ago and managed at the individual site and national level.
Thailand	26[8]	No available data	16[1]	• Administered and managed at the national level.
Viet Nam	31[9]	No available data	4[1]	• Administered and managed at the national level.
SEA Total	1,451		403[1]	

Sources:
[1] ReefBase undated. Regional Summary Report for MPAs in East Asia and Micronesia accessed on 28 April 2010 at http://www.reefbase.org/key_topics/pdf/region%20mpa.pdf.
[2] Ministry of Environment-Cambodia and GEF/UNDP. 2006. Third National Report to the Convention on Biological Diversity, Kingdom of Cambodia. May 2006. pp143.
[3] Kasasiah, Ahsanal. 2009. Nested MPA Networks in Indonesia, PowerPoint presentation for the East Asian Seas Congress 2009, Manila Philippines, 24 November 2009.
[4] UP-MERF, CI-Philippines and BMRI. 2009. MPA Gap Analysis Reports for Philippines and Malaysia, 2009 (pp89-93)
[5] ASEAN Secretariat. 2009. Fourth State of the Environment Report, ASEAN Secretariat, Jakarta Indonesia 2009. pp48
[6] UP-MERF, CI-Philippines and BMRI. 2009. MPA Gap Analysis Reports for Philippines and Malaysia, ASEAN Centre for Biodiversity March 2009, pp22.
[7] Personal comments of Cheryl Chia, National Parks Board, Singapore.
[8] Wongsuryrat, Manoch. 2009. The Status and Trends of MPAs in Thailand, PowerPoint presentation for the Regional Workshop on Gap Analyses for Terrestrial and Marine Protected Areas in the ASEAN Region, September 2009, Yogyokarta, Indonesia.
[9] Trang, Huyen Tran. 2009. Gap Analyses for Marine and Terrestrial Protected Areas in Viet Nam, PowerPoint presentation for the Regional Workshop on Gap Analyses for Terrestrial and Marine Protected Areas in the ASEAN Region, September 2009, Yogyokarta, Indonesia.

A fisherman casts a net at Myanmar's Ayeyarwaddy River. At stake in the fight against rapid biodiversity loss in the marine and coastal ecosystems is the livelihood of those who depend on the bounty of the oceans and seas. *Photo by Kyaw Kyaw Winn*

Various entry points for MPAs have been designed. At the local and community level, these are organized in tandem with livelihood components in order to mitigate the impacts of over-exploitation. MPAs in Viet Nam, such as the Hon Mun Marine Protected Area Pilot Project and the Nha Trang Bay Marine protected area, were established for this purpose.

Studies done on MPAs indicate that those established with community participation and where regulations were effectively enforced demonstrated a slow but incremental increase in fisheries yield, by way of spillover (i.e., adult migration into neighboring fishing grounds[123]) and recruitment (i.e., export of eggs and larvae). Fogarty and Murawski's studies[124] in the Georges Banks showed that closures played an important role in the increase in biomass of a number of commercially and non-commercially important fish (by up to as much as 50 per cent), and shellfish species (by up to 14-fold)[125]. A study by Abesamis et al (2006)[126] concluded that while spillover from fully protected MPAs, or 'no-take' zones, in the Central Philippines may contribute less than 10 per cent to fisheries yield, it should be underscored that social pressure may limit fishing close to fishing reserves and, in fact, contribute to enforcing its boundaries.

More comprehensive approaches like Ecosystems-Based Management and Integrated Coastal Management, which are very much similar to a comprehensively responsible governance system, are likewise growing in popularity. The move to decentralize Indonesia through the establishment and mobilization of Act 22/1999 and its Implementation Regulation 25/2000 places more power for governance at the local level. Targeted and adequate coastal management capacity building, coupled with the appropriate safeguards against unregulated resource uses, will contribute to assuring the local level management of coastal areas. In June 2006, the President of the Philippines signed Executive Order 533, declaring Integrated Coastal Management as the national strategy and policy framework for the sustainable development of coastal and marine resources in the country.

Some marine conservation initiatives have been scaled up to transboundary arrangements and multi-country collaborations. The first transboundary arrangement for the conservation of sea-turtles in Southeast Asia was the Turtle Island Heritage Protected Area: a collaboration between Malaysia and the Philippines. A multi-country collaboration, the Sulu Sulawesi Marine Ecoregion, showcases triumphs gained from the management of marine biodiversity conservation corridors in the Philippines, Malaysia and Indonesia. The recent six-country collaboration known as The Coral Triangle was launched in 2009 and is gaining ground in terms of local initiatives and international support (the aforementioned multi-country collaborations and regional initiatives are discussed in greater detail in Chapter IV).

Photo from Wikimedia Commons

Seagrasses: The least understood of the coastal canaries

Seagrasses are flowering plants that spend and complete their life cycles under water. Not really grasses in the true sense, these organisms have come to be known as such because of their grass-like appearance, although some take on tear-drop and hair-like forms, too. To persist, seagrasses must have access to sunlight, sufficient immersion in seawater, and adequate rooting substrate to avoid being washed away by tides and currents[127].

Seagrasses form the basis of a complex coastal ecosystem, supporting both threatened and economically important fishery species[128]. Seagrass leaves harbor epiphytic algae and animals, like sea squirts, which serve as the base of food sources for a hierarchy of larger animals such as fish, sea birds, crabs, lobsters, *dugongs* and sea turtles. Their foliage also slows down water currents and traps sediments, thus, improving nearshore water clarity. Seagrass ecosystems are one of the most productive coastal habitats in the region[129], with a vital role and contribution to coastal fisheries.

Southeast Asia has 18 of the world's 60 seagrass species[130] and 33 per cent of all seagrass areas on earth. The Philippines, Malaysia and Viet Nam have the most diverse numbers of species, with 16, 15 and 14 kinds of seagrass, respectively.

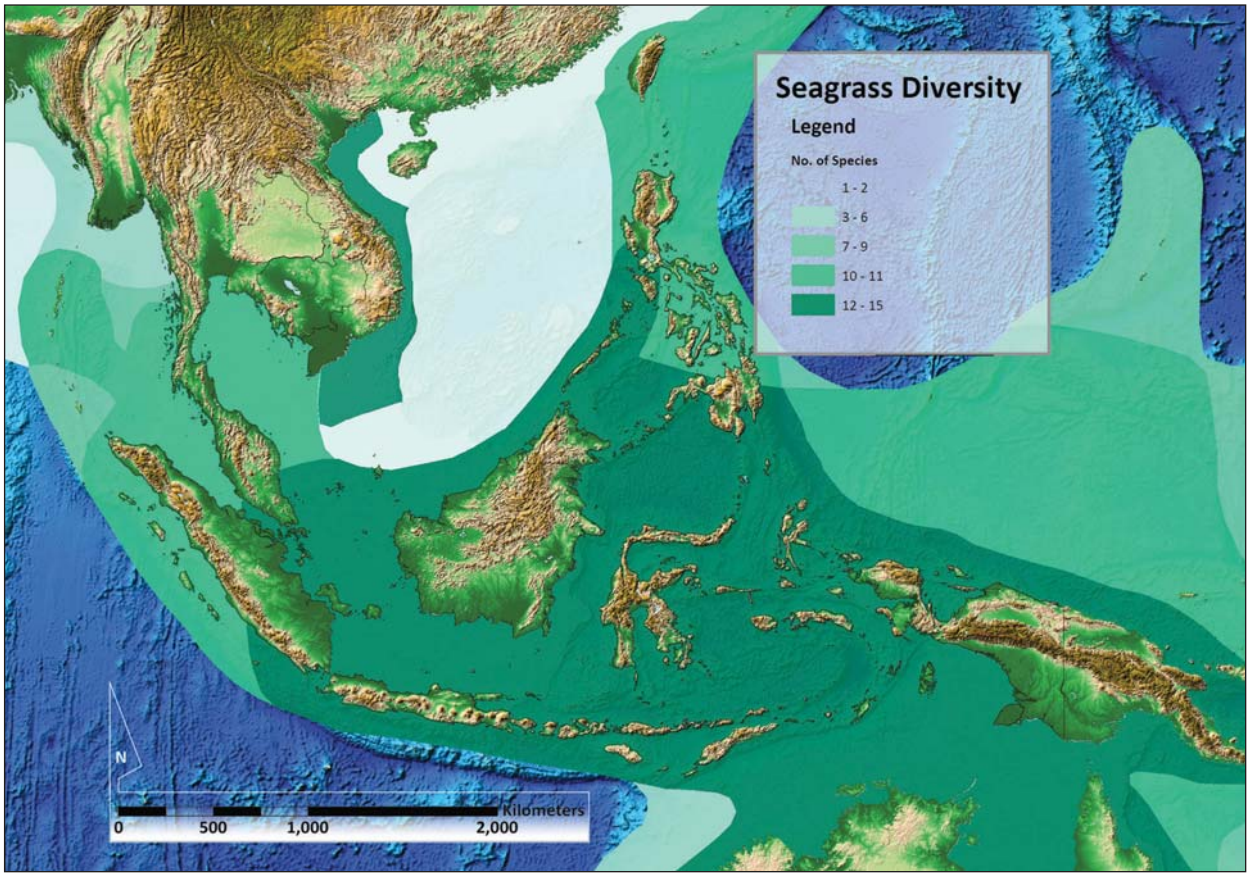
Table 23. Types of seagrass species and extent of seagrass areas in the ASEAN region, 1990 and 2004

Family and Species	BRU[1]	CAM[2]	IND[2]	MAL[2]	MYA[3]	PHI[2]	SIN[1&4]	THA[2]	VIE[2]
Zosteraceae									
Zostera japonica									●
Hydrocharitaceae									
Halophila spinulosa	●		●	●	●	●	●		
Halophila decipiens			●	●	●	●	●	●	●
Halophila minor			●	●	●	●	●	●	●
Halophila beccarii			●	●	●	●	●	●	●
Halophila ovalis	●	●	●	●	●	●	●	●	●
Enhalus acoroides	●	●	●	●	●	●	●	●	●
Thalassia hemprichii	●	●	●	●	●	●	●	●	●
Cymodoceaceae									
Cymodocea serrulata		●	●	●	●	●	●	●	●
Cymodocea rotundata		●	●	●	●	●	●	●	●
Halodule pinifolia		●	●	●	●	●	●	●	●
Halodule uninervis		●	●	●	●	●	●	●	●
Syringodium isoetifolium		●	●	●	●	●	●	●	●
Thalassodendron ciliatum			●	●		●			●
Ruppiaceae									
Ruppia maritima				●		●		●	●
Undescribed taxa									
Halophila minor, new variety						●			
Halophila sp.1*						●			
Halophila sp.2**				●					
Total per country	4	8	13	15	9	16	12	12	14
Area (sq km)	NAD	324.94[5]	18,688.9-30,000[6]	NAD	NAD	27,282[7]	NAD	149.9[8]	68-96.5[9]

Legend: ● - Indicates presence of species in the country.

Sources:
[1] Fortes, Miguel. 1990. Seagrass: A Resource Unknown in the ASEAN Region. International Centre for Living Aquatic Resources and Management. 2004. pp 5-6.
[2] United Nations Environment Programme. 2004. Seagrass in the South China Sea. UNEP/GEF/SCS Technical Publication No. 3. pp10, accessed on 10 April 2010 at http://www.iwlearn.net/iw-projects/unepscs/reports/SCS_Seagrass_Booklet.pdf .
[3] Soe-Htun, U., U San-Tha-Htun, Daw Mu-Mu Aye, Daw Ni-Ni-Win, Daw Lei-Lei-Win, Masao Uno. Notes on Seagrasses along Myanmar Coastal Regions, Bulletin on Maine Science and Fisheries, Kochi University. No 21. pp.13-22. 2001. accessed on 12 April 2010 at https://ir.kochi-u.ac.jp/dspace/bitstream/10126/4380/1/marine21-013.pdf.
[4] National Parks Board, Singapore. 2010. Singapore – 4th National Report to the Convention on Biological Diversity. September 2010. pp19.
[5] Ministry of Environment, Cambodia. 2009. Fourth National Report to the Convention on Biological Diversity. Kingdom of Cambodia. March 2009, pp15.
[6] Ministry of Environment, Indonesia. 2009. Fourth National Report to the Convention on Biological Diversity, Government of Indonesia. pp.23-24.
[7] Department of Environment and Natural Resources, Philippines. 2009. Assessing Progress Towards the 2010 Biodiversity Target, The Fourth National Report to the Convention on Biological Diversity, Republic of the Philippines, pp.52.
[8] Ministry of Natural Resources and Environment, Thailand. 2010. Marine Gap Analysis for Thailand. 2010.
[9] United Nations Environment Programme. 2008. National Report on Seagrass in South China Sea, Viet Nam. October 2008, pp.5, accessed on 10 April 2010 at http://www.seagrasswatch.org/Training/proceedings/Seagrass_Watch_Bali_workshop_May09.pdf.

Figure 19. Seagrass diversity in Southeast Asia



Source: UNEP-WCMC 2005. World Atlas of Seagrasses accessed on 15 April 2010 at http://stort.unep-wcmc.org/imaps/marine/seagrass/viewer.htm. Relief: USGS GTOPO30

Table 23 shows the distribution of seagrass species in the region. Southeast Asia's seagrass areas cover a range from 46,748 to 58,071 square kilometers, based on the aggregate seagrass areas of Cambodia, Indonesia, the Philippines, Thailand and Viet Nam. The distribution map of seagrasses for the region may be seen on Figure 19.

As natural inhabitants of coastal areas, seagrasses exist in proximity to areas of human habitation and are thus exposed to human-based activities. Menez et al (1983)[131] identified potential issues that may harm seagrasses, such as warm water discharges from power facilities, sediments from land-based activities like mining, and sewage from treatment plants and tanker terminals. Coastal development, including recreation facilities, marinas and coastal roads, presents similar threats. The CRC Reef Research Centre (2004)[132] called attention to rising sea temperatures associated with climate change as a probable cause of the scorching or obliteration of seagrasses where its thermal limits are reached.

Williams and Ruckelshaus (1993), Short *et al* (1995), Valiela et al (1997), and Brun *et al* (2006)[133] presented proof from the results of studies conducted elsewhere that increased nitrogen loading in coastal waters stimulates outbreaks of epiphytic algae that could outcompete seagrasses for available light, leading to reductions in seagrass productivity and substantial seagrass losses.

Bottom-trawling, extensive coastline destruction and modification, decline in coastal water quality, and human-induced development have endangered seagrass beds in Southeast Asia. Anthropogenic effects on seagrasses have become apparent in some sites of the Sulu Sea, where epiphytes have been observed to cover entire leaf canopies indicating nutrient enrichment from organic domestic waste[134]. Herrera-Silveira et al (2009)[135] noted that in areas frequently visited by untrained and

Photo from Wikimedia Commons

inadequately informed snorkelers, seagrasses were sparser, shorter, grew more slowly, and had more epiphytes compared to virgin areas. These stresses were associated with sediment re-suspension and the relatively lower presence of epiphyte consumers in more frequently visited seagrass areas. Seagrasses in Viet Nam are threatened by extensive shrimp farming, the use of push nets and trawling in shallow areas, sedimentation, floods and typhoons, reduced water quality from shrimp pond discharge, and eutrophication from rivers[136]. Indonesia, the Philippines and Thailand have each experienced from 30 up to 50 per cent losses of seagrass habitats, compounded by the fact that the loss figures for other Southeast Asian countries remain largely unknown[137].

Table 24 shows the various threats to seagrass ecosystems in Southeast Asia.

As early as 1983, Menez *et al*[138] have recommended that seagrasses must be better understood, mapped and assessed of value before actions that destroy or degrade them are allowed to continue. The high vulnerability of seagrasses to physical damage and pollutive substances must be periodically kept in check to maintain the health of seagrass ecosystems and the health of organisms that are dependent on it. Kockzius (1997)[139] reinforces earlier pronouncements that coral reefs adjacent to shallow water foraging areas, such as seagrass beds, have higher fisheries production compared to those that are not adjacent to such "nursery areas". He suggests that conservation actions, such as the establishment of marine protected areas, should include seagrass meadows to assure a steady source of recruits.

Project initiatives, such as "Reversing Environmental Degradation Trends in the South China Sea and the Gulf of Thailand", have recognized the importance of seagrasses to local coastal ecologies and have supported the preparation of national plans for seagrasses, monitoring of the ecosystem and involving local communities in its management.

As a result of the conduct of the Marine Gap Analysis among countries in Southeast Asia, the ASEAN Member States have identified seagrass areas as part of their future MPA initiatives.

Table 24. Summary of threats to seagrass occurring in Southeast Asia

Threats	BRU	CAM[1]	IND[2]	MAL[2]	MYA[3]	PHI[2]	SIN[4&5]	THA[2&6]	VIE[2&7]
Land reclamation					●		●		
Coastal development							●		●
Land-based activities								●	
Agriculture		●				●		●	●
Aquaculture		●		●	●	●		●	●
Pollution			●					●	
Sedimentation						●	●		
Siltation			●			●			
Dredging									
Trawling								●	●
Blast fishing			●	●		●			●
Illegal fishing								●	
Destructive fishing practices		●						●	
Over/ unsustainable fishing						●			
Eutrophication						●			
Domestic waste		●							
Industrial waste		●							
Mining		●	●	●	●	●		●	
Tourism					●				●
Nutrient loading						●			
Solar salt Production					●				

Legend: ● - Indicates presence of threat in the country.

Sources:

[1] Ministry of Environment and United Nations Development Program/Global Environment Facility. 2006. Third National Report to the Convention on Biological Diversity, Kingdom of Cambodia accessed on 6 March 2010 at https://www.cbd.int/reports/search/.

[2] World Bank. 2007. Thailand Environment Monitor 2006, accessed on 10 April 2010 at http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/EXTEAPREGTOPENVIRONMENT/0,,contentMDK:20194499~menuPK:502892~pagePK:34004173~piPK:34003707~theSitePK:502886,00.html.

[3] Soe-Htun, U, U San-Tha-Htun, Daw Mu-Mu Aye, Daw Ni-Ni-Win, Daw Lei-Lei-Win, Masao Uno. 2001. Notes on Seagrasses along Myanmar Coastal Regions, Bulletin on Maine Science and Fisheries, Kochi University. No 21. pp.13-22, accessed on 12 April 2010 at https://ir.kochi-u.ac.jp/dspace/bitstream/10126/4380/1/marine21-013.pdf.

[4] McKenzie, Len J., Yaakub, S.M., and Yoshida, Rudi L. 2007. Seagrass-Watch: Guidelines for TeamSeagrass Singapore Participants, Proceedings of a training workshop, National Parks Board, Biodiversity Centre, Singapore, 24th – 25th March 2007 (DPI&F, Cairns). 32pp., accessed on 10 April 2010 at http://www.seagrasswatch.org/Info_centre/Publications/pdf/Seagrasses_of_Singapore_2007.pdf

[5] National Parks Board, Singapore. 2010. Singapore – 4th National Report to the Convention on Biological Diversity. September 2010. pp19.

[6] Seagrass-Watch website. Seagrass – Thailand, accessed on 26 March 2010 at http://www.seagrasswatch.org/Thailand.html .

[7] UNEP/GEF South China Sea Project. 2007. National Report of Seagrass in the South China Sea: Viet Nam, accessed on 10 April 20 at http://www.unepscs.org/remository/Download/19_-_Technical_Publications_and_Guidelines/National_Reports/03_National_Reports_on_Seagrass/07_National_Report_on_Seagrass_of_the_South_China_Sea_in_Viet Nam.htm

End Notes

[1] World Resources Institute. 2000.
[2] Forest Trends, The Katoomba Group, and UNEP. 2008.
[3] ASEAN Secretariat 2009. Fourth ASEAN State of the Environment Report 2009. Jakarta, Indonesia, October 2009.
[4] World Resources Institute 2005. Millennium Ecosystem Assessment: *Ecosystems and human well-being. Scenarios Assessment.* Washington, DC, USA.
[5] Australian Government. 2009. Department of Sustainability, Environment, Water, Population and Communities accessed on 1 October 2010 at http://www.environment.gov.au/biodiversity/hotspots/index.html
[6] Australian Government. 2009. *op. cit*.
[7] Fourth ASEAN State of the Environment Report 2009. Jakarta: ASEAN Secretariat, October 2009.
[8] Millennium Ecosystem Assessment. 2005. *op. cit.*
[9] Conservation International. 2008.
[10] Fourth National Report to the Convention on Biological Diversity. Brunei Darussalam.
[11] Fourth National Report to the Convention on Biological Diversity. Cambodia.
[12] Primack *et al*, 1998
[13] Lindenmayer, D.B. and J.Franklin (eds). 2003. Towards forest sustainability, CSIRO Publishing, Collingwood, Victoria.
[14] Garner, Toby. 2010. Monitoring forest biodiversity: improving conservation through ecologically-responsible management, Earthscan, London.
[15] Billington C., V. Kapos, M.S. Edwards, S. Blyth, and S. Iremonger. 1996. Estimated original forest cover map – a first attempt. WCMC, Cambridge, UK.
[16] UNEP, FAO, UNFF. 2009. Vital forest graphics, accessed on 20 September 2010 at http://www.unep.org/vitalforest/
[17] *Ibid.*
[18] *Ibid.*
[19] World Development Report, 2008. Agriculture for Development, The World Bank 1818 H Street, Washington DC.
[20] Millennium Ecosystem Assessment, 2005. *op. cit.*
[21] FAO. 2003. *World Agriculture: towards 2015/2030,* J.Bruinsma (ed.), (London, Earthscan Publications)
[22] Davis, Crystal, 2009. "Decline in Farm Animal Genetic Diversity Raises Food Security Concerns", WRI EarthTrends, accessed on 7 September 2010 at http://earthtrends.wri.org/updates/node/239
[23] *Ibid.*
[24] Paule, Ma. Cristina, Jane Girly Cuerdo, Mary Anne Reyes, Arnel Rala, Jacob van Etten, Andrew Nelson, and Robert J. Hijmans, 2010. *Mapping Gene Bank Collection,* Rice Today, IRRI, Philippines.
[25] Virmani, Sant S, 1998."Hybrid rice research and development in the tropics", in *Advances in Hybrid Rice Technology,* IRRI, p. 35.
[26] FAO, 2004. Biological diversity in food and agriculture: Crops.
[27] FAO. 2007. Subregional report on animal genetic resources: Southeast Asia. Annex to *The State of the World's Animal Genetic Resources for Food and Agriculture.* Rome. accessed on 2 April 2010 at ftp://ftp.fao.org/docrep/fao/010/a1250e/annexes/Subregional%20Reports/Asia/SouthEastAsia.pdf
[28] UNESCAP, 2006. State of the Environment in Asia and the Pacific 2005: Economic Growth and Sustainability. United Nations, Bangkok, Thailand
[29] Altoveros, Nestor C. and Teresita H. Borromeo. 2007. The State of the Plant Genetic Resources for Food and Agriculture of the Philippines (1997-2006). A Country Report. Department of Agriculture, Bureau of Plant Industry. January 2007.
[30] FAO. 2007. *op cit.*
[31] FAO. 2010. International Treaty on Plant Genetic Resources for Food and Agriculture accessed on 4 May 2010 at http://www.fao.org/Legal/treaties/033s-e.htm.
[32] *Ibid.*
[33] Chivian, Eric and Aaron Bernstein (eds), 2008. Sustaining Life: *How human health depends on Biodiversity*, Oxford University Press, New York, U.S.A.
[34] Ellison, J.C., 2009. Geomorphology and sedimentology of mangrove swamps. In Wolanski, E., Cahoon, D.R. and Perillo, G.M.E. (Eds.) *Coastal Wetlands: an Ecosystem Integrated Approach.* Elsevier Science, Amsterdam, pp. 564-591.
[35] Lovelock, C.E. and Ellison, J.C., 2007. Vulnerability of mangroves and tidal wetlands of the Great Barrier Reef to climate change. In Johnson, J.E. and Marshall, P.A. (Eds) Climate Change and the Great Barrier Reef: A Vulnerability Assessment. Great Barrier Reef Marine Park Authority and Australian Greenhouse Office, Australia, pp. 237-269.
[36] Gilman et al, 2008

[37] Ellison, J.C., 2009. Geomorphology and sedimentology of mangrove swamps. In Wolanski, E., Cahoon, D.R. and Perillo, G.M.E. (Eds.) *Coastal Wetlands: an Ecosystem Integrated Approach.* Elsevier Science, Amsterdam, pp. 564-591.
[38] The Global Environment Center. 2009. Conservation of Peat Land Biodiversity in South East Asia (Phase II): A Completion Report Dec 2008 – Nov 2009. Unpublished.
[39] *Ibid*.
[40] *Ibid.*
[41] *Ibid.*
[42] *Ibid.*
[43] *Ibid.*
[44] ASEAN Peatland Management Strategy 2007 accessed on November 2009 at http://www.gecnet.info/index.cfm?&menuid=48.
[45] The Global Environment Center. 2009. *op. cit.*
[46] ASEAN Peatland Management Strategy 2007. *op. cit.*
[47] Corner, E.J.H. 1978. The Freshwater Swamp-Forests of Johor and Singapore. Gardens Bulletin Supplement No. 1. Botanic Gardens, Singapore
[48] ASEAN Peatland Management Strategy 2007. *op. cit.*
[49] The Global Environment Center. 2009. *op. cit.*
[50] Corner, E.J.H. 1978. The Freshwater Swamp-Forests of Johor and Singapore. Gardens Bulletin Supplement No. 1. Botanic Gardens, Singapore
[51] The Global Environment Center. 2009. *op. cit.*
[52] ASEAN Peatland Management Strategy 2007. *op. cit.*
[53] The Global Environment Center. 2009. *op. cit.*
[54] ASEAN Peatland Management Strategy 2007. *op. cit.*
[55] Wyatt-Smith, J. 1963. A manual of Malayan silviculture for inland forests. Malay.Forest Rec. No. 23 (vol. 11)
[56] The Global Environment Center. 2009. *op. cit.*
[57] ASEAN Peatland Management Strategy 2007. *op. cit.*
[58] The Global Environment Center. 2009. *op. cit.*
[59] ASEAN Peatland Management Strategy 2007, *op. cit.*
[60] The Global Environment Center. 2009. *op. cit.*
[61] ASEAN Peatland Management Strategy 2007. *op. cit.*
[62] The Global Environment Center. 2009. *op. cit.*
[63] ASEAN Peatland Management Strategy 2007. *op. cit.*
[64] The Global Environment Center. 2009. *op. cit.*
[65] The Global Environment Center. 2009. *op. cit.*
[66] ASEAN Peatland Management Strategy 2007. *op. cit.*
[67] Joosten, H. and D.Clarke. 2002. Wise Use of Mires and Peatlands. International Mire Conservation Group and International Peat Society. Pp. 304 accessed on January 2010 at http://www.imcg.net/docum/WUMP_Wise_Use_of_Mires_and_Peatlands_book.pdf .
[68] International Strategy for Disaster Reduction. 2010. South East Asia: The ecological and socio-economic background of fire. http://www.fire.uni-freiburg.de/se_asia/sea_back.htm
[69] Goldammer, J.G. 1997. The ASEAN Fire Forum: Initial thoughts towards cooperation in fire and smoke research and management in the ASEAN region. In: Transboundary Pollution and the Sustainability of Tropical Forests: Towards Wise Forest Fire Management - The Proceedings of the AIFM International Conference (Haron Abu Hassan, Dahlan Taha, Mohd Puat Dahalan, and Amran Mahmud, eds.), 137-165. ASEAN Institute for Forest Management, Ampang Press, Kuala Lumpur, 437 p
[70] Ibid.
[71] The Global Environment Center. 2009. *op. cit.*
[72] International Strategy for Disaster Reduction. 2010. South East Asia: The ecological and socio-economic background of fire. http://www.fire.uni-freiburg.de/se_asia/sea_back.htm
[73] Project Fire Fight – South East Asia. 2003. Burning Peatlands Equals Smoke and Haze. No.7 May 2003 Burning Issues Newsletter. http://www.fire.uni-freiburg.de/GlobalNetworks/PeatlandFireNetwork/Burning_no.7.pdf accessed August 2010
[74] The Global Environment Center. 2009. *op. cit.*
[75] ASEAN Peatland Management Strategy 2007. *op. cit.*
[76] The Global Environment Center. 2009. *op. cit.*
[77] ASEAN Peatland Management Strategy 2007. *op. cit.*
[78] The Global Environment Center. 2009. *op. cit.*

[79] The Global Environment Center. 2009. *op. cit.*
[80] McGraw-Hill. 2002. Dictionary of Scientific and Technical Terms. http://www.mhprofessional.com accessed February 2010
[81] The Freshwater Ecoregions of the World accessed on February 2010 at http://www.feow.org/index.php.
[82] *Ibid.*
[83] *Ibid.*
[84] Casey, Michael. 2009. Rare crocs found hiding in plain sight in Cambodia http://usatoday.com accessed March 2010
[85] Millennium Ecosystem Assessment. 2005. *op. cit.*
[86] IEEP, Alterra, Ecologic, PBL and UNEP-WCMC. 2009. *Scenarios and models for exploring future trends of biodiversity and ecosystem services changes.* Final report to the European Commission, DG Environment on Contract ENV.G.1/ETU/2008/0090r. Institute for European Environmental Policy, Alterra Wageningen UR, Ecologic, Netherlands Environmental Assessment Agency, United Nations Environment Programme World Conservation Monitoring Centre.
[87] *Ibid.*
[88] *Ibid.*
[89] *Ibid.*
[90] *Ibid.*
[91] *Ibid.*
[92] The Freshwater Ecoregions of the World. *op. cit.*
[93] Tun, Karenne, Chou Loke Ming, Thamasak Yeemin, Niphon Phongsuwan, Affendi Yang Amri, Niña Ho, Kim Sour, Nguyen Van Long, Cleto Nanola, David Lane, Yosephine Tuti. Status of Coral Reefs in Southeast Asia. Global Coral Reef Monitoring Network, accessed on 22 February 2010 at http://www.reefbase.org/download/gcrmn_download.aspx?type=10&docid=13321.
[94] Tabuchi, Ryuchi. 2003. The rehabilitation of mangroves in Southeast Asia. Forestry and Forest Products Research Institute, Todori-machi, Hachioji, Japan, accessed on February 2010 at http://www.unu.edu/env/plec/marginal/proceedings/TabuchiCH12.pdf
[95] Ellison, Joanna C. 2009. Climate change impacts on, and vulnerability and adaptation of mangrove ecosystems, School of Geography and Environmental Studies, University of Tasmania. Australia 2009.
[96] Global Extent of Mangroves. 2004. Food and Agriculture Organization, Rome, Italy, accessed on February 2010 at http://scholar.google.com.ph/scholar?q=Global+Mangrove+FAO+2004&hl=en&as_sdt=0&as_vis=1&oi=scholart.
[97] Ellison. 2009. *op. cit.*
[98] Ellison. 2009. *loc. cit.*
[99] Ellison. 2009. *loc. cit.*
[100] Polidoro, Beth A., Kent E. Carpenter, Lorna Collins, Norman C. Duke, Aaron M. Ellison, Joanna C. Ellison, Elizabeth J. Farnsworth, Edwino S. Fernando, Kandasamy Kathiresan, Nico E. Koedam, Suzanne R. Livingstone, Toyohiko Miyagi, Gregg E. Moore, Vien Ngoc Nam, Jin Eong Ong, Jurgenne H. Primavera, Severino G. Salmo, III, Jonnell C. Sanciangco,1 Sukristijono Sukardjo, Yamin Wang, and Jean Wan Hong Yong. (under review). 2010. The loss of species: mangrove extinction risk and failure of critical ecosystem services. PLoS ONE 5:(4): e10095, accessed on February 2010 at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2851656/.
[101] Godrej, Soonabai Pirojsha, undated. Symbiosis of Industry and Nature, Mangrove Conservation. Marine Conservation Center, accessed on 21 July 2010 at http://www.mangroves.godrej.com/MangroveVegetation.htm.
[102] Godrej undated. *ibid*.
[103] Godrej undated. *op. cit.*
[104] Godrej undated. *loc cit.*
[105] Godrej undated. *loc cit.*
[106] Ellison. 2009. *loc. cit.*
[107] Ellison. 2009. *loc. cit.*
[108] Personal communication of Dr. Filiberto Pollisco with Dr. Joana Ellison during the conduct of the ASEAN Conference on Biodiversity. Singapore. October 2009.
[109] Ellison. 2009. *loc. cit.*
[110] Ellison. 2009. *loc. cit.*
[111] Buddemeier, Robert R., Joan A. Kleypas, and Richard B. Aronson. 2004. Environment: Coral reefs Potential Contributions of Climate Change to Stresses on Coral Reef Ecosystems & Global Climate. Pew Center on Global Climate Change, Arlington, Virginia, USA, accessed on 10 April 2010 at http://www.pewclimate.org/docUploads/Coral_Reefs.pdf.
[112] Tun, Karenne, Chou Loke Ming, Thamasak Yeemin, Niphon Phongsuwan, Affendi Yang Amri, Niña Ho, Kim Sour, Nguyen Van Long, Cleto Nanola, David Lane, Yosephine Tuti. 2008. Status of Coral Reefs in Southeast Asia, pp.140, accessed on 10 April 2010 at http://02cbb49.netsolhost.com/gcrmn/2008/9.%20South-East%20Asia.pdf.

[113] Wilkinson, C. 2008. Status of coral reefs of the world: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia, pp296 accessed on 6 April 2010 at http://www.reefbase.org/resource_center/publication/main.aspx?refid=27173&referrer=GCRMN

[114] World Coral Reef Atlas 2001. United Nations Environment Programme, accessed on 22 February 2010 at http://coral.unep.ch/atlaspr.htm#Coral%20Reef%20Area%20Statistics.

[115] Allen, Gerald R. and Mohammed Adrim. 2003. Coral Reef Fishes of Indonesia. Zoological Studies 42(1):1-72, accessed on 15 April 2010 at http://www.sinica.edu.tw/zool/zoolstud/42.1/1.pdf.

[116] *Ibid.*

[117] Tun et. al. 2008. *op. cit.*

[118] Assessing Progress Towards the 2010 Biodiversity Target: The 4th National Report to the Convention on Biological Diversity. 2009. Department of Environment and Natural Resources, Manila, Philippines. pp47.

[119] Burke, L., Sellig, L. & Spalding, M. 2002. Reefs at Risk in Southeast Asia. Washington, USA: World Resource Institute

[120] National Report on the Implementation of Convention on Biological Diversity (4th National Report). 2009. Ministry of Natural Resources and Environment, Bangkok, Thailand. p12.

[121] Hinrichsen, Diederich. 1995. Coasts in Crisis, Population and Sustainable Development Programme, AAAS website accessed on 9 April 2010 at http://www.aaas.org/international/ehn/fisheries/fish.htm.

[122] Sumaila, Ussif Rashid, Sylvie Guenette,Jackie Alder and Ratana Chuenpagdee. 2000. Addressing ecosystem effects of fishing using marine protected areas. ICES Journal of Marine Science 57: 752-760, accessed on 25 April 2010 at http://www.idealibrary.com.

[123] Fogarty, Michael J. and Steven A. Murawski. Do Marine Protected Areas Really Work? Georges Bank experiment offers new insights on age-old questions about closing areas to fishing. Woods Hole Oceanographic Institution, Massachussettes, USA, accessed on 27 April 2010 at http://www.whoi.edu/oceanus/viewArticle.do?id=3782.

[124] *Ibid.*

[125] Abesamis, Rene A., Angel C. Alcala and Garry R. Russ. 2006. How much does the fishery at Apo Island benefit from spillover of adult fish from the adjacent marine reserve? Fish Bulletin. 104:360-375.

[126] McKenzie, Len J. and Rudi L.Yoshida. 2009. Seagrass Watch: Proceedings of a Workshop for Monitoring Seagrass Habitats in Indonesia. The Nature Conservancy, Coral Triangle Center, Sanur, Bali, accessed on 10 April 2010 at http://www.seagrasswatch.org/Training/proceedings/Seagrass_Watch_Bali_workshop_May09.pdf.

[127] Seagrass in the South China Sea. 2004. United Nations Environment Programme-Global Environment Facility (UNEP/GEF/SCS) Technical Publication No. 3. pp.10, accessed on 10 April 2010 at http://www.iwlearn.net/iw-projects/unepscs/reports/SCS_Seagrass_Booklet.pdf .

[128] McKenzie and Yoshida. 2009. *op. cit.*

[129] Tun, Karenne, Loke Ming Chou, Annadel Cabanban, Vo Si Tuan, Philreefs, Thamasak Yeemin, Suharsono, Kim Sour and David Lane. 2004. Status of Coral Reefs, Coral Reef Monitoring and Management in Southeast Asia, 2004. Global Coral Reef Monitoring Network, accessed on 25 February 2010 at http://www.reefbase.org/download/download.aspx?type=10&docid=9535.

[130] Menez, Ernani G., Ronald C. Philips and Hilconida P. Calumpong. 1983. Seagrasses of the Philippines. Smithsonian Institution Press. City of Washington. 40 pages

[131] CRC Reef Research Centre. 2004. Current State of Knowledge: Seagrasses in Queensland Waters

[132] Brun, F.G., I. Hernández, J.J. Vergara, G. Peralta, J.L. Pérez-Lloréns. 2006. Assessing the toxicity of ammonium pulses to the survival and growth of *Zostera noltii.* Marine Ecology Progress Series, 225: 177-187.

[133] Ma. Gregoria Joanne P. Tiquio and Randell E. Villanueva. 2006. Characterization of seagrass communities and associated-seaweeds in the Cagayan Ridge and Balabac Strait Marine Biodiversity Conservation Corridors. Trip Report submitted to Conservation International - Philippines (April – May 2006).

[134] Jorge A. Herrera-Silveira, Just Cebrian, Jennifer Hauxwell, Javier Ramirez-Ramirez and Peter Ralph. 2009. Evidence of negative impacts of ecological tourism on turtlegrass (Thalassia testudinum) beds in a marine protected area of the Mexican Caribbean. Aquatic Ecology.

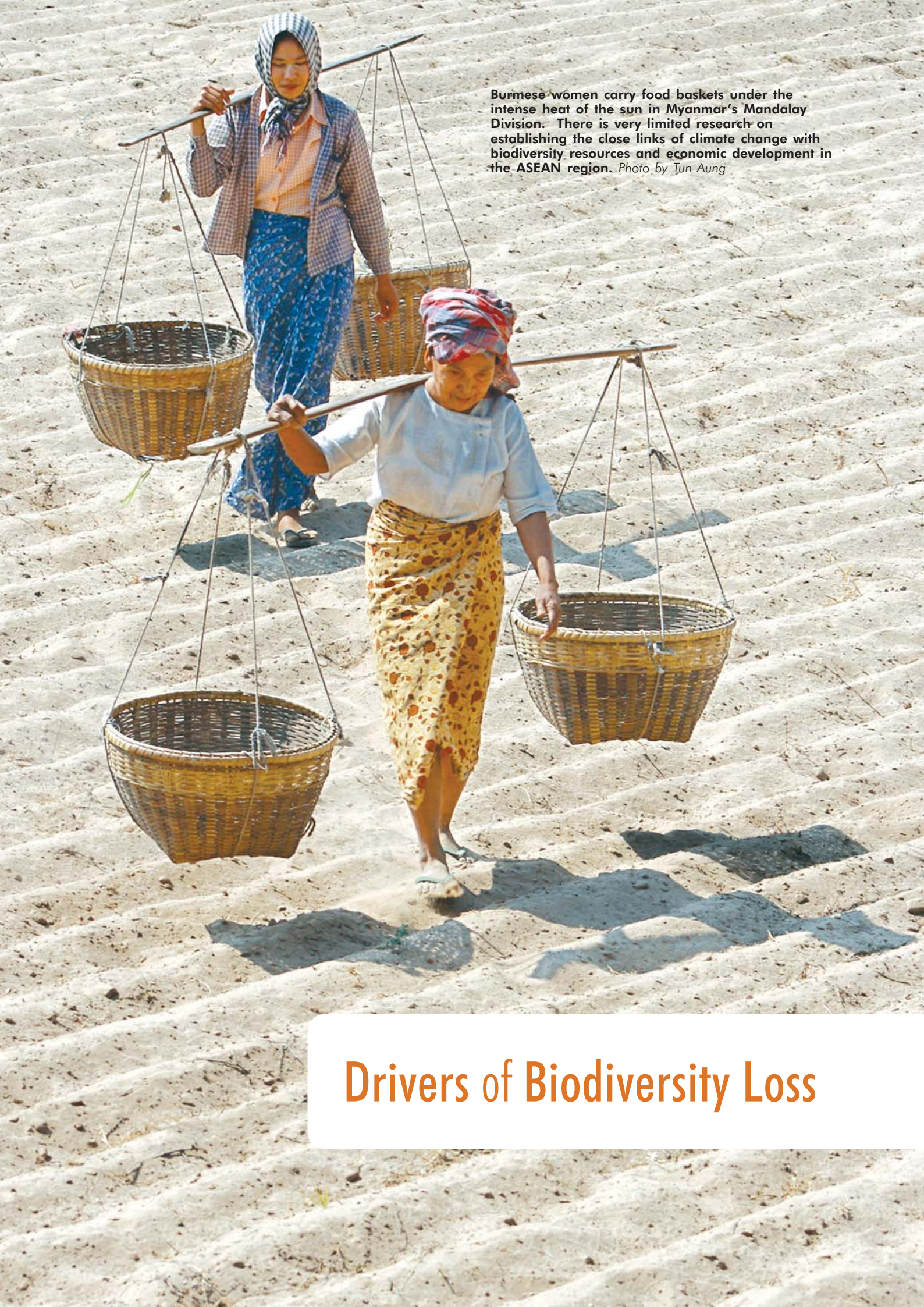
[135] Huu Tri Pham, Huu Dai Nguyen, Xuan Hoa Nguyen and Thi Linh Nguyen. 2006. Study on the variation of seagrass population in coastal waters fo Khanh Hoa Province, Viet Nam. Coastal Marine Science 30(1): 167-173

[136] Menez *et al. op. cit.*

[137] United Nations Environment Programme. 2004. Seagrass in the South China Sea. UNEP/GEF/SCS Technical Publication No. 3. pp10, accessed on 10 April 2010 at http://www.iwlearn.net/iw-projects/unepscs/reports/SCS_Seagrass_Booklet.pdf

[138] Menez et al. op. cit.

[139] Kochzius Marc. 1997. Interrelation of ichthyofauna from a seagrass meadow and coral reef in the Philippines. Proc. 5th Indo-Pac. Fish Conf. Noumea.



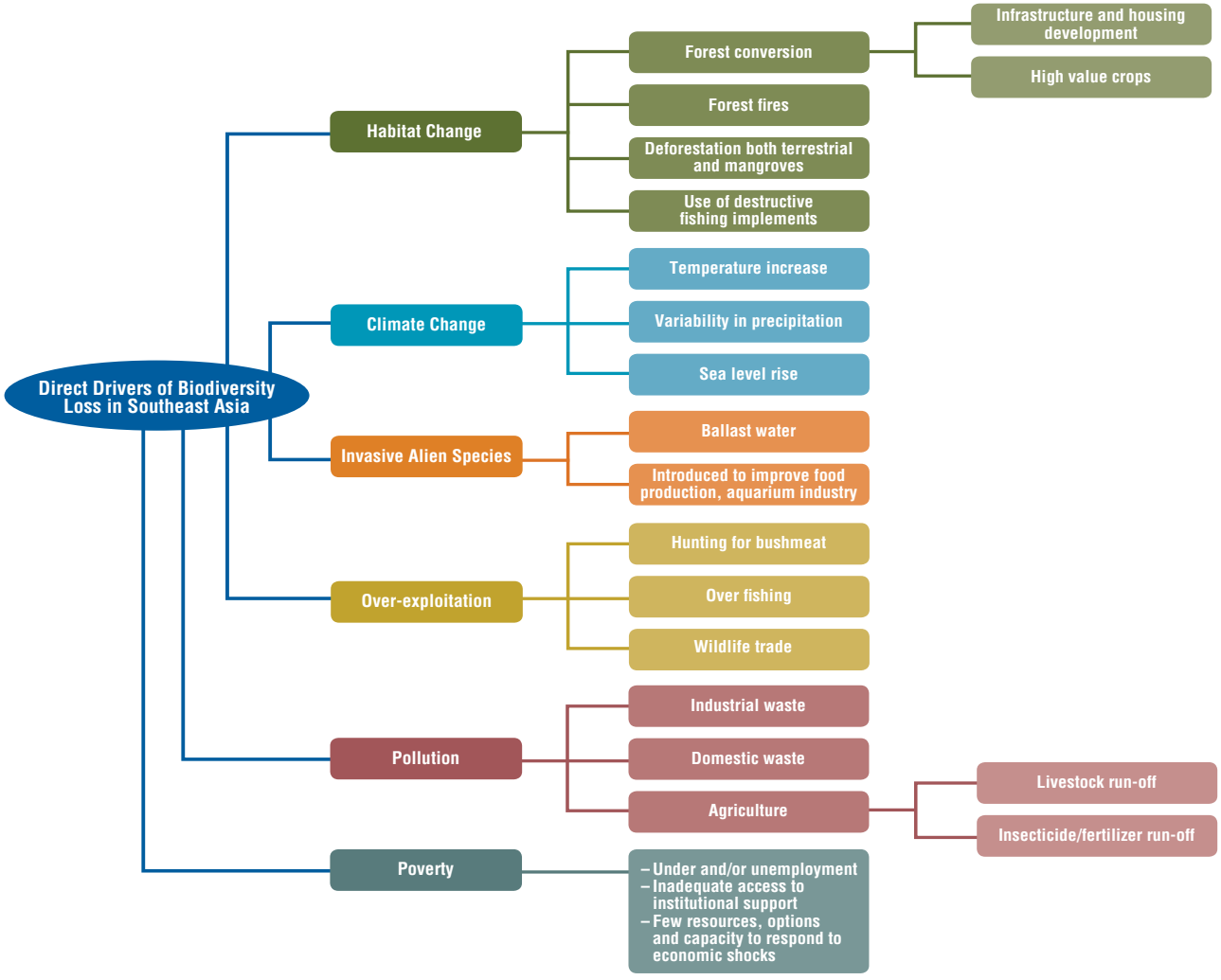
Burmese women carry food baskets under the intense heat of the sun in Myanmar's Mandalay Division. There is very limited research on establishing the close links of climate change with biodiversity resources and economic development in the ASEAN region. *Photo by Tun Aung*

Drivers of Biodiversity Loss

PRESSURES caused by human activities on the region's biodiversity resources have intensified over the past 50 years. However, few truly recognize the full implications of the stress exerted by human activities on the environment. The conventional assessment of biodiversity loss focused largely on the common services that ecosystems provide: provisioning for food and shelter.

Indicators have been developed based on area (*e.g.*, how much forest is lost, in the case of landscapes) and the quantity of species (i.e., species richness), which are more relevant in provisioning services. While these indicators are essential, other equally valuable services, such as regulating and supporting cultural functions, need to be accounted for as well. The Millennium Ecosystem Assessment Report pointed out that, more often, the approach to enhancing one particular service of an ecosystem has a cost to other ecosystem services due to trade-offs[1]. This complex relationship makes it difficult to actually determine the full cost and value of biodiversity loss in the region. Viewed in this light, the Convention on Biological Diversity advocates using ecosystems as the fundamental basis for assessing the state and condition of biodiversity resources; and integrates with it other measures such as species variability, function, quantity and distribution, in order to fully understand the role of biodiversity and the implications of its loss to human well-being. For the ASEAN region, the primary drivers of change are illustrated in Figure 20.

Figure 20. Drivers of biodiversity loss



Source: www.vulnerability-asia.uni-hannover.de/

Ecosystems and Habitat Change: The undesirable shift

THE LOCAL environmental conditions where plant and animal species live are changing due to various human activities, such as land use change and the physical modification of water resources[2]. Today, the loss of habitat areas through clearing or degradation is the primary cause of species decline[3].

Ecosystems are what sustain human life on this planet. Humans are dependent on the natural environment for the provision of food, quality of air, drinking water, building material, clothes, fuel and medicine. Rapid urban development and the consequential exploitation of natural resources, however, are having deleterious impacts on plant and animal habitats. Scientists believe that species are disappearing at the rate of 150 to 200 a day – between 50 and 100 times the natural rate[4]. It has been referred to be the greatest extinction crisis since the dinosaurs disappeared 65 million years ago[5].

Two major pressures exert the most impact on habitat change: threats to coastal and marine ecosystems – which include destructive fishing, coral bleaching and the destruction of coral reefs; and deforestation.

Threats to Coastal and Marine Ecosystems. The ASEAN Member States' coastal and marine ecosystems, mostly belonging to the Coral Triangle, are at immediate risk from a host of factors. Along with its various goods and services, these ecosystems confront threats from land- and sea-based sources, unplanned development activities, fishing and aquaculture, oil and gas exploration, and hazards brought about by oil spills and chemical leakages in the seas and oceans. Additionally, the impact of climate change and rising sea levels are significantly more alarming[6].

Altogether, these factors adversely affect food security, employment opportunities and standard of living of the ASEAN region's over 120 million coastal population that depend on fishing, nature tourism and other coastal and marine resources for survival. Fisheries exports and coastal tourism revenues, each providing some USD3 billion in annual foreign exchange income for the region, are likewise at risk[7].

Destructive means of fishing, as a case in point, has threatened 64 per cent of Southeast Asia's coral reefs. These practices have endangered two-thirds of the reefs of the Philippines, Malaysia and Taiwan, and one-half of Indonesia's.

Sedimentation and pollution caused by coastal development and changes in land use have also threatened 37 per cent of the region's total reefs, according to an experts' workshop report in Indonesia in June 2004[8].

The damage rate of coral reefs in Indonesia has reached 40 per cent in 2006, suspected to be mainly caused by inappropriate fish-catching methods – such as dynamite- and cyanide-fishing, *muro ami*, and the use of unsuitable fishing nets; coral reefs mining; and sedimentation. Water sports and tourism activities also contribute to reef deterioration from boat anchors, harmful disposal activities, and walking on the reef especially by marine tourists[9].

Seagrass beds are subjected to threats from bottom trawling and extensive coastline destruction and modification. In the Philippines alone, it is estimated that between 30 to 40 per cent of seagrass have been lost over the last 50 years[10]. About ten per cent or 3,000 square kilometers of seagrass in Indonesia have been damaged by sand-dredging, the use of bag nets in trawling, and pollution[11]. In Malaysia, the loss and degradation of coral reefs and mangrove areas are caused mainly by land development, human encroachment and overfishing. While in Thailand, many coral reef

Students clean a part of Pudak area at Kampong Ayer in Brunei to support the government's campaign to clean rivers which are crucial to the nation's development. *Photo by Abang Muhammad Saifulizam bin Abang Zamhor*

areas have become vulnerable to ecotourism activities. Seagrass beds are degraded mainly by human impact from fisheries, illegal fishing and sedimentation from coastal construction.

The Philippines' marine and coastal resources were assessed in 2005 along the following indicators: mangrove cover, per cent of coral reefs in excellent condition, seagrass cover, and fisheries productivity from municipal waters. Findings indicate that mangrove cover is increasing, but coral reef cover, seagrass areas and fisheries yields are decreasing[12]. Five major threats were identified: chemical pollution and eutrophication, fisheries operations, habitat alteration, invasive alien species (i.e., particularly from crown-of-thorns infestations), and climate change. Primary threats are habitat alteration and loss due to destructive resource use, development activities and human population pressure. Specific threats include mining, logging, hazardous and solid waste disposal, pollution, and land conversion for industrial, agricultural and urban development[13], as well as coastal erosion and storm surges associated with climate change.

The Philippine coral reefs are considered to be one of the highly threatened reef areas in the world[14]– down from five per cent to three per cent, to less than one[15].

Poaching from foreign fishing operations is also adding to the threats to marine and coastal ecosystems. Particularly targeted are marine turtles which command high prices as a delicacy in some foreign markets[16].

Deforestation. The growing population's dependence on timber, fuel wood and other forest products, as well the conversion of forests into agricultural and industrial lands, are taking their toll on the world's forests[17].

Scientists say that of all major tropical regions, Southeast Asia has the highest relative rate of deforestation. They project that the region could lose 75 per cent of its forests by 2100[18].

Already, Southeast Asian countries have lost a total of 555,587 square kilometers of forests from 1980 to 2007[19]. By 2007, the forest cover of the entire ASEAN region was recorded at 43 per cent, equivalent to a total area of 1,904,593 square kilometers. This area comprises a mere five per cent of the world's total. Southeast Asia's forest area declined at an average rate of 20,578 square kilometers annually since 1980 to 2007. What remains today are over-logged and degraded forests.

Unabated conversion of natural habitats for other uses is a major driver of biodiversity loss in the region. Massive deforestation was

witnessed in the 1800s when the countries pursued agricultural expansion to produce more rice and export crops such as coconut, rubber and oil palm[20].

Today, vast areas of forests have been converted to oil palm plantations, especially in Indonesia and Malaysia.

The most significant impact of deforestation is the degradation or loss of habitats for species, resulting in massive species declines and extinction[21]. Natural forests are innate repositories of biodiversity resources – from genetic to species levels. Its destruction or conversion for other land uses removes the condition by which the diversity and stability of the ecosystem are maintained. Thus, replacing natural forests with plantation forests do not warrant the return of species and its natural habitats which have been eradicated in the process of conversion.

The conversion of forests to other uses results in severe environmental costs. *Photo courtesy of Bert Borger, EU Forest Fire Prevention and Control Project, South Sumatra, Indonesia*

Climate Change: The heat is on biodiversity

A family from the countryside of Myanmar carry fire wood amid land affected by drought. The implications of climate change for the ASEAN region's biodiversity resources are projected to be serious. *Photo by Mar Lar Winn*

THE FOURTH Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) Working Group showed that from 1850 to 2005, the average global temperature increased by about 0.76 degrees Celsius, and global mean sea level rose by 12 to 22 centimeters over the last century[22]. This authoritative report concluded that the "warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level."

Consequently, the future resilience of ecosystems will not be spared by climate change. The IPCC report cited that the resilience of many ecosystems is likely to be exceeded this century by an unprecedented combination of climate change; associated disturbances (e.g., flooding, drought, wildfire, insect infestations, and ocean acidification); and other drivers of global change such as land use change, pollution, and the over-exploitation of resources[23].

There is ample evidence that climate change affects biodiversity. The Millennium Ecosystem Assessment reports that climate change is likely to become the dominant direct driver of biodiversity loss by the end of the century[24]. As it is, climate change already forces biodiversity to adapt either by shifting habitat or by modifying life cycles.

The IPCC report predicts that in Asia up to 50 per cent of biodiversity is at risk, and as much as 88 per cent of coral reefs may be lost in the next 30 years as a result of climate change. Globally, about 20 to 30 per cent of species will be at an increasingly high risk of extinction – possibly succumbing by year

2100, as global mean temperatures exceed two to three degrees Celsius above pre-industrial levels[25].

The implications of climate change for the ASEAN region's biodiversity resources are projected to be serious. Climate change will exacerbate the many factors that are already endangering biodiversity in Southeast Asia. These stressors will be magnified over time. Much uncertainty remains over the magnitude of climate change in the ASEAN region, and how this will affect biodiversity resources.

It is Southeast Asia's less developed nations who are most vulnerable to climate change, as its impact is expected to further worsen poverty, particularly the earning capacity of the poor, and exacerbate the already inadequate provisions for health and livelihood[26].

A significant number of the region's population remains underprivileged, subsisting mainly on the uninterrupted use of biodiversity resources, the losses of which are scaling up and proceeding largely unabated. These challenges buttress one another: climate change exacerbates poverty and accelerates biodiversity loss; poverty sequentially compels the poor to exploit the environment unsustainably. Degraded environments, in return, intensify poverty and hasten climate change. The bottom line is that if deforestation in the region continues at its current rate, Southeast Asia stands to lose up to three-quarters of its forests and up to 42 per cent of its biodiversity by 2100[27].

Impact on Species. Climate change is expected to impact species by affecting their populations, distributions and habitats. While habitat loss and fragmentation have been the primary drivers of past and predicted species extinctions, climate change is now putting additional pressure on many animals and plants. The risk of extinction is increasing for species that are already vulnerable, particularly those with strict habitat requirements and restricted ranges[28].

Some examples of the impact on species of climate change in Southeast Asia are the following:

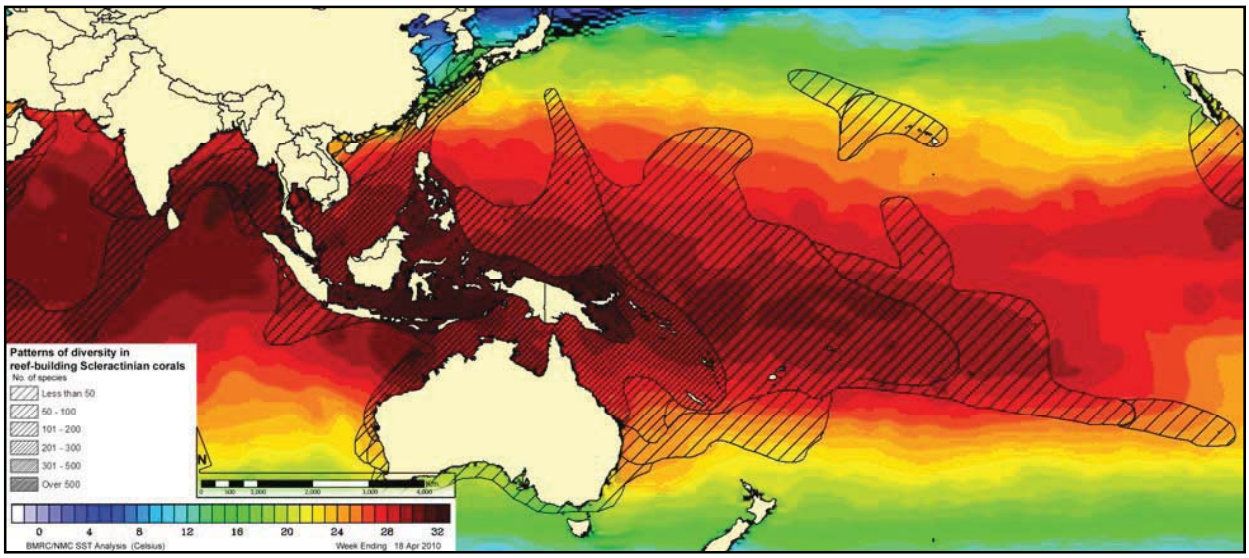
- The Irrawaddy dolphin is a coastal species that relies on the flow of fresh water from estuaries in Bangladesh and elsewhere in Southeast Asia. The Wildlife Conservation Society reported that changes in freshwater flow and salinity may have an impact on the species' long-term survival[29].
- The hawksbill turtle is an ocean-going reptile with a temperature-dependent biology. Specifically, higher temperatures result in more female hatchlings, a factor that could impact the species' long-term survival by skewing sex ratios[30].

Impact on Coastal and Marine Resources. The Asian Development Bank (ADB) cites that climate change will affect coastal and marine resources by: 1) inundating low-lying areas, such as the delta of Cambodia and Viet Nam and certain parts of Bangkok in Thailand, through rising sea levels; 2) affecting seagrass beds in shallow tidal and sub-tidal coastal marine environments along the ASEAN region's coastline, affecting entire food chains that thrive in seagrass ecosystems, including the "dugong" and several species of turtle and fish that feed on seagrass itself; and 3) amplifying the scale of coral bleaching and degeneration of coral reefs[31].

In tropical temperate nearshore habitats, climate change causes a shift in species ranges and tolerance. Coral bleaching occurs, caused by high water temperatures that stress corals, leading them to expel the colorful symbiotic algae that corals need for survival, growth and reproduction (Figure 21). Increases in temperature over a long period of time will eventually kill corals, thereby diminishing ecosystem function and service. Fish population is affected by this occurrence, as the degradation of coastal habitats reduces its capacity to sustain fisheries. Poverty increases and food security diminishes as fish stocks are depleted. This drives fishers to use more and more destructive methods to catch what meager supply is left.

The ASEAN Centre for Biodiversity and the Haribon Foundation in the Philippines conducted a study in 2009 on the impacts of climate change on biodiversity in Southeast Asia. Initial findings show that avian response to climate change causes species distributions to shift pole-wards and up-slopes if current and projected ranges do not overlap, and if

Figure 21. Overlay of species diversity of reef-building sleractinian corals on surface temperature map.



Source: Base layer: Bureau of Meteorology Research Centre, Australia. Sea Surface Temperature – April 2010.
Data layer: J.E.N. Veron and Mary Stafford-Smith. 2000. Corals of the World.

the species are unable to migrate. Interactions between climate change and landscape changes will impede range shifts, resulting in range contractions and potential extinctions[32]. In general, though research on the ecological impact of climate change on amphibians and reptiles is still in the early stages, a few studies have already linked climate change directly to ongoing population declines and species extinctions in herpetofauna.

The direct and indirect impacts of climate change to marine mammals are expected. Direct impacts include temperature and species range alterations; effects on foraging and reproduction due to sea level rise, change in species range and high juvenile mortality; massive die-offs; and shifts in distribution due to the El Niño. Indirect impacts include shifts in the distribution and productivity of prey species due to changes in temperature range, and because nursery grounds for many fish and invertebrate species that are prey to marine mammals will be affected by changes in storm frequency and intensity.

In the fisheries sector, climate change will likely force critical species of fish to migrate towards the poles, gravely disrupting fisheries and the overall marine ecosystem. Warmer water will lead to the large-scale redistribution of these species, mostly moving towards the poles – shifting by more than 40 kilometers per decade, on average.

Impact on Forests. The effects of climate change on forests are manifested through the increased occurrence of forest fires during the dry season; the rising number of pest- and disease-infestations in forest areas; the marginalized survival of seedlings consequent to changes in precipitation patterns; an upsurge in the population of invasive alien species; and intensifying soil erosion due to intermittent drought and flooding[33].

Researchers studying forest fires in Indonesia say that the destruction of forests and peatlands in the country is making it more prone to forest fires, especially during the dry El Niño years. Moreover, according to Dr. Robert Field of the University of Toronto, there was a significant increase in the intensity and scale of fires since the early 1990s, owing to industrial logging and the rapid expansion of oil palm plantations. Dr. Field's team found that Sumatra has suffered from massive forest fires since the 1960s. In Indonesian Borneo, however, where the industrial conversion of forests started later, forest fires became an occurrence beginning only in 1982, and triggered mainly by the drought years[34].

In Viet Nam, the Forestry Management and Protection Division of the Ministry of Agricul-

There is ample evidence that climate change affects biodiversity. According to the Millennium Ecosystem Assessment, climate change is likely to become the dominant direct driver of biodiversity loss by the end of the century. *Photo by George Cabig*

ture and Rural Development (MARD) recorded 226 fires in the first six months of 2009. During this period, a total forest area of 1,200 hectares was destroyed. According to MARD, slash-and-burn agriculture is one of the major causes of forest fires in the country. The occurrence of fires, however, also rose during periods when temperature readings reached over 40 degrees Celsius[35].

Impact on Agriculture. Agriculture is one of the most vulnerable industries to the projected impacts of climate change[36]. Climate change reduces crop yields and intensifies livestock mortality consequent to heat stress and droughts; increases the loss of arable lands due to rising sea levels; and escalates the outbreak of pests and diseases[37].

The ADB reported that extreme weather events have accounted for economic damage to agricultural production in Indonesia, the Philippines, Singapore, Thailand and Viet Nam[38].

In 2004, a group of scientists studied the projected impacts of global warming on crop yields. They examined temperature trends and the relationship between temperature and rice yield at the International Rice Research Institute from 1979 to 2003, and found that grain yield declined by ten per cent for every 1 degree Celsius increase in growing-season minimum temperature during the dry season[39].

Southeast Asia's status as a major producer of grain and various industrial crops is threatened by drought, heat stress and typhoons

– factors that are all offshoots of climate change. A significant decline in fish production due to changes in sea levels, salinity and sea temperature has also been predicted. All told, such downtrends in production are likely to aggravate the existing food insecurity in the region[40].

Impact on Human Health. According to the World Health Organization (WHO), climate change is affecting the following fundamental requirements for health: sufficient food, clean air and safe drinking water. A recent assessment concluded that the global warming that has begun since the 1970s was accountable for over 140,000 excess deaths annually by year 2004[41].

Epidemics of dengue, malaria and other vector-borne diseases are the principal health impacts of climate change[42]. Dengue cases are likely to be amplified by temperature elevations and variability in precipitation[43]. The consequent alterations in the environment create favorable breeding conditions for mosquitoes, allowing them to multiply unabated[44].

In the Philippines, cases of dengue significantly increased from an average of 5,000 cases a year in the early 1990s, to 35,500 cases in 2003. Increasing numbers were similarly observed in Indonesia, Thailand and Viet Nam[45].

Cases of diarrhea-related illnesses are expected to increase consequent to the escalating frequency of drought and floods[46]. Rising sea levels will promote the proliferation of waterborne infectious diseases.

The poor communities are the ones expected to bear the brunt of the impacts of climate change on health, due to their already compromised health prospects[47].

Filipino school children brave the floods to go to school. *Photo by Joel C. Forte*

Invasive Alien Species: An assault with irreversible impact

INVASIVE alien species (IAS) are either plants, animals or microorganisms that have been introduced outside their natural distribution area, and which exhibit rapid growth, reproduction and dispersal to such an extent that they are highly competitive to native species, destructive and difficult to control, particularly if the new ecosystem lacks the predators or pathogens of their own native range. Their introduction to a new ecosystem threatens biodiversity, food security, human health, trade, transport and economic development. The cost of damage caused by IAS globally is estimated at USD1.4 trillion per annum[48].

The invasiveness of alien species lies in their adaptive behaviors, such as rapid growth, great dispersal characteristics, large reproductive capacity, broad environmental tolerance, and effective competition with local species.

The globalization of trade and industry has facilitated the mobility of people and goods over the past decades. Its effect is the increased associated transport of animals, plants and micro-organisms[49]. Shipping, for one, is a major pathway for the unintentional introduction of aquatic invaders when, for instance, some species get carried either in the ballast water or other parts of a vessel.

Species introduction can be both intentional and unintentional. People export or import species for trade to support agriculture, aquaculture, horticulture, forestry, fisheries, food and others. Some species introduction, employed for the biological control of certain pests, ironically turn out into major nuisances themselves. International aid organizations with altruistic intentions of introducing new sources of food to impoverished nations have brought in plants and animals that eventually grew to be invasive. Instances when exotic pets, such as snakes, monkeys and ornamental fish, are released into the environment by its owners also account for some of the intentional introduction of invasive species.

Unintentional introduction may occur when species hitchhike on planes, ships, and even on garbage floating in the open sea. Seeds may adhere to clothes and suitcases. Insects may infest wood packaging materials. Exotic animals kept in captivity, as pets or for breeding, may escape and then turn invasive.

When IAS enter new habitats, the lack of predators and their ability to compete with native species over the existing food supply can allow them to dominate the local ecosystem. Local species can actually become a food source of the IAS, and drive the former to extinction. The supremacy of the IAS can change the community structure and species composition of the area, which may then have cascading effects on ecosystem functions. Habitats are modified to a point where these become no longer livable for the native community. Chain reactions may occur, and reproduction, or the survival of associated species, becomes affected. Predicting impacts is difficult because of the myriad combinations of all factors and possible outcomes that have to be considered. Ultimately, local biodiversity is affected when a non-native species eliminates indigenous species and with it the valuable functions that they perform for the ecosystem. The demise of the native species consequently affects the associated flora and fauna. Vital ecosystem functions, such as pollination, soil regeneration, nutrient cycling, hydrologic functions and others, eventually deteriorate.

IAS is a major driver of environmental change in the region, placing considerable constraints on environmental conservation, economic growth, and sustainable development.

(Clockwise) Among the known invasive alien species in Southeast Asia are the janitor fish, golden apple snail, tree plant and giant toad. *Photo from ASEAN Biodiversity magazine*

The rate at which IAS moves around is rapidly intensifying with the globalization of trade, travel and transport. On top of this, the number and diversity of species being moved all over the world increased. Changes in land use and climate patterns are causing some habitats higher susceptibility to biological invasions[50].

In the ASEAN region, invasive alien species are becoming a threat to biodiversity and the economy. Over the recent years, the region witnessed how the introduction of certain species into ecosystems turned into virtual ecological and economic nightmares. The following examples clearly illustrate the impacts of IAS in the region:

- The janitor fish (*Pterygoplichthys pardalis* and *P. disjunctivus*) originally imported as aquarium cleaners, escaped and infested the Philippines' Laguna Lake and Marikina River, disrupting balance in the lake's and river's ecosystem. It damaged fish cages and fishing nets, affecting fish production and the fish catch of locals. It also damaged important waterways, causing the collapse of riverbanks.
- The golden apple snail cost Philippine rice farmers USD28 to 45 million annually[51]. The snail wrought havoc to Viet Nam's rice fields, where it was introduced in 1988 to the public for culturing in backyard ponds as an alternative high-protein food for duck and fish. Subsequently, two snail farms were established as a joint venture between Viet Namese and Taiwanese companies for large-scale culture and export to Taiwan. Some snails escaped and spread to nearby ponds, trenches and rice fields, where they quickly reached pest status. The government eventually banned snail farming, and spent vast sums of money on control programs and public awareness campaigns.
- The tree plant *Mimosa pigra* (in Thai: "chi yop", "mai yah raap yak", or "maiyarapton"; in Malay: "kembang gajah" or "semalu gajah"; in Bahasa Indonesia: "putri malu"; and in Viet Namese: "trinh nu nhon" or "xao ho") in the Greater Mekong Sub-region converted fertile agricultural lands along

Photo by Ng Wei Chean

the Mekong River into unproductive expanses of shrub lands that harbor lesser biodiversity, reducing fish production (*i.e.,* especially of those with no scales), and affecting water birds relying on grasslands.

IAS is an issue that is tied to major economic activities, and is thus a problem affecting both developed and developing countries. While some countries have addressed specific IAS issues in national programs like the National Biodiversity Strategies and Action Plans and specific IAS frameworks, the nature of the problem requires greater cooperation, particularly among regional partners.

The CBD calls on Parties to "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species (Article 8h)." It has also developed a set of guidelines to assist countries with the implementation of this article.

At the national level, capacities to deal with IAS should be developed by paying attention to training on the biology and control of IAS and biosecurity issues. The level of awareness and skills must be high, particularly along entry points, such as customs and border checkpoints. The evolving problem of IAS in relation to other environmental issues (i.e., climate change, land use changes and pollution) requires constant research and the development of new control technologies. Protected area managers must also be trained to identify non-native species because protected areas are becoming increasingly threatened by IAS which may have been transported through tourism. An integrated national program covering public awareness, skills training, research and information sharing must be developed to manage IAS concerns.

Over-exploitation: Can humans change their consumption patterns?

ILLEGAL wildlife trade. The ASEAN region has long been targeted by illegal wildlife traders as a hotspot in the lucrative, multi-billion dollar global trade of wildlife, in which both live and processed goods of most species are traded, ranging from tigers and elephants to rare orchids and indigenous medicinal herbs, from rare marine species to endemic reptiles and songbirds.

The illegal wildlife trade has esoteric economic implications for the region, involving broad and complex networks of sourcing and marketing. It engages a diverse range of actors including rural harvesters, professional hunters, and an array of traders from wholesalers to retailers, up to the final consumers.

While all ASEAN Member States are signatories to the Convention on International Trade in Endangered Species of Wild Fauna (CITES) and Flora, the poaching, trafficking and illegal consumption of wildlife parts and products remain rampant. The scale of illegal wildlife trade is alarming. Due to the illicit nature of the trade, it has been hard to obtain exact figures, but experts estimate the value of illegal wildlife trade at USD10 to 20 billion annually[52].

Data from the ASEAN Wildlife Enforcement Network (ASEAN-WEN) show the rich biodiversity of Indonesia, Malaysia and Myanmar as being particularly targeted. Smugglers have been frequently caught utilizing transport links through Thailand and Viet Nam. How-

Bats sold on the streets of Medan, North Sumatra in Indonesia are popular as exotic food and traditional medicine. Almost all wild species including illegally cut timber, birds, reptiles, and mammals are traded in the ASEAN region. *Photo by Andi Anshari*

ever, poaching, transit and consumption occur in all countries in varying degrees. A significant proportion of wildlife trafficked through the ASEAN region is purchased by wealthy consumers from outside the region, *i.e.,* China, Europe and the United States[53].

Almost all wild species, including illegally cut timber, birds, reptiles and mammals, are traded in the ASEAN region. The pangolin is the most heavily traded exotic mammal. ASEAN-WEN estimates that 13,000 metric tons of turtles are shipped to China every year from ASEAN countries, where approximately three-quarters of freshwater turtle species are already considered threatened. Illegal wildlife traders have also exported snakes in large numbers to China from Viet Nam, resulting in an explosion of the local rat population in the latter, which subsequently affected crop production.

A fish known in Malaysia as Ikan Todak is trapped in a net laid by village fishermen at the seashore off Tanjung Sepat, Morib, Selangor in Peninsular Malaysia. *Photo by Helena Kalsom Binti Elias*

Illegal wildlife trade will result in massive and irrevocable biodiversity loss if left unchecked. The ASEAN-WEN cites that, "If trends continue, scientists predict that 13 to 42 per cent of the region's animal and plant species could be wiped out this century. At least half of those losses would represent global extinctions[54]."

The World Bank highlighted the devastating effects that the illegal trade and exploitation of wild animals and plants are having on Southeast Asia's biodiversity. "There has been a drastic decline in the population of many wildlife species with high commercial value, many of which are now rare, endangered, or locally extinct – such as the tiger, Sumatran rhinoceros, Javan rhinoceros, Asian elephant, pangolins, freshwater turtles and tortoises, agarwood, and numerous wild orchid species," the study stated[55].

Illegal, unreported and unregulated fishing. In addition to threats brought about by known and quantifiable stresses, illegal, unreported and unregulated (IUU) fishing is a blatant aggravating factor, posing impediments to all attempts to manage fisheries resources and fish stocks in the region[56]. Fish populations tend to remain constant under normal conditions and decline, in most cases, due to overfishing[57]. The growing demand for fisheries resources, the increase in the numbers of fishers and vessels, and the improving efficiency of fishing gears drive the collection of these resources way beyond their capacity to recover. Moreover, the reduced availability of fisheries resources increases competition and, thus, prods players to resort to illegal, and often, more efficient forms of fishing. The lack of capacity of the ASEAN Member States to monitor highly mobile fishing vessels and deliberate poaching from both in-country (local fishers) and those coming from neighboring countries makes it next to impossible to quantify the level and extent of IUU fishing. Wide-

Photo of monkey in cage *Photo by Joanne Nicdao*

There is increasing recognition that the wildlife trade in Southeast Asia has far-reaching effects. *Photo by Tassanee Vejpongsa/FREELAND.*

ranging estimates, however, are available. A recent report estimated the value of IUU fishing at the global scale to be between USD10 to 23.5 billion annually[58]. Information in the same report attributes Philippine losses in 2008 to the amount of Php26.5 billion to poaching by foreign vessels and blast- and cyanide-fishing[59].

Bushmeat Crisis. The Bushmeat Crisis Task Force[60] reported that while habitat loss is often cited as the primary threat to wildlife, commercial hunting for the meat of wild animals has become the most significant immediate threat to the future of wildlife all over the world. The task force refers to bushmeat hunting as a crisis because it is rapidly expanding to countries. Species which were previously not at risk are now threatened due largely to an increase in commercial logging, opening up an infrastructure of roads and trucks that links forests and hunters to cities and consumers.

Humans are extracting wildlife from forests at more than six times the sustainable rate[61].

The Asia-based wildlife trade monitoring network, TRAFFIC, contends that increasing affluence in major consumer markets, particularly China, together with huge improvements in transportation infrastructure, are resulting to a heightened demand for many wild animal species for bushmeat consumption.

Pangolins are the most frequently found mammals seized from illegal traders in the region. In June 2008, TRAFFIC convened a pangolin experts meeting in Singapore. The group concluded that despite adequate 'paper protection', the illegal trade in Asian pangolin meat and scales has caused the disappearance of the scaly anteaters in the region[62].

Current human lifestyle and consumption patterns are now, more than ever, critically incompatible with sustaining the world's remaining natural flora and fauna. Unless serious modifications are made in the realm of human consumption, the degradation of wildlife will gather momentum before it may still be slowed down, rendering the extinction of wildlife inevitable.

Pollution: An issue that can be prevented

THE GBO-3 aptly described that pollution loading from nutrients (nitrogen and phosphorous) poses an imminent threat to terrestrial, inland water and coastal ecosystems[63]. This is particularly true in a region where agriculture is a key economic sector and farming practices have moved towards intensification of food production. The introduction of the Green Revolution Program has enabled many countries in the region to meet their expanding demand for food. Along with this program, however, is the introduction of inorganic inputs such as fertilizers and pesticides, which later were realized to have significant environmental and health impact. As a surrogate indicator of how much anthropogenic nitrogen entered into the agro-ecosystem of ASEAN, the per capita consumption of fertilizer is shown as Table 25.

The implications of the intensive use of inorganic fertilizers and pesticides in many of the water bodies in the region are quite serious. Rice farming generally involves irrigation and the flooding of paddies. This practice opens up vast pathways for nitrogen and phosphate deposition through run-offs that end up in most water bodies especially the river systems and freshwater lakes. A number of countries are already showing a decline in river quality over recent years owing to rapid urbanization, industrialization and agricultural intensification. In Thailand, river quality showed deterioration between 2005 and 2007. The number of rivers classified as poor increased from 29 per cent in 2005 to 48 per cent in 2007. Indonesia is a similar case. In 2007, 27 per cent of the 30 rivers monitored were found to be polluted. A year later in 2008, 54 per cent of the 33 rivers monitored were polluted[64]. In some ASEAN Member States, eutrophication of some of their water bodies has been reportedly characterized by algal blooms: a clear indication of excessive nutrients that stimulate excessive plant growths. Such manifestations have dire impacts on the biodiversity of these ecosystems as they create ecological imbalances.

It must be stressed that the spread of nutrient pollution is not confined to freshwater ecosystems. Coastal and marine areas are equally affected as observed recently and have become a huge challenge for many states. Over the past decade, there have been frequent reports of "red tide" occurrences – a manifestation of excessive nutrients in coastal zones that leads to toxic outbreaks of paralytic shellfish. The impacts of such outbreaks have sometimes been devastating for many fisher folks whose livelihood is solely dependent on seafoods. Similarly, various human activities have increased sediment flows in rivers by about 20 per cent. Mining has also caused heavy toxic pollution, the impacts of which are felt not only on-site but also off-site which are mostly coastal areas: making these areas the "most highly chemically altered ecosystems in the world[65]."

Table 25. Per capita consumption (in nutrients) of NPK fertilizers in the ASEAN region, 1990-2008.

Fertilizer	Consumption (kg/person)				
	1990*	1995*	2000*	2005	2008
Total Fertilizer	18.99	23.09	27.19		
Nitrogen (N total nutrients)				18.66	19.05
Phosphate (P205 total nutrients)				5.04	5.55
Potash (K20 total nutrients)				6.38	9.96

Note: per capita consumption used rural population only.
* year wherein figures of fertilizer consumption where not broken down to each element. FAO data started to break down the nutrient content of fertilizers only in 2002.
Source: FAOSTAT. 2010.Accessed on 9 September 2010 at http://www.faostat.fao.org.

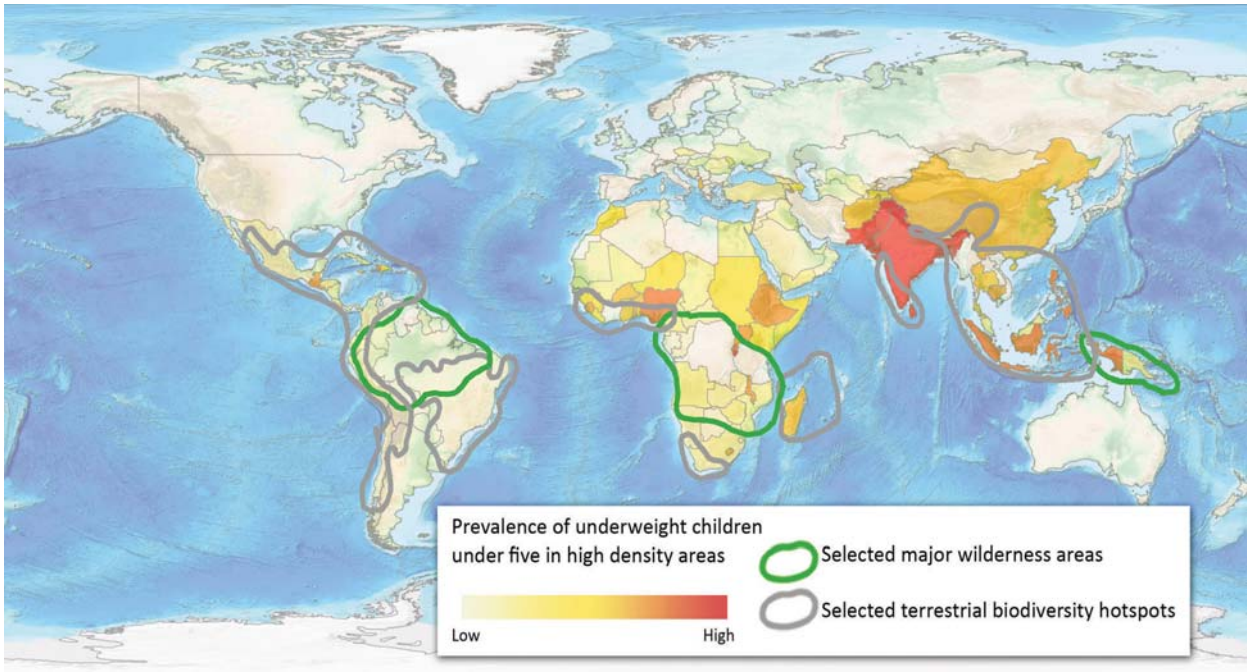
Poverty: A social challenge that must be addressed

AROUND 1.3 billion people live in conditions of extreme poverty, generally in areas of high biodiversity, who depend on biodiversity for food, health, and livelihood[66]. Three quarters of the worlds' poorest citizens, or the sum of those living on less than USD2.00 per day, rely on the environment in a major way for their daily existence[67]. Environmental income, or nature-based earnings, is crucial to the livelihoods of the rural poor as their household economies are anchored on natural resources. In the last decade, the connection between environment and the livelihoods of the poor had been well elucidated. Environmental income, the main sources of which are small-scale farming and the collection of wild food, materials and medicines, often contributes from one-half to two-thirds of the total income stream of poor rural families. Case studies show that the better management of ecosystems producing these goods and services can significantly increase the household incomes of the poor[68].

Poverty often leads to unsustainable pressures on nature and its biological resources. The Millennium Ecosystem Assessment (MA) of 2005 found that 15 out of the 24 major ecosystem services it assessed were being degraded or used unsustainably. These included plant pollination and the provision of fresh water, wood fuels, wild food and fish. The MA concluded that the greatest burden of ecosystem degradation already falls on the poor, and it will continue to do so in increasing measure should current trends persist. This makes world poverty intrinsically linked to ecosystem deterioration and biodiversity loss[69].

The eradication of extreme poverty remains a crucial challenge for most ASEAN Member States.
Photo by © Thomas Moran 2003 - MKH0020

Figure 22. Spatial overlap between areas with globally high biodiversity values and areas of poverty



Source: Undernourished children below five: UN Statistics Division (unstats.un.org); Population Density: CIA World Factbook and other domain sources (Feb 2006); Conservation International 2004; Relief USGS ETOPO30

Figure 22 shows a significant spatial overlap that exists between areas with globally high biodiversity values, and areas where human societies are hammered by poverty.

The ASEAN economic growth rates have fluctuated through the years, suggesting its dynamism and resilience during periods of economic adversities. This pattern is also reflected in its social development. The growth in incomes has allowed for increased public sector investments to meet the rising cost cover for providing social services. The region is home to 580 million people, with a steady annual growth rate of 1.9 per cent. Human development, as measured by the United Nations Development Programme's Human Development Index (HDI) values, varies widely among countries, signifying disparities in the level of development. While the variance is understandable, it should be noted that the 2005 HDI of individual ASEAN Member States have exhibited progressive increases in values since 1995[70], especially those bracketed in the medium ranked countries (i.e., Cambodia, Indonesia, The Lao PDR, Philippines, Thailand and Viet Nam). Increases in the HDI can be attributed to significant improvement in life expectancy, rising prosperity with the expansion of middle-income families, and growing access to information and knowledge as literacy improves. Notably, the dramatic increase in HDI values was due to those from the least developed countries of the ASEAN.

A key social issue that remains challenging for most ASEAN Member States, except Singapore and Brunei Darussalam, is the attainment of Millennium Development Goal 1: the eradication of extreme poverty and hunger, which targets to cut the incidence of poverty by half by 2015. Many of the ASEAN Member States have made significant strides in achieving this goal. However, over 50 million people in the region are still living below the poverty threshold, at USD1.00 a day[71]. This number may be much higher should the poverty threshold level be raised to USD2.00 a day. It is important to note that a significant number of the poor are in rural areas, and they exert intense pressure on the state and condition of natural resources in the region.

Although ASEAN economies continue to be largely agricultural, some significant shifts in the key drivers of economic growth are being noted in the region. Over the past decade, the share of the agriculture sector as a driver of growth has been declining. Conversely,

the share of the industrial and service sectors have been rising significantly. This trend was manifested in 2005 and 2006 when economic growth in the region was attributed to the boost in the exports of electronic products and increases in services relating to the electronic industry[72]. While this shift may be a welcome transition for many Southeast Asian countries that have relied on agriculture to propel their economies, this may also generate negative social and environmental impacts if done without the necessary policy and infrastructure support. In the context of the sustainable management of natural resources, including biodiversity, the implications of such a growth pattern could be far-reaching, potentially affecting the overall sustainability of economic growth in the region. Concern among ASEAN Member States that unbridled growth may lead to unsustainable economic growth patterns is not unfounded. As has been observed, a number of the environmental issues currently being experienced are invariably linked to the way the countries pursue economic growth.

Rural-urban migration is significantly rising in the region. In 2005, the United Nations reported that 42 per cent of the ASEAN Member States' population is in the urban areas, which is double the ratio of rural-urban population in the 1960s[73]. At the current population growth rate, it is projected that more people will live in urban areas than in rural areas by 2020[74]. This trend has profound implications on the quality and integrity of the environment, not only in urban centers, but also in the immediate vicinities of cities. Unabated urbanization has given rise to water and air pollution, solid waste management problems, unsafe disposal of toxic and hazardous waste, the proliferation of informal settlers, and the conversion of other productive land areas for urban use. Urbanization has also resulted in a major change in the consumption patterns of people that exert additional pressures on the environment. This change is particularly significant since the ASEAN Member States are also renowned for producing environmentally sensitive products for export and domestic consumption.

Photo by Filiberto Pollisco, Jr.

While economic development is crucial to meeting the Millennium Development Goals on poverty reduction, long-term sustainability will be undermined should biodiversity issues not be taken into account in all decision-making processes across all sectors. Many actions that could be taken to eradicate extreme poverty are likely to accelerate biodiversity loss in the short-run[75]. The Convention on Biological Diversity further emphasizes that the existence of trade-offs implies that environmental considerations, including those related

Table 26. Progress in achieving MDG 1 Target 1: Halve the proportion of people whose income is less than USD1.00 a day

Country	Data on MDG Performance
Cambodia	The official figures of Cambodia indicate that the poverty headcount index at the national level declined slightly from 39 to 35.9 per cent between 1993 and 1999. A significant number of households are also very close to the poverty line and highly vulnerable to falling into poverty[77].
Indonesia	The poverty level in Indonesia was previously increasing, consequent to the economic crisis in 1999. However, the country has succeeded in lowering the number of poor people from a baseline of 23.4 per cent to 18.2 per cent in 2002, to 17.4 per cent in 2003, and to 16.7 per cent in 2004. Meanwhile, the portion of the population whose daily income is under USD1.00 also dropped from 9.2 per cent in 2001, to 7.2 per cent in 2002[78].
The Lao PDR	Poverty reduction is central to The Lao PDR's development agenda. A strong commitment by the government and international donors has contributed to a remarkable record of poverty reduction over the last 15 years. Poverty was reduced by nearly 30 per cent from 1992 to 2006[79].
Malaysia	Poverty eradication is the over-arching goal among the MDGs, and Malaysia's story in this regard is remarkable. In Malaysia, less than half of all households were poor in 1970. This proportion was halved in about 15 years, and more than half again in the next 15 years. By 2002, only 5.1 per cent of households were poor[80].
Myanmar	Poverty is one of the major challenges facing Myanmar, particularly in the remote and border areas. The Household Income and Expenditure Survey of 2001 showed that the estimated poverty rate is 20.7 per cent for urban areas and 28.4 per cent for rural areas, or a rate of 26.6 per cent for urban and rural combined. The poverty gap ratio was 6.8 per cent. This survey was conducted by the Central Statistical Organization of its Ministry of National Planning and Economic Development[81].
Philippines	As of 2003, the proportion of people with incomes below the subsistence threshold was 13.5 per cent (*i.e.,* 10.2 per cent of all Filipino families), down from the baseline figure of 24.3 per cent (*i.e.,* 20.4 per cent of all Filipino families) in 1991. This represents a decline of 0.90 percentage point each year. At this annual rate of decline, the Philippines is on track in meeting its target of halving the proportion of people below the food threshold. The Mid-term Philippine Development Plan 2004-2010 has set a higher target in terms of proportion of families falling below the subsistence threshold: 8.98 per cent by 2010[82].
Thailand	Most, if not all, of the Millennium Development Goals will be achieved by Thailand well in advance of 2015. Poverty incidence has already been reduced by two thirds: from 27.2 per cent in 1990 to 9.8 per cent in 2002. This success can be attributed to a powerful mix of national harmony, astute policy-making, the strengthening of democratic governance, the industriousness of the Thais, rapid economic expansion, public investment in social services for all, and advantageous historic and geopolitical circumstances[83].
Viet Nam	The poverty rate in Viet Nam, measured by international standards, fell from 58.1 per cent in 1993 to 24.1 per cent in 2004 – with nearly 60 per cent of poor households moving out of poverty. However, the pace of poverty reduction slowed down between 1998 and 2004, with an annual average of a 2.4 percentage point-reduction in the number of poor in the last two years. Viet Nam is among the countries that have successfully achieved the goal of halving the proportion of the poor and hungry well ahead of the 2015 target[84].

Table 27. Progress in achieving MDG 7 Target 1: Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources

Country	Data on MDG Performance
Cambodia	Forest cover in Cambodia declined to 58.7 per cent vis-à-vis the country's total area in 1997, despite the re-plantation of 11,125 hectares between 1985 and 2002. The reduction in forest cover between the 1960s and 2002 amounted to almost 2 million hectares, which represents a rate of reduction of less than half a percentage point per year. At this rate, Cambodia will fall below its country MDG target of 60 per cent from 2005 to 2015.
Indonesia	In Indonesia, the proportion of forest areas to land has gone down to 63.0 per cent in 2004, from 64.2 per cent in 2001, and 67.7 per cent in 1993. The reduction was caused by illegal logging, bush fires and forest conversion for development activities (e.g., mining, road construction and settlement). Indonesia has the biggest forest areas compared to the other ASEAN Member States. However, Indonesia has the highest rate of deforestation, together with the Philippines. The deforestation rate during the period between 1985 and 1997 was 1.6 million hectares per year, and this increased to 2.1 million hectares from 1997 to 2001.
Viet Nam	Forest cover in Viet Nam has increased over the past 10 years from 27.2 per cent in 1990, to 33.2 per cent in 2000, reaching 37.0 per cent in 2004. This is attributed to the government's afforestation policies and the realization of the Five Million Hectare Reforestation Program. The improvement was achieved despite losses of thousands of hectares of forest due to uncontrolled forest fires and illegal logging. The government promulgated forest protection policies in 1996 to improve forest quality and arrest the exploitation of virgin forests.

to biodiversity, should be integrated into the implementation of all relevant MDGs.

The eight developing countries of the ASEAN, namely: Cambodia, Indonesia, The Lao PDR Malaysia, Myanmar, the Philippines, Thailand and Viet Nam, have adopted MDGs as a platform for development (Table 26). However, disparities in MDG performances exist[76], and observations are made based only on available data. Indonesia, Malaysia, Viet Nam and Thailand are considered as early achievers in meeting Target 1: Halve the proportion of people whose income is less than USD1.00 a day.

On MDG 7: Ensuring environmental sustainability, the ASEAN Member States have shown a decline in the proportion of land area covered by forest from 56 per cent to 47 per cent between 1990 and 2005 (Table 27). Forest resources play a key role in poverty reduction and food security. Many people depend on forests for subsistence and as a source of livelihood[85]. Thus, the proportion of land area covered by forest provides a good indication of achievement in meeting MDG 7, Target 1: Integrate the principles of sustainable development into country policies and programs and reverse the loss of environmental resources.

In the midst of worsening ecosystem trends, and in recognition of the close connection between poverty and the environment, there is a need to scale up efforts to improve economic conditions in a way that helps arrest rather than exacerbate environmental damage[86].

End Notes

[1] Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, D.C.

[2] "Scientific Facts on Biodiversity and Human Well-Being," accessed on 17 March 2010 at http://www.greenfacts.org/en/biodiversity/index.htm.

[3] Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, D.C.

[4] Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, D.C.

[5] "Statement by Mr. Ahmed Djoghlaf, the Executive Secretary of the Convention on Biological Diversity, on the Occasion of the Cities alive! World Green Roof Infrastructure Congress, 20 October 2009, Toronto, Canada," accessed on 15 March 2010 at www.cbd.int/doc/speech/2009/sp-2009-10-20-toronto-en.pdf.

[6] Hoi Chu, Nguyen. "A Review of Good Practices in Developing Networks of MPAs in the ASEAN." East Asian Seas Congress. 23 November 2009.

[7] "ADB Support to the Coral Triangle Initiative," accessed on 15 March 2010 at http://www.adb.org/Documents/Brochures/CTI-brochure.pdf.

[8] Delineating The Coral Triangle, its ecoregions and functional seascapes: report of an expert workshop held at the Southeast Asia Center for Marine Protected Areas, Bali, Indonesia on 30 April - 02 May 2003 accessed on 04 February 2011 at http://www.southchinasea.org/docs/Nature%20Conservancy-Coral20%20Triangle.pdf.

[9] Indonesia State of Environment Report 2007. Jakarta: Ministry of Environment.

[10] Fortes, 2008

[11] Indonesia State of Environment Report 2007. Jakarta: Ministry of Environment.

[12] World Bank. 2005. Philippines Environment Monitor: Coastal and Marine Resource Management.

[13] CI, DENR-PAWB and Haribon, 2006

[14] Burke, L., Sellig, L. & Spalding, M. 2002. Reefs at Risk in Southeast Asia. Washington, USA: World Resource Institute.

[15] Nanola et al, 2004

[16] WWF Philippines, 2008

[17] United Nations Environment Programme. 2002. Global Environment Outlook 3. Accessed on 18 August 2010 at http://www.grida.no/publications/other/geo3/?src=/geo/geo3/english/178.htm.

[18] Sodhi, N.S., Koh, L.P., Brook, B.W. and Ng, P.K.L. (2004). Southeast Asian Biodiversity: An Impending Disaster. TRENDS in Ecology and Evolution, Vol. 19 No. 12. 12 December 2004 (London, Elsevier).

[19] Country reports: 4th NR to the CBD, 2008.

[20] Sodhi, N.S., Koh, L.P., Brook, B.W. and Ng, P.K.L. 2004. Southeast Asian Biodiversity: An Impending Disaster. TRENDS in Ecology and Evolution, Vol. 19 No. 12. 12 December 2004 (London, Elsevier).

[21] Sodhi, N.S., Koh, L.P., Brook, B.W. and Ng, P.K.L. 2004. Southeast Asian Biodiversity: An Impending Disaster. TRENDS in Ecology and Evolution, Vol. 19 No. 12. 12 December 2004 (London, Elsevier).

[22] Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: Synthesis Report. Available online at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf.

[23] Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: Synthesis Report. Available online at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf.

[24] Millennium Ecosystem Assessment. 2005. Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, D.C.

[25] Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: Synthesis Report. Available online at http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf.

[26] Asian Development Bank. 2009. The Economics of Climate Change in Southeast Asia: A Regional Review. Available online at http://www.adb.org/Documents/Books/Economics-Climate-Change-SEA/PDF/Economics-Climate-Change.pdf.

[27] Sodhi, N.S., Koh, L.P., Brook, B.W. and Ng, P.K.L. 2004. Southeast Asian Biodiversity: An Impending Disaster. TRENDS in Ecology and Evolution, Vol. 19 No. 12. 12 December 2004 (London, Elsevier).

[28] Nozawa, Cristi Marie C. 2009. Climate Change and Biodiversity: Potential Impacts on Species, Sites, Habitat and People. ASEAN Conference on Biodiversity.

[29] "New WCS Report Identifies 'Unsung' Species Under Stress from Climate Change," Accessed on 12 March 2010 at http://www.wcs.org/press/press-releases/wcs-report-identifies-species-under-stress-from-climate-change.aspx.

[30] "New WCS Report Identifies 'Unsung' Species Under Stress from Climate Change," Accessed on 12 March 2010 at http://www.wcs.org/press/press-releases/wcs-report-identifies-species-under-stress-from-climate-change.aspx.

[31] Asian Development Bank. 2009. The Economics of Climate Change in Southeast Asia: A Regional Review. Available online at http://www.adb.org/Documents/Books/Economics-Climate-Change-SEA/default.asp

[32] Haribon Foundation. December 2009. Report of the Experts' Meeting on Climate Change, Biodiversity and Human Population in Island Ecosystems: Proposed Methods and Joint Research Arrangements.

[33] Asian Development Bank. 2009. The Economics of Climate Change in Southeast Asia: A Regional Review. Available online at http://www.adb.org/Documents/Books/Economics-Climate-Change-SEA/default.asp

[34] Butler, Rhett A. 2009. New Fire Record for Borneo, Sumatra Shows Dramatic Increase in Rainforest Destruction. Mongabay. 22 February 2009. Accessed on 17 August 2010 at http://news.mongabay.com/2009/0022-fires_indonesia.html.

[35] Viet Nam Ministry of Natural Resources and Environment. 2009. Urgent action needed to tackle forest files. Accessed on 17 August 2010 at http://www.monre.gov.vn/monreNet/Default.aspx?tabid=259&idmid=&ItemID=69503.

[36] Zhai, F. and J. Zhuang. 2009. Agricultural Impact of Climate Change: A General Equilibrium Analysis with Special Reference to Southeast Asia. ADBI Working Paper 131, Tokyo: Asian Development Bank Institute. Accessed on 17 August 2010 at http://www.adbi.org/working-paper/2009/02/23/2887.agricultural.impact.climate.change/

[37] Asian Development Bank. 2009. The Economics of Climate Change in Southeast Asia: A Regional Review. Available online at http://www.adb.org/Documents/Books/Economics-Climate-Change-SEA/PDF/Economics-Climate-Change.pdf.

[38] Asian Development Bank. 2009. The Economics of Climate Change in Southeast Asia: A Regional Review. Available online at http://www.adb.org/Documents/Books/Economics-Climate-Change-SEA/PDF/Economics-Climate-Change.pdf.

[39] Peng, S.B., J.L. Huang, J.E. Sheely, R.C. Laza, R.M. Visperas, X.H. Zhong, G.S. Centeno, G.S. Khush, and K.G. Kassman. 2004. Rice Yields Decline with Higher Night Temperature from Global Warming. Proceedings of the National Academy of Scientists 101:9971-75. Accessed on 17 August 2010 at http://www.ncbi.nlm.nih.gov/pmc/articles/PMC454199/

[40] Asian Development Bank. 2009. The Economics of Climate Change in Southeast Asia: A Regional Review. Available online at http://www.adb.org/Documents/Books/Economics-Climate-Change-SEA/PDF/Economics-Climate-Change.pdf.

[41] World Health Organization. 2010. Climate Change and Health. Accessed on 17 August 2010 at http://www.who.int/mediacentre/factsheets/fs266/en/

[42] United Nations Framework Convention on Climate Change. 2007. Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries. Accessed on 17 August 2010 at http://unfccc.int/resource/docs/publications/impacts.pdf

[43] Asian Development Bank. 2009. The Economics of Climate Change in Southeast Asia: A Regional Review. Available online at http://www.adb.org/Documents/Books/Economics-Climate-Change-SEA/PDF/Economics-Climate-Change.pdf.

[44] Kochtcheeva, L. and A. Singh. 2000. An Assessment of Risks and Threats to Human Health Associated With the Degradation of Ecosystems. United Nations Environment Programme. Accessed on 17 August 2010 at http://na.unep.net/publications/heireport.pdf

[45] Asian Development Bank. 2009. The Economics of Climate Change in Southeast Asia: A Regional Review. Available online at http://www.adb.org/Documents/Books/Economics-Climate-Change-SEA/PDF/Economics-Climate-Change.pdf.

[46] United Nations Framework Convention on Climate Change. 2007. Climate Change: Impacts, Vulnerabilities and Adaptation in Developing Countries. Accessed on 17 August 2010 at http://unfccc.int/resource/docs/publications/impacts.pdf

[47] World Health Organization. 2009. Climate Change is Affecting Our Health. Something Should Be Done Now. Accessed on 17 August 2010 at http://www.who.int/globalchange/publications/climate_change_health_brochure/en/index.html.

[48] The Global Invasive Species Programme. 2007. Economic Impacts of Invasive Alien Species: A Global Problem with Local Consequences. Available online at http://www.cabi.org/Uploads/File/CABIDotOrg/gisp%20report/gispeconomicstudies071607(2).pdf.

[49] The Global Invasive Species Programme. 2008. Invasive Alien Species and Poverty: Exploring the Links. Available online at www.gisp.org/publications/reports/invasivesandpoverty.pdf.

[50] IUCN. 2001.

[51] The Global Invasive Species Programme. 2008. Invasive Alien Species and Poverty: Exploring the Links. Available online at www.gisp.org/publications/reports/invasivesandpoverty.pdf.

[52] TRAFFIC. Wildlife Trade: What is it? Accessed on 09 March 2010 at http://www.traffic.org/trade/.

[53] ASEAN-WEN. 2009. Illegal Wildlife Trade in Southeast Asia. Accessed on 08 March 2010 at http://www.asean-wen.org/index.php?option=com_docman&Itemid=80&limitstart=5

[54] ASEAN-WEN. 2009. Illegal Wildlife Trade in Southeast Asia. Accessed on 08 March 2010 at http://www.asean-wen.org/index.php?option=com_docman&Itemid=80&limitstart=5

[55] TRAFFIC. 2008. What's Driving the Wildlife Trade? A Review of Expert Opinion on Economic and Social Drivers of the Wildlife Trade and Trade Control Efforts in Cambodia, Indonesia, The Lao PDR and Viet Nam (East Asia and Pacific Region Sustainable Development Discussion Papers). Washington, DC. USA: East Asia and Pacific Region Sustainable Development Department, World Bank.

[56] Torell, Magnus, Siri Ekmaharaj, Somboon Siriraksophon, and Worawit Wanchana. 2010. Strategies to Combal Illegal Fishing and Manage Fishing Capacity: Southeast Asian Perspective. Fish for the People (8:1). pp10-19.

[57] Pauly, Daniel. 1990. On Malthusian Overfishing. The ICLAEM Quarterly 13(1):3-4.

[58] Agnew et al. 2009 in Torell et al. 2010.

[59] Bureau of Fisheries and Aquatic Resources. 2008. in Torell et al. 2010.

[60] The Bushmeat Crisis Task Force is a Washington-based organization which works on building a public, professional and government constituency aimed at identifying and supporting solutions that effectively respond to the bushmeat crisis in Africa and around the world.

[61] Sodhi, N.S., Koh, L.P., Brook, B.W. and Ng, P.K.L. 2004. Southeast Asian Biodiversity: An Impending Disaster. TRENDS in Ecology and Evolution, Vol. 19 No. 12. 12 December 2004 (London, Elsevier).

[62] TRAFFIC. Wild Animals for Food and Medicine. Accessed on 26 April 2010 at http://www.traffic.org/wild-meat/.

[63] Secretariat of the Convention on Biological Diversity. 2010. Global Biodiversity Outlook 3, Montreal.

[64] ASEAN. 2009. Fourth ASEAN State of the Environment Report 2009.

[65] Millennium Ecosystem Assessment. 2005. Coastal Systems. Accessed on 18 August 2010 at http://www.millenniumassessment.org/documents/document.288.aspx.pdf.

[66] IUCN, 2004a

[67] World Resources Institute in collaboration with United Nations Development Programme, United Nations Environment Programme, and World Bank. 2008. World Resources 2008: Roots of Resilience–Growing the Wealth of the Poor. Washington, DC: WRI.

[68] World Resources, 2005

[69] Ried et al, 2005

[70] United Nations Development Programme. Human Development Report 2007-2008.

[71] United Nations Development Programme. Human Development Report 2007-2008.

[72] UN, 2007

[73] UN, 2006

[74] UN, 2006

[75] SCBD, 2006

[76] UNDP, March 2007

[77] United Nations Development Group. 2003. Cambodia Millennium Development Goals Report. Available online at http://www.undg.org

[78] United Nations Development Group. 2005. Indonesia Progress Report on the Millennium Development Goals. Available online at http://www.undg.org

[79] United Nations Development Group. 2008. The Lao PDR Millennium Development Goals Progress Report. Available online at http://www.undg.org

[80] MDG Report 2005

[81] United Nations Development Group. 2005. Malaysia: Achieving the Millennium Development Goals: Successes and Challenges. Available online at http://www.undg.org

[82] United Nations Development Group. 2007. Philippines Midterm Progress Report on the Millennium Development Goals. Available online at http://www.undg.org

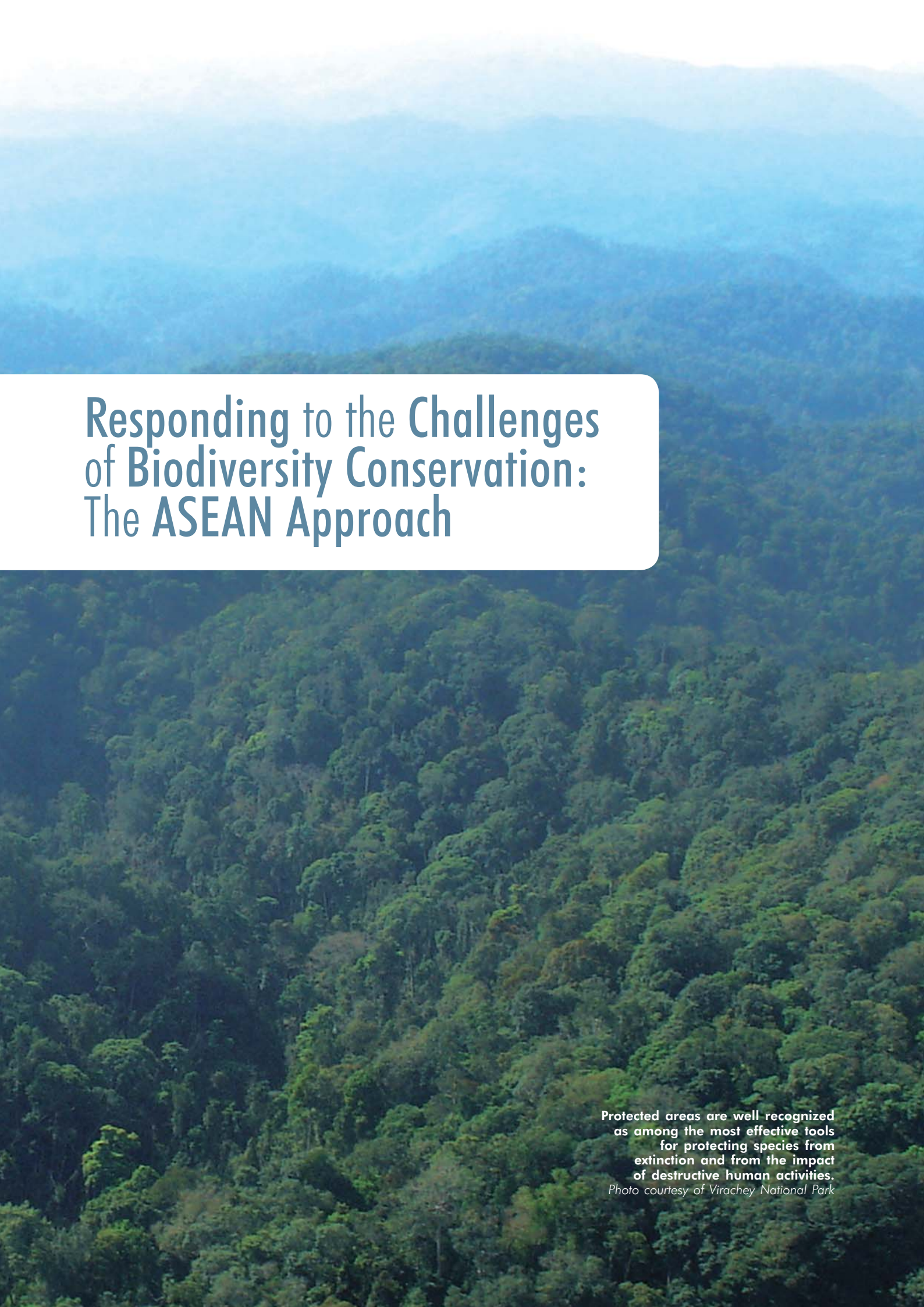
[83] United Nations Development Group. 2004. Thailand Millennium Development Goals Report. Available online at http://www.undg.org

[84] United Nations Development Group. 2005. Viet Nam: Achieving the Millennium Development Goals Available online at http://www.undg.org.

[85] UNDP, March 2007

[86] World Resources Institute in collaboration with United Nations Development Programme, United Nations Environment Programme, and World Bank. 2008. World Resources 2008: Roots of Resilience–Growing the Wealth of the Poor. Washington, DC: WRI.

Responding to the Challenges of Biodiversity Conservation: The ASEAN Approach



Protected areas are well recognized as among the most effective tools for protecting species from extinction and from the impact of destructive human activities.
Photo courtesy of Virachey National Park

Initiatives that are Making a Difference

Protected Areas: Conserving the last frontiers

THE ESTABLISHMENT of Protected Areas (PAs) remains one of the key cornerstones of biodiversity conservation. Protected areas serve as a key benchmark for halting biodiversity loss: associating its establishment in stopping the extinction of many of the identified threatened and endangered species[1]. The value and importance of protected areas have long been recognized since the early twentieth century when countries developed their respective approaches in declaring national parks, natural reserves, and areas prohibited for hunting and collecting of flora and fauna. Global consensus for developing common standards or terminology that best describes the management of these areas came about in 1933 at the International Conference for the Protection of Fauna and Flora[2]. Since then, several refinements have been made particularly in the definition of what a protected area is (and what is not), as well as in their categories based on management objectives. These revisions were done taking into account new understanding anchored on more robust information, the collection of best practices for effectively managing these areas, and shifting development paradigms. The most recent revisions were done in 2008 when the WCPA Steering Committee, following exhaustive consultation processes, endorsed the revised definitions for consideration by the IUCN membership. The new definition of a protected area by the IUCN features the following salient points:

- Clearly defined geographical space covering land, inland water, marine and coastal areas, or a combination of two or more of these;
- Recognition of a range of governance types;

Photo by Corinthia Mercado

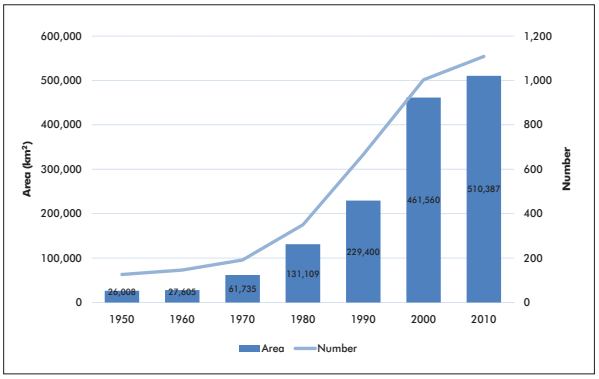
- A legal basis that is either gazetted, recognized through an international convention or agreement, or managed through other non-gazetted means such as recognized traditional rules;
- Reference to biodiversity at genetic, species and ecosystem levels;
- Cognizance of the importance of ecosystem services; and
- Recognition of cultural values which should not interfere with conservation outcomes.

Within this framework, a PA is a "clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values[3]. Correspond-

ing to this refinement of the definition of PAs, the IUCN re-defined as well the six protected area categories (see Box 7). With this revised framework guidelines, countries can be better guided in considering effective management options of existing and future protected areas.

The GBO-3 noted the increasing proportion of land surface designated as protected areas and reckoned from the time such areas have been established more than 50 years ago. This trend is also manifested in the ASEAN region (Figure 23). Since 1950, the designated protected areas have increased by 98 per cent in terms of area, and by 89 per cent in terms of number.

Figure 23. Growth in area and number of designated protected areas in the ASEAN region, 1950-2010



Source: UNEP-WCMC. 2010. World Database on Protected Areas, accessed on June 17, 2010 at http://www.wdpa.org

Box 7. Refined categories of Protected Areas

THE IUCN introduced the PA category system largely to help standardize the descriptions of a particular protected area. It is stressed, however, that countries are given latitude to define these areas in accordance with the management objective they have set. As such, the categorization system should serve as a framework guide for improving the overall management of these conservation areas. The re-defined categories of PAs are as follows:

Categories I and II: Nature reserves, wilderness areas and national parks

Category Ia. Strict nature reserves are strictly protected areas set aside to protect biodiversity and also possibly geological/ geomorphological features where human visitation, use and impacts are strictly controlled and limited to ensure the protection of conservation values. Such protected areas can serve as indispensible reference areas for scientific, research and monitoring.

Category Ib. Wilderness areas are usually large, unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, which are protected and managed in order to preserve its natural condition.

Category II. National parks are large, natural or near natural areas set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible, spiritual, scientific, educational, recreational and visitor opportunities.

Categories III, IV and V: Natural monuments, habitat/species management areas, and protected landscapes and seascapes

Category III. Natural monuments or features are areas set aside to protect a specific natural monument, which can be a land form, sea mount, submarine cavern, or a geological feature such as a cave, or even a living feature such as an ancient grove. Generally, these are small protected areas with frequent high visitor value.

Category IV. Habitat/species management areas are places that aim to protect particular species or habitats and their management reflects this priority. Many protected areas under this category will need regular and active interventions to address the requirements of particular species or to maintain habitats.

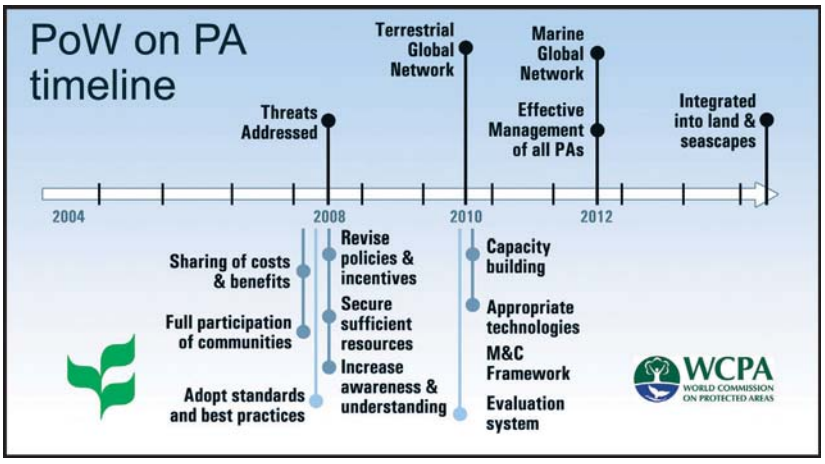
Category V. Protected landscapes/seascapes are areas where the interaction of people and nature over time has produced an area of distinct character with significant ecological, biological, cultural and scenic value and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values.

Category VI: Protected areas for the sustainable use of natural resources

Category VI. Protected areas for the sustainable use of natural resources are places of conserved habitats with associated cultural values and traditional natural resource management systems. Generally large areas, most of them are preserved in their natural state, where portions are under sustainable natural resource management, and where the low-level, non-industrial use of natural resources are compatible with nature conservation.

Source: Dudley, Nigel (ed). 2008. Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86pp accessed on 1 September 2010 at http://data.iucn.org/dbtw-wpd/edocs/PAPS-016.pdf

The Philippines, Indonesia and Malaysia have the most number of protected areas. In terms of coverage, Indonesia, Thailand and the Philippines have the most expansive areas (Appendix 4). The ASEAN region has also met the suggested target of having ten per cent of its terrestrial land declared as PAs, having established 13.2 per cent for such purpose (Appendix 5). Six ASEAN Member States have exceeded the 10 per cent target; and of the six, Brunei Darussalam, Cambodia and Thailand have set aside more than one fifth of their total land area for protection and conservation.



Significant as this achievement may be, the ASEAN Member States nonetheless acknowledged the steep challenges that remain. As the establishment of PAs is considered a cornerstone of conservation, it needs to be connected with the protection of key species and ecosystems. The CBD supported the implementation of the Programme of Work for Protected Areas (PoWPA), which sets out an ambitious target that would warrant the attainment of the ecologically representative protected area systems. Part of the target of the PoWPA is to focus on efforts that would provide the viable population of wildlife plant and animal species in protected areas, which sometimes are outside of these declared areas. In the region, efforts are being done to narrow this gap while recognizing that significant initiatives would have to be taken to address the issue of biodiversity.

Marine Protected Areas

The establishment of Marine Protected Areas (MPAs) is an effort that requires particular attention, given the region's generally archipelagic configuration where vast marine resources exist (Table 28). Despite a notable increase in the number of designated MPAs, many of the existing MPA systems are assessed to be

Table 28. MPAs of special significance within Southeast Asia

Country	World Heritage Sites	ASEAN Heritage Sites	Biosphere Reserves
Indonesia	• Komodo National Park • Lorentz National Park		• Komodo National Park • Tanjung Putting National Park • Gunung Leuser Nature Reserve • Siberut Nature Reserve
Myanmar		• Lampi Marine National Park	
Philippines	• Tubbataha Reef National Marine Park		• Palawan and Puerto Galera
Thailand	• Ujung National Park • Mu Ko Surin-Similan Marine National Park	• Tarutao National Park • Mu Ko Surin-Similan Marine National Park • Ao Phang-nga Marine National Park	
Viet Nam	• Ha Long Bay		

Marine protected areas are crucial in safeguarding biodiversity and the integrity of ecological processes in the coastal and marine environment. *Photo by John MacKinnon*

inadequate in achieving realistic marine biodiversity conservation results.

Increasing the number of MPAs alone does not guarantee improvements in the conservation of marine areas[4]. As a case in point, only about 10 to 20 per cent of MPAs in the region are considered to be effectively managed when the conservation targets are coral reefs[5] (Table 29).

This is because only about eight per cent of the ASEAN's reefs lie within MPAs, and that of these, only a mere one per cent is being effectively managed.

Most of the ASEAN Member States recognize the need to step up their efforts to enhance the current system of managing MPAs. As a step for improving the effectiveness of managing MPAs, a number of gap analyses have been undertaken which identified the following priority actions:

1. Improving and implementing legislative reforms to enhance MPA effectiveness;

Table 29. Management status of coral reef MPAs in the ASEAN region, 2003, 2005, 2007

	BRU	CAM	IND	MAL	MYA	PHI	SIN	THA	VIE
Total number of actively managed MPAs	6	2	114	83	6	339	2	23	36
Total number of MPAs with coral reefs	3	1	38	43	2	294	1	16	4
Total number of MPAs established <=5years	0	0	12	0	0	Unknown	0	0	21
% of reefs within MPAs	0	Unknown	9	7	2	1	0	50	11
% of MPAs that have good management rating	0	10	<3	16	0	20-30	50	18	8

Note: MPAs with coral reefs increased from 178 (MPA Global, 2003) to 403 (2005/07 update)

Source: LM Chou, Regional Technical Workshop on Gap Analyses for Marine and Terrestrial Protected Areas in the ASEAN Region, Yogyokarta, Indonesia, 27 September - 3 October 2009.

2. Incorporating MPA planning and management into an integrated coastal management framework;
3. Enhancing mechanisms to enable managers and institutions to continue adaptive management;
4. Filling gaps in the establishment and understanding of representatively adequate MPAs in the various biogeographic zones (*e.g.,* west of Sumatra, east of the Philippines, and Myanmar); and
5. Improving and establishing joint research and cooperative management areas (*e.g.,* the Turtle Islands and the Spratlys).

The future of MPAs in the region ushers the transformation of existing MPAs into MPA networks. Already, the Regional Networking of MPAs initiative is in place, encompassing the biogeographic region comprised by the East Asian Seas and the South China Sea.

In establishing MPA networks, the following have to be satisfied: 1) strengthening the collaborative institutional framework and developing strategies for MPA networks, i.e., the sharing of experiences, lessons learned, and best practices in the management of existing MPAs; 2) establishing monitoring and evaluation mechanisms and upgrading existing databases and information systems; 3) developing funding and resource mobilization mechanisms to support implementation at the national, regional and international levels; 4) increasing local capacity and public participation; and assuring the availability of information to enable the science-based reference for establishing MPAs and MPA networks.

Boxes 8 and 9 are examples of MPA best practices in the region that showcase commendable accomplishments in various aspects of MPA management.

Box 8. Bunaken National Park, Indonesia

LOCATION: The northern tip of Sulawesi, covering 890 square kilometers of diverse reefs and large mangrove forests.

Catalyst events: Management problems, such as destructive fishing and farming practices and poorly planned coastal development, resulted to poor compliance of management objectives and vague zoning regulations.

Management response and conservation activities:

- A Management Advisory Board (MAB), as a co-management strategy with stakeholders, was developed to oversee funds generated by the park as well as coordinate patrols and conservation development activities.
- Under the MAB, a Park Entrance Fee System was implemented to support the Bunaken National Park (BNP) Authority operations, with annual target revenues of USD250,000.
- To date, 80 per cent of the BNP's revenue supports conservation programs which include enforcement, education, waste management and village development. The other 20 per cent goes to local, provincial and national governments.
- A no-take policy is observed in the conservation and tourism zones, which include areas for reef fish, spawning aggregation sites and dive sites.
- A joint patrol system has significantly reduced illegal activities, such as destructive fishing practices, coral mining and mangrove cutting.
- Higher compliance has resulted to increased coral cover and abundance of commercial fish species.

Key success features for sustainable management:

- A strong information campaign created a single community with a strong sense of awareness and ownership of marine resources.
- The advisory board was composed of multisectoral membership: government agencies, village stakeholders, and representatives of tourism sector, academia and NGOs.
- All villages participated in the BNP Concerned Citizen's Forum, thus, facilitating communication among all interest groups.
- The element of strong private sector involvement in park management provided support through employment generation among locals, educational programs and assistance with park enforcement.

Source: Tun, Karenne, Ming Chou, Annadel Cabanban, Vo Si Tuan, Philreefs, Thamasak Yeemin, Suharsono, Kim Sour and David Lane. 2004. Status of Coral Reefs, Coral Reef Monitoring and Management in Southeast Asia, 2004. Global Coral Reef Monitoring Network 2004, accessed on 25 February 2010 at http://www.reefbase.org/download/download.aspx?type=10&docid=9535.

Box 9. Tubbataha Reef National Marine Park, Philippines

BIODIVERSITY importance:

- Consists of two isolated coral atolls in the Sulu Sea, 92 miles southeast of Palawan; the park coverage increased up to 968.24 square kilometers in 2008, almost thrice its original declared coverage of 332 square kilometers in 1988.
- Houses over 1,000 species of marine organisms, many of which are endangered; its diverse ecosystems rivaling that of the Great Barrier Reef.

Catalyst events: Damaged in the 1980s from blast fishing by both local and foreign (Taiwan and China) fishers; decreasing coral reef areas by 24 per cent over a five-year fishing period.

Management response and conservation activities:

- The multi-sectoral Tubbataha Protected Area Management Board (TPAMB), under the Palawan Council for Sustainable Development and the Department of Environment and Natural Resources, manages the area with technical assistance from research institutions and NGOs. Financial support comes from government, external grants and user fees.
- Consistent collaboration with stakeholders arrested and reversed the damage caused by illegal fishing and other illegal marine animal collection.
- Management measures: the presence of mooring buoys, a field station, and the involvement of the Philippine Navy and Coast Guard which routinely patrol the area. Tourism operators also assist in law enforcement and decision-making activities.
- Annual ecological monitoring is undertaken by the TPAMB since it was started by the WWF in 1997. Information, education and communication activities have strengthened law enforcement and support for marine conservation initiatives.
- Local marine reserves and training packages are conducted with the local government, who also undertake socio-economic monitoring in collaboration with park managers and the WWF.

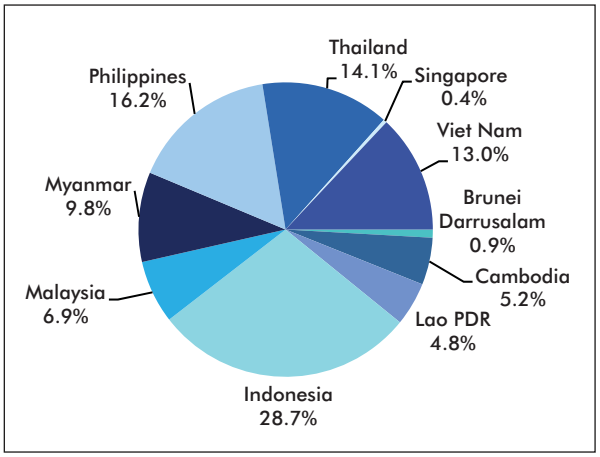
Sources: Tun, Karenne, Ming Chou, Annadel Cabanban, Vo Si Tuan, Philreefs, Thamasak Yeemin, Suharsono, Kim Sour and David Lane. 2004. Status of Coral Reefs, Coral Reef Monitoring and Management in Southeast Asia, 2004. Global Coral Reef Monitoring Network 2004, accessed on 25 February 2010 at http://www.reefbase.org/download/download.aspx?type=10&docid=9535.

Key Biodiversity Areas

Key biodiversity areas (KBAs) are sites of global significance for biodiversity conservation[6]. These are identified using global standard criteria and thresholds, based on the needs of biodiversity requiring safeguards at the site scale. The criteria are based on the framework of vulnerability and irreplaceable value widely used in systematic conservation planning[7]. A site meets the vulnerability criterion if it holds significant numbers of at least one globally threatened species, as enumerated in the IUCN Red List of Threatened Species. The IUCN Red List is the accepted standard for assessing species extinction risks.

As of 2007, there were 792 KBAs identified in the ASEAN region, distributed as follows: Indonesia (28.7 per cent), the Philippines (16.2 per cent), Thailand (14.1 per cent), Viet Nam (13.0 per cent), Myanmar (9.8 per cent), Malaysia (6.9 per cent), Cambodia (5.2 per cent), The Lao PDR (4.8 per cent) and Singapore (0.4 per cent) (Figure 24).

Figure 24. Distribution of 792 Key Biodiversity Areas (KBAs) among ASEAN Member States, July 2007



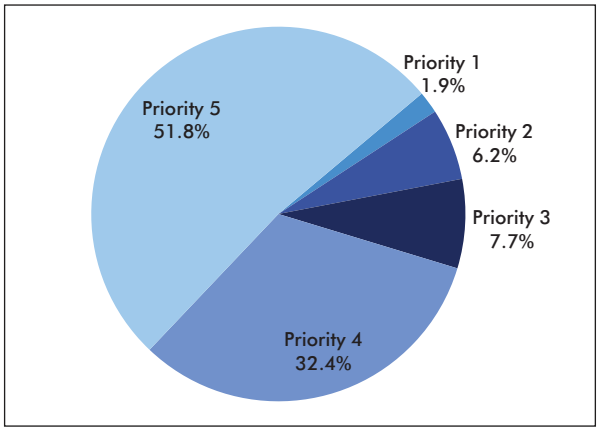
Source: Birldlife, IUCN, WCPA and ACB, 2007. Gap Analysis of Protected Area Coverage in the ASEAN Countries, ASEAN Centre for Biodiversity. Los Baños, Laguna, Philippines. July 2007.

These KBAs were allocated priority scores (*i.e.*, from 1 to 5: where a score of '1' is accorded the highest priority and a score of '5' corresponds to lowest priority) according to the vulnerability and irreplaceable value of

the globally threatened species that the area is known to support. All KBAs are global priorities for biodiversity conservation, and those considered high priority (e.g., priority 1 to 3) are considered to be exceptionally significant because of the highly threatened and unique species being supported.

The degree of importance of the 792 KBAs are as follows: Priority 1: 15 sites (1.9 per cent); Priority 2: 49 sites (6.2 per cent); Priority 3: 61 sites (7.7 per cent); Priority 4: 257 sites (32.4 per cent); and Priority 5: 410 sites (51.8 per cent) as illustrated in Figure 25.

Figure 25. Distribution of species priority scores allocated to Key Biodiversity Areas in the ASEAN region



Source : Birldlife, IUCN, WCPA and ACB, 2007. Gap Analysis of Protected Areas Coverage in the ASEAN Countries, ASEAN Centre for Biodiversity. Los Baños, Laguna, Philippines. July 2007.

Marine Key Biodiversity Areas

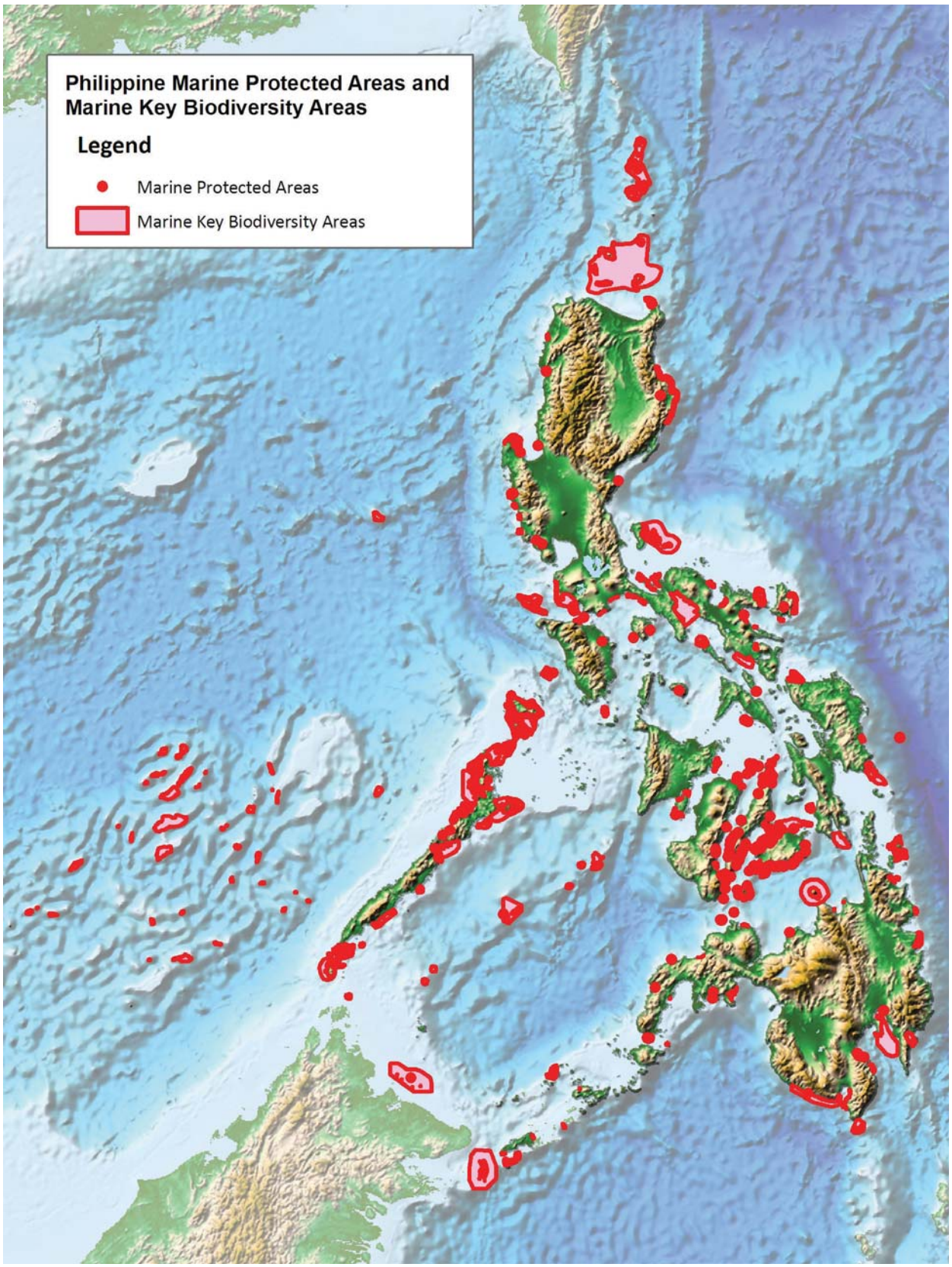
Specifically, there are KBAs designated as marine key biodiversity areas (MKBAs). To date, only the Philippines and Malaysia have identified MKBAs for conservation management, with 65 and 28 sites, respectively.

The Philippine MKBAs cover a total of 419,409 square kilometers of coral reefs[8]. These sites represent areas where 91 globally important species (63 vulnerable and 28 irreplaceable species) can be managed. Yet, when comparing the MKBAs to existing MPAs in the country, only 71 per cent of the existing 1,169 MPAs overlap with 53 identified MKBAs, but do not necessarily cover the entire MKBAs. Furthermore, the remaining 29 per cent of the MPA areas are outside MKBA areas, as shown in Figure 26. This indicates the need for additional analysis on the extent and coverage of MPAs vis-a-vis MKBAs to determine whether MPAs enfold the critical habitats of the trigger species.

In Malaysia, there are MPAs still to be gazetted based on their significance as habitats for important and/or threatened species, nesting grounds for migratory species and important mangrove and reef areas.

Coral reefs serve as the physical framework of critical habitats that support the nursery needs of fish and invertebrate larvae. *Photo courtesy of Conservation International Philippines*

Figure 26. Initial MKBAs vis-à-vis the localities of MPAs in the Philippines



Source: Redrawn from Marine Environment and Resources Foundation, Inc., Conservation International, Borneo Marine Research Institute, Universiti Malaysia Sabah, 2009. Marine Protected Areas (MPA) Gap Analysis for Philippines and Malaysia. ASEAN Centre for Biodiversity. Los Baños, Laguna, Philippines. March 2009

Network of Protected Areas

ASEAN Heritage Parks

To instill greater awareness, promote conservation, and provide a sense of pride and enjoyment of the rich natural heritage sites, ASEAN Heritage Parks (AHPs) were established. Specifically, AHPs are protected areas of high conservation importance, preserving in total a complete spectrum of representative ecosystems and species of the ASEAN region.

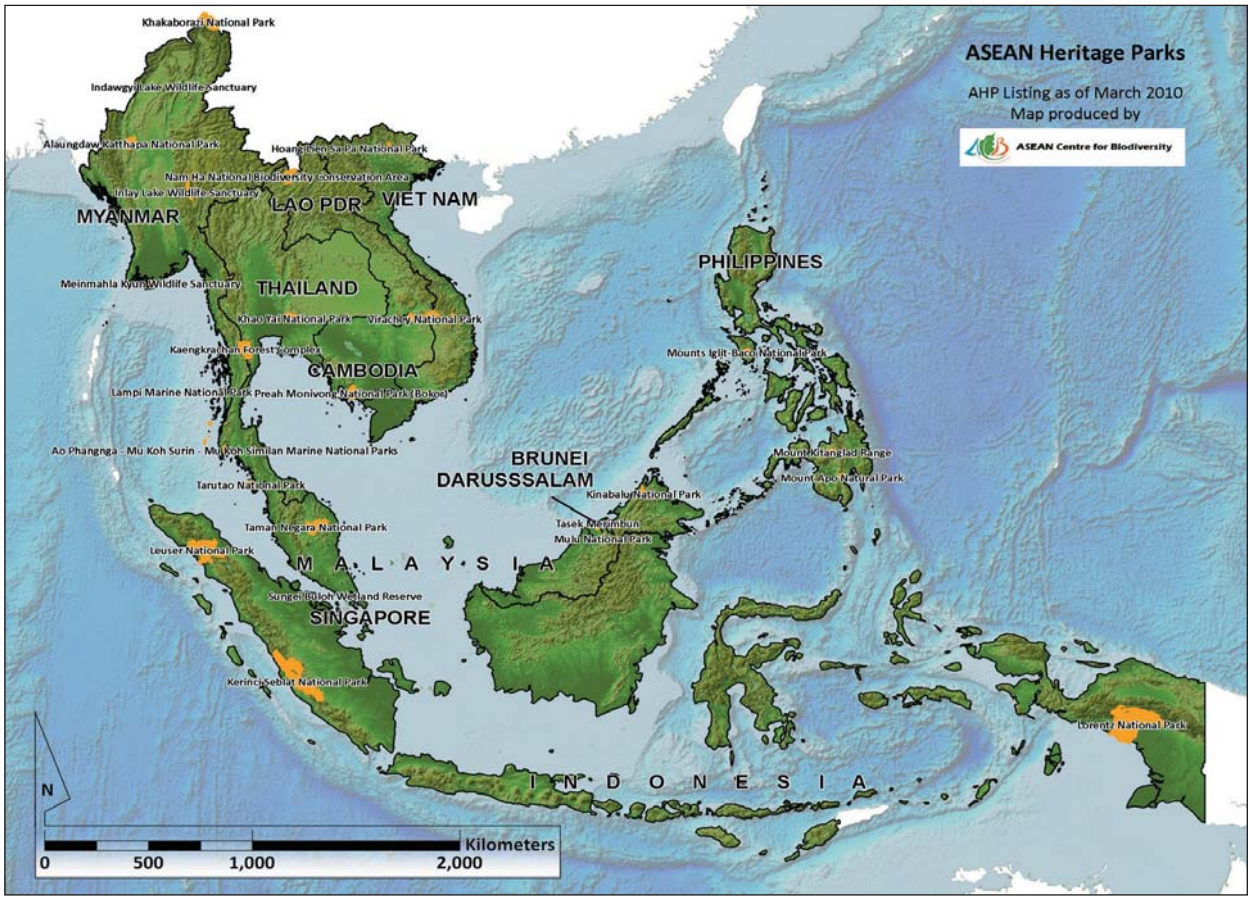
The ASEAN Declaration on Heritage Parks was signed in December 2003. The corresponding AHP program underlines the need for greater collaboration for biodiversity conservation in the ASEAN, particularly since the region provides habitats for some of the world's most enigmatic species and harbors a globally significant wealth of biodiversity. The ACB supports the AHP program by promoting AHPs, developing resource materials, and developing the capacity of protected area managers. The ACB also supports the protection of the ASEAN's natural heritage through the conduct of ASEAN Heritage Parks Conferences. These conferences seek to develop and promote effective management of the AHPs and determine common areas of cooperation. The First and Second AHP Conferences were conducted in Khao Yai National Park, Thailand in 2004 and in Kota Kinabalu, Sabah, Malaysia in 2007. The Third AHP Conference was conducted in Brunei Darussalam in June 2010.

At present there are 28 AHPs, with boundaries by country, as shown in Figure 27. Some distinctive features of the AHPs are shown in Appendix 6.

Transboundary Protected Areas

Transboundary protected areas (TBPA) are places of land or seas or both that straddle or border between states, sub-national units such as provinces and regions, autonomous areas and/or areas beyond the limit of national sovereignty or jurisdiction, whose constituent

Figure 27. Map of the ASEAN Heritage Parks



Much remains to be done in terms of effectively managing protected areas in the ASEAN region.
Photo courtesy of Mt. Apo Natural Park

parts are especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed cooperatively through legal or other effective means (IUCN 2007). The Park for Peace, formally dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources, and to the promotion of peace and cooperation, is a special type of TBPA. It is believed that transboundary cooperative action is a highly strategic means of achieving regional integration and securing landscape-level conservation.

As of 2002, there were more than 170 complexes of two or more adjoining protected areas divided by international boundaries, involving a total of 669 protected areas representing 113 countries[9]. The World Conservation Congress, at its Third Session in Bangkok, Thailand on 17 - 25 November 2004, urged the Governments of Southeast Asia to: 1) recognize the importance of transboundary forests and marine areas for the conservation of natural ecosystems; and 2) formulate transboundary conservation strategies in collaboration with the international community for all important shared ecosystems, especially where existing TBPAs provide an institutional and management framework for cooperative action.

The most significant milestone in 2004 was the inclusion of the specific provisions on transboundary conservation in the CBD Programme of Work on Protected Areas (PoWPA). The PoWPA requires the Parties to:

- Apply the ecosystem approach by extending protected areas beyond national boundaries, including transboundary protected areas and protected areas in marine areas beyond the limits of national jurisdiction;
- Establish, where appropriate, new transboundary protected areas with adjacent Parties and countries, and strengthen the effective collaborative management of existing TBPAs;
- Compile and disseminate information

on regional networks of protected areas and transboundary protected areas, and provide an enabling policy environment for transboundary protected areas; and
- Develop and adopt minimum standards and best practices for national and regional protected area systems, and evaluate and improve the effectiveness of protected area management by establishing frameworks for monitoring, evaluating and reporting protected area management effectiveness at sites, national and regional systems, and transboundary protected area levels.

In 2007, the UNEP-WCMC Global List of TBPAs identified 227 TBPAs. Twenty-two (22) TBPAs are within Southeast Asia (Table 30).

Following are some of the initiatives in the ASEAN on the establishment and management of TBPAs:

1. Transboundary Management in the Heart of Borneo

Borneo represents the only place remaining in Southeast Asia where forests, biodiversity and its ecosystems services can still be conserved on a very large scale. The discovery of new species in the Heart of Borneo (HoB) has highlighted the urgency to conserve this globally significant transboundary ecosystem[10].

The HoB Initiative started as a project of ITTO, covering the Betung Kerihun National Park (West Kalimantan), the Lanjak-Entimau Wildlife Sanctuary-Batang Ai National Park and the Pulong Tau National Park (Sar-

Table 30. List of TBPAs within Southeast Asia

Countries	Transboundary protected areas
Myanmar and India	• Kamlang-Namdapha-Khakaborazi
The Lao PDR and China	• Xishuangbanna-Nam Ha
The Lao PDR and Viet Nam	• Huanglianshan-Phou Dene Din-Muong Nhe • Nam Et-Phou Loey-Sop Cop • Corridor Nalai-Nam Theun-Phou Hin-Phou-Hin Nam No-Nam Chuane-Nam Thoun Ext-Nui Giang Man-Phong Nha-Ke Bang-Pu Mat-Vu Quang
Viet Nam and China	• Chaotianma-Guanyinshan-Jinpingfenhuiling • Gulongshanshuiyuanlin-Trung Khanh
Cambodia, The Lao PDR and Viet Nam	• Lomphat-Mondulkiri-Phnom Nam Lyr-Phnom Prich-Virachey-Dong Amphan-Nam Kading-Phou Kathong-Chu Mom Ray-Yok Don
Malaysia and Thailand	• Bolum-Bukit Perangin-Joli-Kuala Gula-Ulu Muda-Bang Lang-Bala-Bala-Sun Gala Khiri
Myanmar and Thailand	• Lenya-Namtok Huay Yang-Sadej Naikom Krom Luang Chumpon (North and South)
The Lao PDR and Thailand	• Nam Phouy-Doi phukha-Lam Nam Nan-Mae Charim-Sri Nan • Phou Xiengthong-Kaeng Tana-Pha Tam
Cambodia and Thailand	• Banteay Chmar-Preah Vihear-Boon Trik-Yod Mon-Dong Phayayen-Khao Yai-Dong Yai-Hua Tabtan-Hadsamran-Huay Sala-Khao Pravihan-Pang Sida-Panom Dong Rak-Phu Chong Na Yoi-Ta Phraya-Thap Lan-Yod Dom • Central Cardamom-Phnom Sankos-Samlaut-Klong Kruewai Chalerm Praklat-Namtok Klong Kaew
Indonesia and Malaysia	• Hutan Sambas-Gading-Pueh-Maludam-Samunsam-Triso • Lanjak Entimau-Batang Ai-Betung-Kerihun-Bukit Batikap-Bukit Batutenobang-Muller Schwart-Balleh • Muara Sebuku-Sungai Serudung
Brunei Darussalam and Malaysia	• Labi Hills, Gunung Buda-Gunung Mulu
Indonesia and Papua New Guinea	• Wasur-Maza-Tonda
Philippines and Thailand	• Pulau Penyo-Turtle Islands

awak), and the Kayan Mentarang National Park (KMNP) in East Kalimantan. Among its activities were: community-based livelihood development programs; joint training for local communities on the development and promotion of non-timber forest products; a joint workshop on biodiversity conservation to raise awareness; joint ecotourism development and promotion; coordinated patrol; development of a strategic plan for orangutan conservation; and conduct of cross-visits and staff exchange.

The HoB Initiative was signed by Indonesia, Malaysia and Brunei to address the following issues:

- Transboundary conservation of pygmy elephants and banteng
- Transborder recognition of the traditional life of local people
- Transborder socioeconomic-cultural activities of local people
- Potential illegal activities
- Transboundary ecotourism
- Capacity of traditional people

A related account on this subject may be found further along in this chapter.

2. Turtle Islands Heritage Protected Area

The Turtle Islands Heritage Protected Area (TIHPA) is the first transboundary protected area in the world, and its area of coverage spans Malaysia and the Philippines. It is the major nesting ground of the green sea turtle *(Chelonia mydas)* and is the only remaining nesting rookery of green sea turtles in the ASEAN region. It is also the eleventh major nesting area of marine turtles in the world. Turtles lay hundreds of thousands of eggs in the TIHPA each year, with approximately more than 2,000 nesters. While the hawksbill turtle *(Eretmochelys imbricata)* also nests in the TIHPA, the majority nests in the Gulisaan Island, Malaysia.

Biodiversity resources in the TIHPA include 34 avian species, fruit and field bats, and reptiles (snakes, green sea and hawksbill turtles, monitor lizards); 15 principal arborescent species; 24 to 27 genera of corals; 76 to 128 fish species; and 62 species of marine flora.

The TIHPA's mission is the conservation and management of marine turtles and other natural resources, taking into consideration the culture, traditions, needs and involvement of local communities, as well as national policies and laws of the respective countries, for the benefit of both present and future generations, and to make the TIHPA a model transborder conservation area.

A case in point for consideration is a Philippine law involving turtle egg collection in the Turtle Islands. The Philippines' Presidential Proclamation 171 of 26 August 1999 declared the entire municipality of the Turtle Islands as the Turtle Islands Wildlife Sanctuary (TIWS). Its management is under the Department of Environment and Natural Resources' (DENR) Protected Area Management Board, and chaired by the DENR Director for Region 9. This was followed by the passage of the Wildlife Resources Conservation and Protection Act of 2001(Republic Act 9147).

Prior to the passage of the Wildlife Act, the collection of turtle eggs in designated islands of the Turtle Islands was regulated through a DENR permit system that allowed collection only during open season from April to December. Sixty per cent of turtle eggs produced in the TIWS, except in the Baguan Island (which accounts for more than 50 per cent of the total of all eggs laid), were collected for trade – the rest were conserved. After the passage of the Wildlife Act, the collection of sea turtles or any of its derivatives, including eggs, was prohibited. This resulted to conflicts among stakeholders, inasmuch as egg collection has been a source of livelihood accounting for 35 per cent of the overall income sources in the area[11].

A proposal for a phase-out of the collection of turtle eggs and phase-in of alternative livelihood projects in the TIWS, under a memorandum of agreement among stakeholders, has been finalized and is pending approval. The declaration of developmental and foraging habitats for marine turtles as Critical Habitats, pursuant to Republic Act 9147, is being proposed.

The following are some of the TIHPA's areas of concern:

- High incidence of intrusion in the vicinity of the Taganak Island;
- Illegal fishing;
- Jump off point for smuggling; and
- Jump off point for illegal migrants from Sabah.

3. Sulu Sulawesi Marine Ecoregion

The Sulu Sulawesi Marine Ecoregion (SSME) is one biogeographic unit in the center of marine biodiversity covering three countries: Malaysia, Indonesia and the Philippines. It has productive coastal and marine ecosystems, with sea turtles being its flagship species. Five out of the seven sea turtles species are found in the SSME.

The SSME ensures that biodiversity is conserved, productivity is maintained and the SSME jointly managed. It has a network of 58 priority conservation or management areas with sea turtles as among its conservation targets in the high priority areas.

The SSME was adopted by the governments of Indonesia, Malaysia and the Philippines through a tri-national Memorandum of Understanding signed during the CBD CoP7.

The following are some future actions to be taken toward establishing the transboundary Turtle Islands Heritage Protected Area for Sea Turtles in the SSME:

- Verify additional Indonesian sites for inclusion in the design of networks of MPAs;
- Publish the Action Plan of the SSME Sub-committee for Threatened, Charismatic and Migratory Species in order to communicate and gain support from policy makers and donors;
- Publish the SSME Action Plan and the Design of Network of MPAs for Sea Turtles for dissemination in order to generate political and funding support;
- Pursue transborder enforcement under a Philippines-Malaysia lateral cooperation;
- Initiate the social networking of selected MPAs; and
- Pursue ecotourism development in the Philippines' Turtle Islands under joint cooperation with Malaysia.

The following are some of the significant experiences and valuable lessons learned in the SSME:

- Use the best available scientific knowledge in sites for the MPA networks;
- Network the MPA management units. The sharing of learning and good practices will strengthen each MPA within the network;
- Network law enforcement units. Sea turtles and eggs are targeted by both local and foreign poachers for illegal trade;
- Address community needs in the network of MPAs;
- Networking MPAs as a strategy for conservation and fisheries management should be implemented within a bigger conservation management framework. The bigger framework allows for threats outside the MPA network to be better addressed;
- Link initiatives to regional programs like the BIMP-EAGA, CTI, PEMSEA, IOSEA, and the ASEAN;
- Initiatives on the transboundary network of MPAs should be supported by a policy or legal instrument and by a politically-recognized governance or cooperation mechanism;
- Respect political sensitivities; and
- Experiences in the SSME demonstrate that partnerships with NGOs, both at the national and tri-national levels, are valuable in terms of facilitating activities beyond customary government momentum.

A related account on this subject may be found further along in this chapter.

4. Transboundary Law Enforcement: ASEAN-WEN

Lack of law enforcement in transboundary protected areas can lead to the use of forest trails for transnational smuggling, the commercial exploitation of natural resources, the free movement of illegal immigrants, and the illegal import-export of wildlife. Illegal wildlife trade is considered to be the most profitable unlawful trade in the world, amounting to an estimated USD10 to 15 billion. It has been reported that 50 per cent of world timber production comes from illegal sources.

Forest and national parks, including transboundary forests, are sometimes used for refuge by criminal elements, terrorists, and insurgents, and as trafficking routes. These be-

come threats to national security and stability.

Law enforcement in transboundary PAs is being bolstered by the ASEAN Wildlife Enforcement Network (ASEAN-WEN). The network is tasked to facilitate marine patrols, aerial surveys, fire suppression, community outreach, and access to existing military border coordination mechanisms. It specially conducts courses and on-the-job training on law enforcement.

There is no international designation or convention that sets up TBPAs, but there are other laws that can play a role in their establishment and management:

- International laws pertain to binding agreements like the Multilateral Environmental Agreements, treaties and "international customary law", and voluntary agreements.
- Negotiated laws refer to bilateral and multilateral agreements (*e.g.,* those establishing TBPAs) that are similar to contracts where parties agree to provisions which become enforceable.
- National policies, law and regulations can help create a TBPA, although integrating different national legal, administrative and judicial structures can be difficult.
- Sub-national laws and regulations cover conservation responsibilities that are often decentralized in order that negotiations may be undertaken by provinces or states, particularly in federated systems.
- Local laws and customs (traditional law) involve the devolution of authority so that the protection of areas can extend to local levels, (*e.g.,* municipalities and villages).

Although international laws do not offer a template for resolving TBPAs issues, they should not be considered as barriers because they can help set agreed objectives and mandates which are generally not intended to be automatically binding as a law. Parties to international agreements have made high level decisions and are obliged to meet commitments by passing national laws. Table 31 shows the relevant biodiversity-related Multilateral Environmental Agreements which provide for the management of TBPAs.

A related account on this subject may be found further along in this chapter.

Table 31. Relevant biodiversity-related Multilateral Environmental Agreements

Agreement	Description
World Heritage Convention and Ramsar Convention	It was primarily designed around the designation of special PAs (World Heritage Sites and Wetlands of International Importance). Party countries propose sites and if designated, are obligated to protect them.
Convention on Biological Diversity	The CBD promotes conservation and the sustainable use and equitable sharing of genetic resources, which includes the creation and management of protected areas, with a mandate for collaborative arrangements between countries.
United Nations Convention on the Law of the Sea	The UNCLOS promotes natural resource management in oceans, including those outside or extending across national boundaries. Its purpose is to support the development of transboundary and high seas MPAs constituting an important legal precedent that may apply on land.
Convention on International Trade in Endangered Species	CITES imposes mandatory requirements for laws relating to species trade including across borders.
Convention on Migratory Species	The CMS acts mainly through habitat protection including those outside national jurisdiction, often using new international mechanisms (e.g. MoU and Joint Action Plans).
Framework Convention on Climate Change	The FCCC offers incentives for the restoration of forests and grasslands.
Convention to Combat Desertification	The CCD focuses on sustainable land uses.
World Trade Organization	Agreements under this body also impacts on conservation.

The Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security

The Coral Triangle, renowned for harboring the richest marine biodiversity in the world, is an area in the Indo-Pacific defined by the coasts and marine territories of Indonesia, Malaysia, Papua New Guinea, the Philippines, Solomon Islands and Timor Leste. The heads of state of these countries officially launched the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) to address threats to the marine, coastal and small island ecosystems within the Coral Triangle region through accelerated and collaborative action, taking into consideration multi-stakeholder participation in all six countries. By signing the CTI-CFF Leaders' Declaration on 15 May 2009 in Manado, Indonesia, the countries adopted the CTI Regional Plan of Action (RPoA), reaffirmed a cooperative arrangement, committed to establish a secretariat for the CTI-CFF, and mobilized a call for the mobilization and effective allocation of financial resources to implement the CTI Regional Plan of Action[12] (see Box 10).

Box 10. The CTI Regional Plan of Action

THE CTI Regional Plan of Action (RPoA) is a ten-year plan. It is a non-binding document that articulates the goals and mechanisms on how to achieve the conservation and sustainable management of coastal and marine resources in the Coral Triangle region, while giving due consideration to the laws and policies of each of the six signatory countries. The RPoA adheres to the following goals:

1. Priority seascapes designated and effectively managed;
2. Ecosystem approach to the management of fisheries and other marine resources fully applied;
3. Marine Protected Areas established and effectively managed;
4. Climate change adaptation measures achieved; and
5. Threatened species status improving.

Former Philippine Agriculture Secretary Arthur Yap addresses participants of The Coral Triangle Initiative Business Summit. *Photo by Filiberto Pollisco, Jr.*

The Heart of Borneo Initiative

Borneo is the world's third largest island, next to Greenland and New Guinea. It covers an area of approximately 745,567 square kilometers. Most of the island is Indonesian territory, which is Kalimantan (540,000 square kilometers); the rest is covered by the Malaysian states of Sabah (73,711 square kilometers) and Sarawak (124,449 square kilometers). Brunei Darussalam is also located in this island. Borneo straddles the equator and, as such, receives about 4,000 to 5,000 millimeter of rain every year. The climate is wet during the Southwest Monsoon from April to September, and even wetter during the Northeast Monsoon occurring from October to March. Humidity is constantly high, with daytime temperatures ranging from 25 to 35 degrees Centigrade in low-lying areas[13].

Amidst this favorable climate lies a vast forested land, located right in the middle of Borneo. In being the entire island's lifeblood, where the headwaters of major rivers are located, the expanse came to be known as the "Heart of Borneo" (HoB). The HoB covers an area of 22 million hectares stretching across the territories of Brunei Darussalam, Indonesia and Malaysia. The three territories are inhabited by about 19 million people. The HoB Initiative is designed not only to protect the large area of forests, but also to provide food security and adequate water to its inhabitants.

In 2007, the governments of Brunei Darussalam, Indonesia and Malaysia agreed that the remaining vital areas of the rainforest needed protecting[14]. Through the World Wide Fund for Nature (WWF) and an international cooperation led by the Bornean governments, a network of protected areas and sustainably-managed forests was established. Resource assessments, science expeditions, community development and other related activities are continuously being undertaken to enhance the management and conservation efforts within the HoB. A related account on this subject may be found under Transboundary Protected Areas.

HoB Biodiversity

The area is rich by virtue of its natural resources and the local culture. The rainforest has more than 15,000 species of flowering plants, including 3,000 species of trees, of which 267 are dipterocarps. The HoB is also home to 13 different primates, including orangutans and proboscis monkeys. It provides a habitat to 44 endemic mammals, such as the rhino and dwarf elephants; 39 endemic bird species; and over 160 species of fish. Moreover, in it may be found 100 endemic amphibian species, 47 lizards, and 41 snakes – all of which are endemic to the territory. The Bornean mountains, which in itself cradle 24 endemic bird species, is classified as an Endemic Bird Area.

Most plant species in Borneo can be found in forest habitats. There are mangrove, peat swamp and freshwater swamp forests; lowland dipterocarp forests; ironwood forests; and hill dipterocarp forests. Borneo is also home to the largest heath forests in Southeast Asia[15].

From 1994 to 2004, an expedition to the HoB discovered at least 361 new species of plants and animals. A total of 52 new species were discovered between July 2005 and September 2006, comprising 30 fish species, 16 ginger species, three tree species, two tree frog species, and one large-leafed plant species. Dipterocarps hold the greatest insect diversity in Borneo, where as many as 1,000 species could be found in just one tree[16].

Borneo holds more than 2,000 species of orchids, over 50 species of the carnivorous pitcher plant, and two of the largest flowers in the world: the *Rafflesia* and the *Amorphophallus.*

The Lambir Hills National Park in Sarawak, Malaysia holds the record of having the highest tree diversity in the world. In just 0.52 square kilometers of forest in the 70-square kilometer park, a total of 1,175 species of trees has been recorded; and the prospect of even higher diversity elsewhere in the HoB is very likely[17].

The most widespread mammals found are bats, with some 90 species. There are also 10 species of tree shrews (squirrel-like primates), 14 species of flying squirrels, and the mysterious Moonrat[18]. The freshwater crocodilian *Tomistoma schlegelii,* a flagship species of the remaining peat swamp forest, counts Borneo among its last strongholds. It is also home to

the Earless Lizard *(Lanthanotus borneensis)*, a strange-looking semi-aquatic burrowing endemic species, whose natural history traits still remain unknown[19].

The HoB is also inhabited by the *Dayaks*, locally interpreted as "interior" or "upriver" person. This term refers to the variety of indigenous peoples living in the area, each having a unique culture and language. When humans inhabited the island, their populations lived in hundreds of tribes across the islands. In Kalimantan alone, over 140 languages are spoken. Sabah natives have 50 languages and dialects, while those in Sarawak speak over 30 different ones.

Emerging concerns

In the mid-1990s, Borneo's forest cover was calculated at 75 per cent. By 2005, only 50 per cent remained. Borneo lost an average of 850,000 hectares of annually within that 15-year period. It has been estimated that by the year 2020, Borneo would have lost about two-thirds of its forest cover.

Monitoring in Sabah revealed that orangutans are able to adapt to significant changes in habitats. Proof of this is that over 60 per cent of orangutan subpopulations occur in commercial forests outside protected areas. As such, over 55,000 of these primates still remain in numerous subpopulations in Borneo. However, a 2020 projection of forest loss showed that very few orangutan populations would exist by then.

In Malaysian Borneo, the average annual increase in the size of oil palm plantations was nearly eight per cent between 1998 and 2003, where over 1.6 million hectares of oil palms now exist in Sabah and Sarawak alone. In Kalimantan, the area planted to oil palm increased by 11.5 per cent or to nearly a million hectares in 2003[20]. The conversion of natural forests into other uses remains as one of the major causes of forest loss, and ultimately, to the loss of biodiversity in the region.

Sulu Sulawesi Marine Ecoregion

The Sulu and Celebes Seas comprise the Sulu-Celebes Sea Large Marine Ecosystem (LME), an area of about 900,000 square kilometers of marine resources[21]. The expanse covered by these two seas, also called the Sulu Sulawesi Marine Ecoregion (SSME), is partially divided by a chain of small islands known as the Sulu Archipelago. A large portion of the LME is located in the midst of three ASEAN nations – Indonesia, Malaysia and the Philippines. The seascape is characterized by a tropical climate, tepid waters, and complex and wide-ranging biophysical characteristics and oceanography that contribute to its exceptionally abundant marine biodiversity. However, the SSME has porous borders acting like a magnet to threats of piracy and illegal fishing (e.g., cyanide and blast fishing), which contributes considerably to its environmental degradation[22]. The over-exploitation of marine resources, population pressure, and pollution further undermine its rich legacy[23].

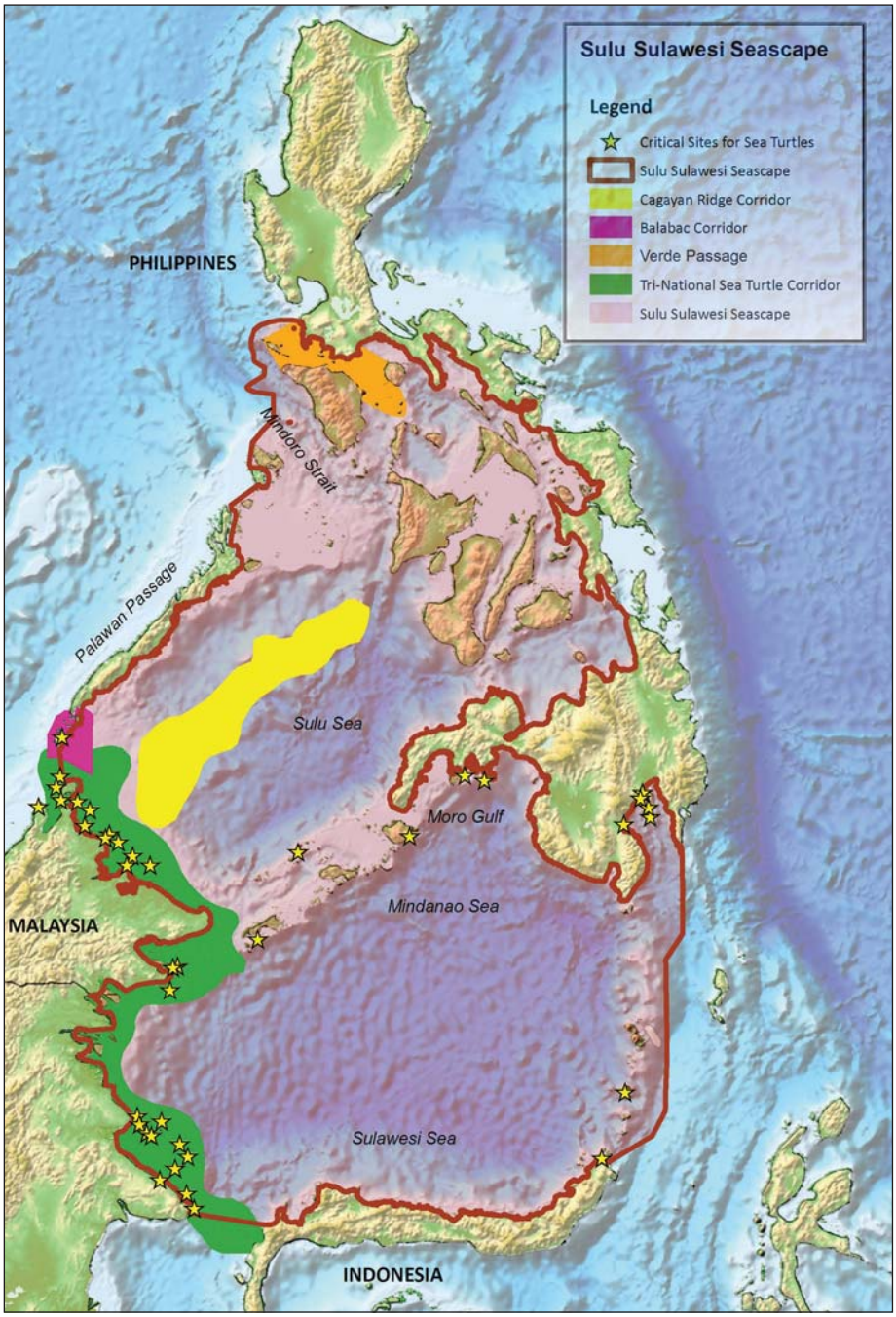
The multi-gear and multi-species fisheries of this marine ecoregion provide sustenance and livelihood to some 35 million people.

Lambir Hills National Park, Sarawak, Malaysia *Photo by phylodiversity.net*

Fishing in the area has been reported to be excessive and destructive, and has resulted to declining catches and reduced economic returns, changes in fish population structures, depleted coral reefs, and heightened threats to rare and endangered species.

Conservation initiatives in the ecoregion have been taken up by the WWF (*i.e.*, the Sulu Sulawesi Marine Ecoregion Conservation Program, launched in 1999) and the Conservation International (i.e., Sulu Sulawesi Seascape Initiative 2005-2010)[24]. Both NGOs have strategically mobilized the establishment of marine protected areas, accompanied by law enforcement support in priority conservation areas, otherwise known as marine biodiversity conservation corridors (MBCCs). As a result, networks of MPAs have been established, including the social network of MPAs in the Verde Island Passage Corridor and the network of Marine Turtle Protected Areas in the Sea Turtle Corridor.

Figure 28. Sulu Sulawesi Seascape



A 2009 report on the Sulu Sulawesi Seascape (SSS) indicated that the SSS initiative has contributed to the expansion of the total 'no-take' zone in three corridors of the seascape (i.e., the Verde Island Passage, the Cagayan Ridge and the Tri-national Sea Turtle Corridor) to 1,476 square kilometers, placing a total of 1,624 square kilometers under management (Figure 28). The SSS initiative also played a part in the updated mapping of Priority Sites for Conservation in the Philippines, which is a major contribution to the Philippines' Clearing-House Mechanism (discussed separately in this report under Institutional and Intra-regional Initiatives), which will set the trend for similar undertakings in the ASEAN region. (A related account on this subject may be found under Transboundary Protected Areas.)

Greater Mekong Subregion

The Core Environment Program

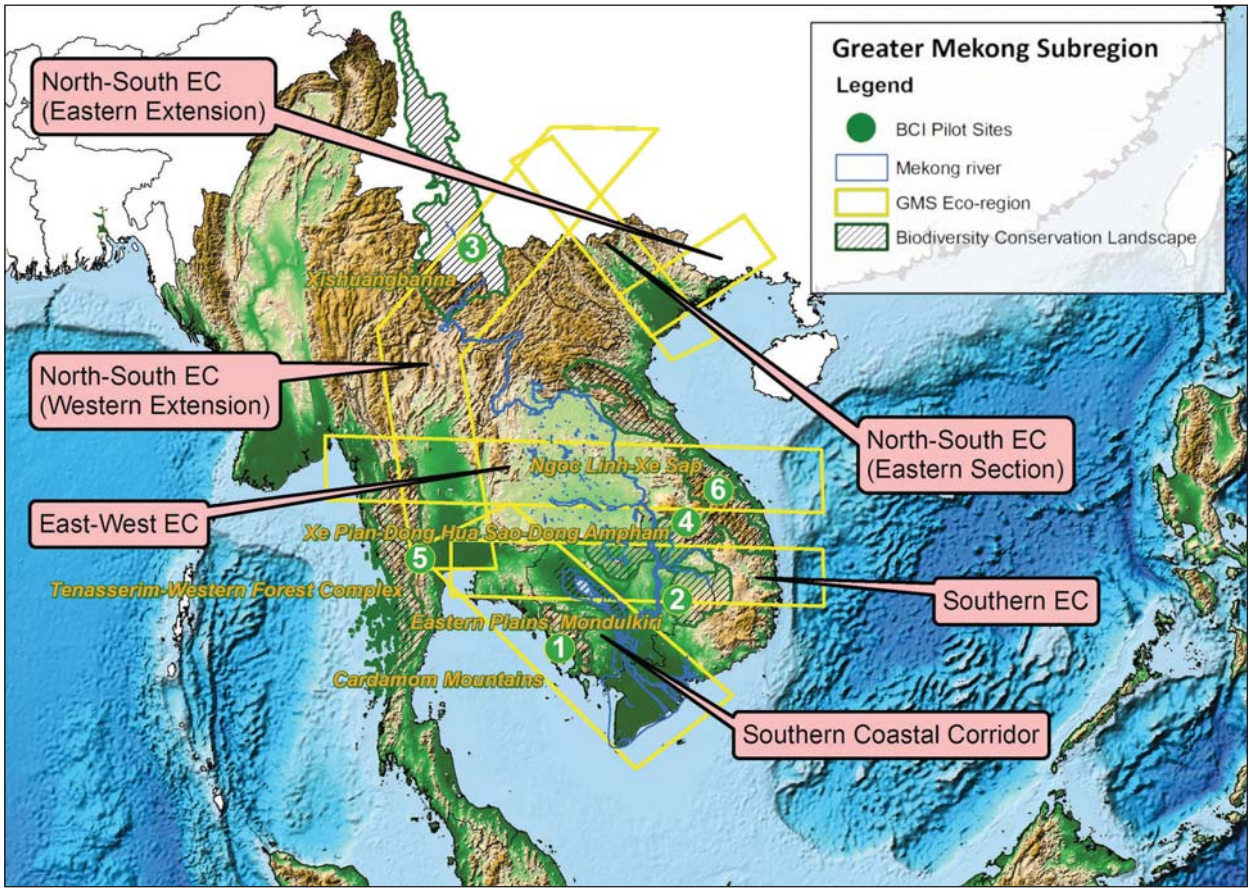
Environmental degradation and its effect on economic development have been recognized by the international community as among the major impediments to sustainable development. Thus, in 2006, the Asian Development Bank supported improved environmental management in the Greater Mekong Subregion (GMS) through its Core Environment Program (CEP). The GMS is composed of the nations of Cambodia, The Lao PDR, Myanmar, People's Republic of China (its southern region), Thailand and Viet Nam. The CEP is also supported by the governments of Finland and Sweden.

The Core Environment Program was officially launched in April 2006 with the establishment of the GMS Environmental Operations Center in Bangkok, Thailand. The CEP aims to mainstream environmental considerations into the transport, energy, tourism and agriculture sectors of the GMS Economic Cooperation Program. It promotes the application of development planning tools that integrate environment into sustainable development.

The Biodiversity Corridors Initiative

The Biodiversity Conservation Corridors Initiative (BCI) is a flagship component of the Core Environment Program in the Greater Mekong Subregion. It is an innovative approach combining poverty reduction with biodiversity conservation. The BCI is a regional technical assistance program for promoting the establishment of sound environmental management systems and institutions. It aims to mainstream environmental management and biodiversity conservation in the GMS Economic Cooperation Program and subregional development. The initiative also aims to prevent the ecosystem fragmentation that could result from pressures in the economic development along the GMS economic corridors (Figure 29).

Figure 29. GMS economic corridors



By 2015, the GMS countries will endeavour to maintain and improve the cover, condition and biodiversity of forestlands and associated ecosystems in priority biodiversity conservation landscapes and corridors by empowering the GMS countries to effectively manage their environment and economic development.

Gaining ground

As of February 2010, several results have already been achieved by the CEP-BCI. These are, among others, the following:

- Improving the connectivity of ecosystems at greater landscape level and improving its biodiversity vitality and ecosystem functioning: six BCI pilot sites established and functional; forest connectivity maintained (22,900 square kilometers); and forest restoration/ enrichment (24.29 square kilometers);
- Capacity-building for over 5,000 direct beneficiaries facilitating a better institutionalization of the local, national and subregional anchoring of natural resources management practices;
- Improved tenure rights amounting to 19,248 hectares by bringing these under a local management regime, including five-square-kilometer forest livelihood plantations promoted for 2,500 beneficiaries;
- Sustainable financing for the upscaling and integration of BCI into other initiatives (*e.g.*, REDD) with public/ private sector funding initiated in Thailand (USD13.8 million);
- Upscaling of the successful 'payment for environmental services' (PES) policy to achieve conservation targets in Viet Nam and Cambodia. The work is carried out in collaboration with the USAID, the United Nations Economic and Social Commission for Asia and the Pacific, and the ASEAN Centre for Biodiversity. PES is part of an emerging policy framework that can provide sustained incomes to local communities who protect their watersheds, as well as budgets for responsible government agencies; and
- Passing of the Biodiversity Law of Viet Nam, with support from CEP/BCI, which captures the regional policy dimensions in its Articles 69 and 70. These articles focus on regional cooperation, exchange of information, coordinating management of biodiversity corridors across international borders, and participation in international biodiversity conservation programs. Over two million hectares of protected forest prevent the emission of at least 10 million tons of carbon dioxide.

Photo courtesy of Inle Lake Wildlife Sanctuary

ASEAN Wildlife Enforcement Network

The ASEAN Wildlife Enforcement Network (ASEAN-WEN) is currently the world's largest wildlife enforcement network addressing the issues of wildlife crime in the ASEAN region. It was launched in Bangkok, Thailand on 1 December 2005 by the ASEAN Ministers responsible for the implementation of CITES, and covers all ten ASEAN Member States. The Bangkok-based Program Coordination Unit (PCU) acts as the secretariat of the ASEAN-WEN. The PCU coordinates trainings and workshops, organizes annual meetings, facilitates communication, and builds high level support.

The objective of the ASEAN-WEN is to address the illegal exploitation and trade of CITES-listed species in the region. It is an integrated network among law enforcement agencies and involves CITES authorities, customs, police, prosecutors, specialized governmental

wildlife- law enforcement organizations, and other relevant national law enforcement agencies.

The ASEAN-WEN operates on two levels: national and regional. On the national level, each country operates an inter-agency task force comprised by police, customs, and environmental officers. Task forces form the backbone of a regional network dedicated to battling transnational wildlife crimes. The concept is similar to that of already existing networks dealing with other transnational crimes like drug smuggling.

Through annual meetings, workshops and trainings, the ASEAN-WEN facilitates increased capacity and better coordination and collaboration of law enforcement agencies not only among the ASEAN Member States, but also regionally and globally. It links up with CITES, the Interpol, the US Fish and Wildlife Service, the US Department of Justice, and with other wildlife law enforcement groups. The ASEAN-WEN likewise partners with non-governmental organizations like Freeland, Traffic, and Wildlife Alliance. Through the activities of the ASEAN-WEN, the region has recently experienced an improvement in wildlife law enforcement actions.

The ASEAN Centre for Biodiversity works with the ASEAN-WEN in enhancing the capacity of park rangers on law enforcement. On 9 - 22 November 2009, the Enforcement Ranger Basic Training Course was conducted with the ASEAN-WEN and Freeland. The course provided park rangers, law enforcement officers and staff the minimum knowledge required to conduct tasks on patrolling confidently and safely in a tropical forest environment. A subsequent capacity-building course is the Managers' Workshop for PA Protection and Enforcement. (A related account on this subject may be found under Transboundary Protected Areas.)

Park rangers from the 10 ASEAN Member States learn basic ranger enforcement skills under trainers from the ASEAN-WEN and FREELAND Foundation. *Photo by Rhia Galsim*

Mangroves for the Future

The Mangroves for the Future (MFF) is a unique partner-led initiative to promote investment in coastal ecosystem conservation for sustainable development. It provides a collaborative platform among the many different agencies, sectors and countries addressing challenges to coastal ecosystem and livelihood issues in working towards a common goal.

The MFF builds on a history of coastal management interventions before and after the 2004 tsunami, especially the call to continue the momentum and partnerships generated by the immediate post-tsunami response. It initially focused on countries worst-affected by the tsunami, which includes India, Indonesia, Maldives, Seychelles, Sri Lanka and Thailand. The MFF recently expanded to include Pakistan and Viet Nam. It will continue to reach out to other countries in the region that confront similar issues, with the general objective of promoting an integrated ocean-wide approach to coastal zone management[25].

The MFF initiative uses mangroves as its flagship ecosystem in recognition of the de-

Visitors explore a mangrove area
Photo by Rhia Galsim

struction caused to mangroves by the tsunami. The organization, however, takes account of all coastal ecosystems, including coral reefs, estuaries, lagoons, sandy beaches, sea grasses and wetlands. Its long-term management strategy is based on identified needs and priorities for sustainable coastal ecosystem management. These priorities emerged from extensive consultations with over 200 individuals and 160 institutions involved in coastal management in the Indian Ocean Region.

The MFF seeks to achieve demonstrable results in influencing regional cooperation, national program support, private sector engagement, and community action. This aims to be achieved through a strategy of generating knowledge and empowering institutions and individuals to promote good governance in coastal ecosystem management .

Building ASEAN's Capacity on Taxonomy

The Convention on Biological Diversity adopted the Programme of Work of the Global Taxonomy Initiative (GTI) in its Decision VI/8 of April 2002, reiterating the need to strengthen taxonomy, especially in less developed countries.

The GTI was initiated primarily to remove impediments in the taxonomy profession, and to attract more students and professionals to go into taxonomy. The removal of taxonomic impediments to biological diversity conservation is crucial to maintaining nature's wealth in the ASEAN region. It has been pointed out that taxonomy is one of the major disciplines in biodiversity because, without it, species would not be able to be identified. Hence, a long-term capability development program was put in place to pursue collaboration, not only among the ASEAN Member States, but with Europe and other first world countries as well.

There is an urgent need to train and support more taxonomic experts and to understand the relationship of the biological components of the varied ecosystems and ecological processes. In 2009, the ACB undertook initiatives in this respect in cooperation with key world taxonomic institutions and NGOs.

A Regional Action Plan on GTI for East and Southeast Asia was developed as a result of the ASEAN+3 Regional Workshop on Global Taxonomy Initiative: Needs Assessment and Networking conducted by ACB on 19 - 22 May 2009. The workshop provided a venue for sharing experiences in the implementation of the Programme of Work for GTI and identifying future programs and plans for capacity development for the ASEAN. The Regional Action Plan identifies collaborative activities on taxonomy and charts the course of the GTI in the region for the next five years (2010 - 2014).

A recent project that has been launched in this regard was the "Taxonomic Capacity Building and Governance for the Conservation and Sustainable Use of Biodiversity," which aims to develop and enhance capacities in taxonomic knowledge for strengthening scientific bases in decision-making which are vital for environmental governance, business and technological developments. Two project activities have been identified. The first activity on taxonomic capacity building includes an eight-week internship program. The second undertaking on networking and institutionalization entails the ASEAN Member States' appointment of GTI National Focal Points. The project likewise intends to strengthen collaboration between the ASEAN Member States

and the East and Southeast Asia Biodiversity Information Initiative (ESABII), an undertaking being supported by Japan.

ASEAN Framework Agreement on Access and Benefit Sharing

The ASEAN Framework Agreement on Access to Biological and Genetic Resources[26] was initially formulated in 2002. It acknowledges the need to ensure the uniformity and consistency of regulations on access to genetic resources and its equitable benefit sharing in the ASEAN region. It also sets minimum requirements for national implementation and maximizes opportunities for the conservation and sustainable use of biological and genetic resources[27].

The ASEAN has a common interest to realize the value of biological and genetic resources in the development of products, compounds and substances that have medicinal, industrial, agricultural and related applications. The proposed ASEAN Framework Agreement also recognizes that access to biological and genetic resources are currently unregulated – therefore, the urgent need to protect ASEAN interests against biopiracy, as provided for in the Convention on Biological Diversity. The aim is to provide a level playing field for all countries wishing to control the exploitation of their genetic resources[28].

In this regard, the framework's objectives include ensuring the conservation and sustainable use of biological and genetic resources and the equitable sharing of benefits arising from its access, consistent with the principle of prior informed consent; according recognition and protection to the traditional knowledge of indigenous peoples and local communities; facilitating the fair and equitable sharing of benefits with said communities where traditional knowledge is utilized; and guaranteeing that the peoples of the ASEAN derive maximum and fairly shared benefits from the development and uses of the biological genetic resources within their territories[29].

There are divergent interests between providers and users of genetic resources in the ASEAN region, particularly in the areas of prior informed consent, and the fair and equitable sharing of benefits of indigenous and local communities. The doctrine of sovereignty, as viewed by each member state, and the concerns of indigenous peoples and local communities, account for the divergent views[30]. The dynamics of sovereignty in a changing world still has to be better appreciated.

The objectives of the proposed ASEAN Framework Agreement call for the promotion of cooperation among ASEAN Member States and ensuring the uniformity and consistency of regulations to be enforced. Though seemingly simple in its framing, the objectives are gargantuan given the divergent interests between the providers and users of genetic resources in the region, and in light of the varying degrees of development in environmental governance among the ASEAN Member States stemming from divergence in population, territories, development, economy, history and government.

A close look at the ASEAN Member States' respective laws would easily make apparent the various nuances of the legal systems in place in the region. The body of laws is not classifiable simply as common law, or civil law, or a mixture of both. While one system is founded on Islamic or Hindu law, a few others share the traditions of British law super-imposed upon Islamic foundations, further modified by modern indigenous legal innovations. Others have indigenized eclectic legal systems integrating concepts from the American, Spanish, Italian and French systems of law. Intricate as it already is, the legal labyrinth is made even more complex when viewed in the context of the myriad ethnic and customary laws. For one, Viet Nam, The Lao PDR, Myanmar and Cambodia have substantial capacity-building requirements in environmental protection.

Benefit-sharing is one of the advantages which may ensue from controlling access to genetic resources[31]. It is therefore worth mentioning that, instead of 'access', greater emphasis could be placed on 'benefit-sharing' derived from the use of biological and genetic resources. The mere absence of it in the wording of the Framework Agreement's title already points to a fundamental deficiency. The sharing of benefits derived from the use of resources is as important as being able to pro-

mote cooperation and ensuring uniformity and consistency in regulating access to biological and genetic resources as the providers of such resources must be fairly and equitably rewarded and compensated for the access and use of their resources, including traditional knowledge. All these explain why the adoption of the Framework Agreement by the ASEAN Member States is proving to be difficult and challenging.

Box 11. Lessons from the Philippines

A KEY PROBLEM in the ASEAN region is the absence of statutes that explicitly regulate bioprospecting, which in effect allows collectors free access to genetic resources. For this reason, Philippine Executive Order 247[32] was adopted in 1995. It prescribes guidelines and procedures for bioprospecting in the Philippines. The regulation defines bioprospecting as the research, collection and utilization of biological and genetic resources for purposes of applying the knowledge derived therefrom for scientific/or commercial purposes. A Research Agreement between the Philippine Government and a prospective applicant is necessary for the conduct of bioprospecting activities. This may either be an Academic Research Agreement (ARA) or a Commercial Research Agreement (CRA), both requiring the prospective applicant to satisfy certain requirements and undergo an application process managed and enforced by the Inter-agency Committee on Biological and Genetic Resources. It also contains provisions on prior informed consent of indigenous and other local communities, which may be of value for other countries. The regulation is far from perfect. It had been questioned a number of times because of the tedious process involved before agreements are finally approved. Some local scientists and researchers found it to be a barrier to research and development.

The bioprospecting procedures were revised in 2001 through the Wildlife Resources Conservation and Protection Act. It amended the definition of bioprospecting to the research, collection and utilization of biological and genetic resources for the purpose of applying knowledge derived therefrom solely for commercial purposes[33]. The procedure for issuing a Commercial Research Agreement was streamlined, and now enables a more reasonable timeframe for approval. For scientific research activities, a separate procedure that is simpler and practical was adopted.

Implementing guidelines covering an access and benefit-sharing system, a quota for the collection of specimens, the determination of the amount of performance, an ecological and rehabilitation bond, and a monitoring scheme was drafted and presented to stakeholders for consultation[34].

Regarding intellectual property rights as this relates to species of plants and animals, the Philippines' Indigenous Peoples Rights Act provides that in relation to the right to indigenous knowledge systems and practices to develop their own sciences and technologies, the indigenous peoples are entitled to the recognition of the full ownership and control and protection of their cultural and intellectual rights. They shall also have the right of special measures to control, develop and protect their sciences, technologies and cultural manifestations, including human and other genetic resources; seeds, including derivatives of these resources; traditional medicines and health practices; vital medicinal plants, animals and minerals; indigenous knowledge systems and practices; knowledge of the properties of fauna and flora; oral traditions, literature, designs, visual and performing arts[35].

The Department of Environment and Natural Resources (DENR) laid down the basic policy (DENR Administrative Order No 2, 1993) on indigenous communities in relation to traditional knowledge and practices, which is to ensure the recognition of the customs and traditions of their ancestral domains and the importance of promoting indigenous ways in the sustainable management of natural resources, *i.e.*, their ecologically sound traditional practices. In furtherance of this policy, indigenous communities are to exercise general supervision and control over the management of their respective ancestral domains, including the resources found therein. For this purpose, the Council of Elders existing in the community is recognized as the decision-making and managing body.

No government programs under the control of the DENR are to be implemented within any ancestral domain without the written consent of the indigenous cultural community concerned, signed in its behalf by a majority of its recognized leaders. Such consent being given, ample opportunity to participate in the planning, implementation and maintenance of the program will be given to the community.

Management of the community by the indigenous cultural group excludes individuals who are not bona fide residents of the area from having a permit, license or other legal instruments to enter for the purpose of exploiting the resources therein without the collective consent in writing of the community expressed through public hearings and consultations with them.

The DENR rules and regulations require the preparation of a comprehensive ancestral domain management plan by each indigenous community, which shall take into consideration indigenous land use and a tenurial system including customary laws, beliefs and traditional practices, as well as issues relative to indigenous community participation in the protection, conservation, development and exploitation of natural resources in the area; protection and maintenance of indigenous community rights over livelihood resources; and provision of a supplemental source of livelihood; among others.

Access and Benefit Sharing at the global level

The third objective of the Convention on Biological Diversity is the fair and equitable sharing of benefits derived from the use of genetic resources, which is defined as "genetic material of actual or potential value", itself defined as "any material of plant, animal, microbial or other origin containing functional units of heredity[36]".

The fair and equitable sharing of benefits arising from the use of genetic resources is very important to developing countries, particularly in the ASEAN region, which is home to most of the world's biological diversity. However, there is an observation that the ASEAN Member States do not get their fair share of benefits from the use of biodiversity resources for the development of products, such as high-yielding crop varieties, pharmaceuticals and cosmetics. Such situation reduces the incentive for the world's biologically richer but economically poorer countries to conserve and sustainably use their resources for the ultimate benefit of mankind[37].

Biodiversity and indigenous peoples have an intimate link in most of Asia, and most especially in the ASEAN Member States. It is no accident at all that, along with the massive loss of biodiversity, indigenous cultures with their largely undocumented knowledge are being wiped out as well. Because indigenous peoples live close to the earth, with their individual and collective lives revolving around nature over generations, much of their knowledge relates to biodiversity, habitats, ecological relationships and patterns[38]. This traditional knowledge has proven to be a potentially valuable reservoir of information on the medicinal and agricultural uses of plants.

An example of the vulnerability of indigenous knowledge is when aboriginal knowledge is tapped to facilitate the bioprospecting activities of pharmaceutical firms or similar companies While companies make substantial profits through patenting or the manufacture of synthetic equivalents, most likely under the protection of intellectual property rights laws, the indigenous knowledge that was extracted remains treated traditionally: as common heritage open and available to everybody in the universe – and not accorded rightful recognition of ownership, control and protection of the cultural and intellectual resource that were theirs to begin with[39].

Implementing the access and benefit-sharing (ABS) regime is indeed a challenge and an opportunity. So far, the proposed ASEAN Framework Agreement on Access to Biological and Genetic Resources has yet to be ratified. The ASEAN Member States remain confronted by conflicting interests between providers and users of genetic resources, particularly in the areas of prior informed consent, the fair and equitable sharing of benefits of indigenous and local communities, as well as the implementation and enforcement of uniform and consistent access regulations within the ASEAN region.

However, despite the challenges being faced by the region as a whole, ASEAN has embarked on capacity building activities on ABS both at national and regional levels:

- The Philippines, as mentioned in its Fourth National Report to the Convention on Biological Diversity, has an Administrative Order (AO) entitled *Guidelines for Bioprospecting Activity in the Philippines,* issued jointly by the Department of Environment and Natural Resources (DENR), Department of Agriculture (DA), Philippine Council for Sustainable Development (PCSD), and the National Commission on Indigenous Peoples (NCIP). The AO provides separate regulations for access to biological and genetic resources for scientific and commercial research. Complementing this regulation is AO No. 1 by the NCIP, the *Free and Prior Informed Consent (FPIC) Guidelines* of 2006, which ensures that activities within the ancestral domain are consistent with traditional practices and that the benefits are fairly and equitably shared with the concerned community. As a result, NCIP records show that indigenous people communities have benefited from royalties, infrastructure and social programs from 199 projects involving mining, mini-hydro/dam, forestry, small-scale quarrying and gravel, biodiversity research, and others[40].

- ABS Framework developed in Sarawak, Malaysia is discussed in Box 16, page 157
- The ASEAN Centre for Biodiversity (ACB) organized an ASEAN Regional Workshop on Access and Benefit Sharing of Genetic Resources and their Uses in Siem Reap, Cambodia in August 2009. The workshop served as a forum for ASEAN Member States to discuss ABS issues and activities at both country and regional levels, as well as promote a common understanding of the draft document on the International Regime on ABS. At the workshop's conclusion, the ASEAN Member States agreed that the region needs to: build its capacity in understanding key ABS issues; develop national policies; and actively participate in regional and international processes on developing the international regime. As a result, a Regional Consultation for Asia in Support of the Finalization of the International Regime on Access and Benefit Sharing was held in December 2009. The meeting agreed on a set of common understandings hinged on three areas, namely: benefit-sharing, access, and compliance.

The ASEAN, as a whole, has taken steps in addressing the ABS issues by acknowledging the need to ensure the uniformity and consistency of regulations on access to genetic resources and its equitable benefit sharing through the drafting of the ASEAN Framework Agreement. However, there are still many challenges ahead, specifically its ratification. Some setbacks have been experienced. For instance, The Lao PDR stated in its Fourth National Report to the Convention on Biological Diversity that the issue of ABS has been discussed but not resolved, as the international regime for ABS was only recently drafted for negotiations and will be considered for adoption at COP10.

In this regard, public awareness about the ASEAN Framework Agreement must be strengthened, targeting not only the ASEAN Member States' government institutions but the entire ASEAN community as well. Likewise, attention should be focused on the need of some ASEAN Member States for capability building in developing and enacting ABS national policies. Enhanced participation and capacity building must also be achieved through heightened community involvement, as well as awareness and understanding of each member state's role in effectively implementing ABS in their respective communities.

Biosafety

The ASEAN Context

Biotechnology, which is the use of biological processes to develop products, is a science that has long been employed by humankind. It refers to a range of techniques, including selective breeding, cross-fertilization and fermentation. Generally, biotechnology has brought about many economic and human health benefits. For example, the selection and breeding of grains has produced better quality and higher yielding varieties, and has expended the use of diverse crop species well beyond their centers of origin.

Animals, plants and micro-organisms to which one or more foreign genes have been introduced are called "transgenic organisms". Genetically Modified Organisms (GMOs), which in some instances are referred to as Living Modified Organisms (LMOs), contain combinations of genes or genetic material that have been altered in ways that do not occur naturally through mating or recombination.

GMOs have potential benefits for humankind. Modern biotechnology makes it possible to mass-produce therapeutically useful compounds, vaccines, new drugs, diagnostic aids, novel or improved industrial enzymes, and crops with improved agronomic or consumer benefits. Genetic manipulation can improve the quality and quantity of agricultural production and allows the development of plants and animals that are disease- and pest-resistant. Agricultural output incorporates additional vitamins and nutrients that can enhance consumers' health. The environment also benefits from the farmers' reduced dependence on fertilizers and herbicides which, in turn, reduces pollution and allows farmers to reinvest their savings on increasing production. This leads to increased food security for the world's grow-

ing population. Finally, efficiencies made possible by GMOs could reduce the area of land dedicated to agriculture, leaving more habitats and ecosystems undisturbed and thereby preserving biodiversity.

On the other hand, GMOs also pose serious threats. Genetic engineering raises issues of misuse, new health risks, and the unintended creation of organisms or genetic traits that may cause irreversible effects to the world's complex and delicate ecological cycle. GMOs may also threaten human health by giving rise to new food allergies and inadvertent immune responses to existing antibiotics and medicines.

With regard to the environment, the use of GMOs raises concerns about the possible transfer of modified genes to naturally occurring plant and animal species. The effects of such transfers are unknown and uncontrollable. Of particular concern is the effect GMOs could have on genetic diversity in plants and animals. Large-scale farming is another potential problem resulting from society's dependence on GMOs. The mass production of identical plants and animals can lead to the unwitting disregard of valuable indigenous knowledge. Moreover, as agricultural output is homogenized, it becomes more susceptible to disease and pests. This increased vulnerability could rapidly outweigh the benefits of increased food security[41].

The issue of safety in biotechnology found its way very early after the CBD entered into force, through Article 19 (3), where Parties were provided some guidance for taking the need for a biosafety protocol under serious consideration. The said article obliged Parties to the Convention to deliberate, at a later date, the need for and requirements of a protocol "setting out appropriate procedures, including, in particular, advance informed agreement, in the field of the safe transfer, handling and use of any living modified organism resulting from biotechnology that may have adverse effect on the conservation and sustainable use of biological diversity". The Cartagena Protocol on Biosafety is the first protocol under the CBD, concluded in Montreal, Canada in January 2000.

The objective of the Cartagena Protocol is to contribute in ensuring an adequate level of safety in the transfer, handling and use of LMOs. Generally, the Protocol applies to all LMOs, but excludes from the agreement certain transgenics or uses of transgenics, including LMOs used in pharmaceuticals for humans and addressed in other international agreements or by other international organizations. In regulating the international movement of LMOs, the Protocol seeks to prevent or mitigate risks by focusing on the obligation that requires exporters of LMOs that are intended for direct release into the environment to seek prior agreement from authorities of importing countries. Importing countries, in turn, are required to subject these LMOs to risk assessment before they make decisions regarding the approval or prohibition of imports. The adoption of the Protocol itself underscores the precautionary principle that runs throughout the agreement[42].

To date, eight of the ten ASEAN Member States are parties to the Cartagena Protocol, namely: Cambodia, Indonesia, The Lao PDR, Malaysia, Myanmar, the Philippines, Thailand and Viet Nam[43].

As a party to the Protocol, a country is expected to put in place a domestic implementing legislation that will allow it to adhere to the terms of the international agreement. Appendix 7 summarizes the eight countries' status and history in fulfilling their obligations to the Protocol.

Current Status of Biosafety Regulation in the ASEAN

At present, a wide variation exists on the status of biosafety regulations in the ASEAN region. Some countries have operational regulations, while others have no regulation at all. The Lao PDR and Myanmar do not have biosafety regulations in place; Thailand does not have legislation specifically for GMOs; Viet Nam has biosafety regulations which are either still under development or are not yet being fully implemented; while Cambodia, Indonesia, Malaysia and the Philippines already have operational systems[44].

The Institutional and Intra-regional Initiatives

The ASEAN Socio-Cultural Community Blueprint: Ensuring environmental sustainability

The ASEAN was established in 1967 in Bangkok to create an organization that would bring about a region of peace, freedom and prosperity for the people of Southeast Asia, covering the ten countries of Brunei Darussalam, Cambodia, Indonesia, The Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam.

Since its establishment, the regional grouping has expanded and grown into a robust political, economic and social bloc. With the remarkable economic performance of a number of ASEAN Member States, the ASEAN leaders during their 1997 Summit agreed to pursue the ASEAN Vision 2020: "a concert of Southeast Asian nations, outward looking, living in peace, stability and prosperity, bonded together in partnership in dynamic development and in a community of caring societies."

The Hanoi Plan of Action (1999 - 2004), the first in a series of plans of action to build up the realization of the ASEAN Vision 2020, reaffirmed the ASEAN commitment to protect the environment and promote sustainable development, and identified the need to strengthen the ASEAN Regional Centre for Biodiversity Conservation (ARCBC) Project. Specifically, it aimed to establish networks of relevant institutions and implement collaborative training and research activities by the year 2001; and promote regional coordination for the protection of the ASEAN Heritage Parks and Reserves and formulate and adopt an ASEAN Protocol on access to genetic resources by the year 2004.

The Yangon Resolution on Sustainable Development, signed by the ASEAN Ministers of Environment (AME) on 18 December 2003, endeavoured to conclude by 2004 the ASEAN Framework Agreement on the Access to, and Fair and Equitable Sharing of Benefits Arising from the Utilization of Biological and Genetic Resources, in order to sustainably manage the rich biodiversity resources of the ASEAN. The said resolution likewise adopted the revised ASEAN Declaration on Heritage Parks, which included all ten members of the ASEAN, and resolved to further enhance cooperation through the mechanisms provided by the AHP Declaration. The resolution acknowledged further the valuable contributions made by the ARCBC, and agreed to enhance its role by reviewing its management structure and programs and providing necessary support for the continued sustainability of the centre. This led to the subsequent establishment of the ASEAN Centre for Biodiversity (ACB).

The Vientiane Action Programme (2004 - 2010), approved by the Heads of State and/or Governments of the ASEAN Member States at the 10th ASEAN Summit in November 2004, called for the promotion of environmental sustainability and sustainable natural resource management that meets current and future needs, promotes a clean and green ASEAN with fully established mechanisms for sustainable development to ensure the protection of the region's environment, the sustainability of its natural resources and the high quality of life of its people. The program ensures that the ASEAN's rich biological diversity is conserved and sustainably managed, and that the benefits arising from these biological and genetic resources are fairly and equitably shared toward enhancing social, economic and environmental well-being.

Ensuring environmental sustainability while aggressively pursuing economic development for the benefit of present and future genera-

Photo collage by Nanie Gonzales

tions is at the heart of the ASEAN Socio-Cultural Community (ASCC) Blueprint (2009 - 2015). Its Roadmap for an ASEAN Community covers the sustainable management and conservation of forest, soil, water, coastal and marine resources; improvement of water and air quality; and active participation of the ASEAN to address global environmental issues such as climate change, ozone layer protection and the promotion of environmentally sound technologies. The ASCC further promotes the enhancement of the role and capacity of the ACB to function as an effective regional centre of excellence in promoting biodiversity conservation and management.

Fulfilling ASEAN's commitments to the CBD and other biodiversity-related agreements

All ten ASEAN Member States are Parties to the Convention on Biological Diversity (CBD), the first global agreement that encompasses three major goals: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from the use of genetic resources. This agreement is regarded as a clear signal that countries acknowledge that biodiversity conservation is a global priority, and thus requires working together as a global society.

The Parties to the Convention in April 2002 adopted a strategic plan which targets to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional, and national levels as a contribution to poverty alleviation, and to the benefit of all life on Earth. The target's end goal is to effectively halt the loss of biodiversity in order to secure the continuity of its beneficial uses, and also to ensure that future generations will benefit from these resources. As Parties to the Convention, the Parties committed to reduce biodiversity loss by 2010 – the International Year of Biodiversity.

In December 2003, the ASEAN Ministers of the Environment signed the ASEAN Declaration on Heritage Parks, wherein the ASEAN Member States agreed that "common cooperation is necessary to conserve and manage the ASEAN Heritage Parks for the development and implementation of regional conservation and management action plans as well as regional mechanisms complementary to national efforts to implement conservation measures". To date, 28 ASEAN Heritage Parks have been declared, the most recent of which is the Mount Kitanglad Range Natural Park in the Philippines. The ASEAN Heritage Parks embody the aspirations of the ASEAN Member States to conserve natural heritage representing the bounty and diversity of the living organisms of their nations. The abundance of these diverse biological resources also ensures the continuous flow of goods and ecosystem services for the benefit of the present and future generations.

The ASEAN Member States are also Parties to other international agreements such as the Convention on International Trade of Endangered Species of Wild Fauna and Flora (CITES), the Convention on Wetlands of International Importance, especially the Waterfowl Habitat (Ramsar), the Cartagena Protocol on Biosafety, and the World Heritage Convention.

As Parties to these conventions, the ASEAN Member States are committed to save the world's as well as the region's rich biological diversity. To show commitment in further addressing global environmental issues, the ASEAN Ministers on Environment, through the Singapore Resolution on Environmental

Sustainability and Climate Change, agreed in October 2009 to protect and conserve the ASEAN's rich biodiversity by taking into account the three objectives of the CBD, and to work together to achieve a successful outcome of the 10th Conference of the Parties to the Convention on Biological Diversity. The resolution likewise encouraged the ASEAN Member States to identify and establish more ASEAN Heritage Parks and to maintain the current parks through a comprehensive, effectively-managed and ecologically representative system of protected areas to significantly reduce the current rate of biodiversity loss, and to focus efforts on biodiversity conservation as one of the key measures in mitigating and adapting to climate change. The resolution also supports further the biodiversity conservation and management initiatives and programs under ACB.

The ASEAN Centre for Biodiversity: Promoting the conservation and sustainable management of natural resources and biodiversity

Southeast Asian governments are steadily becoming aware of how extremely vital biodiversity conservation is to human development. For this reason, national and local authorities across the region continue to employ various means of protecting their natural resources. There are, however, a number of issues that can be more effectively addressed through actions at the regional level.

In the mid-1990s, the need to establish an ASEAN institution to promote knowledge sharing about best practices and common efforts in the biodiversity sector had become apparent. It led to the first European Commission-funded project: the ASEAN Regional Centre for Biodiversity Conservation (ARCBC). This regional project started in 1999, with a grant of €9.5 million from the European Commission.

The ARCBC fostered strong collaboration among the ASEAN Member States and between ASEAN and EC partner institutions, gradually gaining recognition in the regional and global biodiversity arena. Stakeholders agreed on the need for a permanent institution, as against a mere time-bound instrument. This promptly translated to the creation of a regional centre of excellence to strengthen the capacity of the ASEAN Member States in formulating and coordinating biodiversity-related policy, strategy and action; fulfilling relevant treaty obligations; and promoting and advancing common positions on matters related to biodiversity conservation and the management and sustainable use of natural resources.

Confirming its willingness to support the ASEAN in establishing this regional centre, the EC approved in 2004 a grant of €6.0 million to support the establishment and initial operation of a new institution: the ASEAN Centre for Biodiversity (ACB). The Financing Agreement with the ASEAN Secretariat was signed in April 2005, and its Establishment Agreement was signed by the ASEAN Ministers of Environment shortly thereafter. The ACB was formally launched at the Ninth Informal ASEAN Ministerial Meeting on 27 September 2005.

The ACB is being hosted by the Government of the Philippines through the Host Country Agreement signed in 2009. The Philippines came to be the official home of the ACB headquarters after the Philippine Senate approved a resolution concurring with the ratification of the Host Country Agreement (HCA) signed between the ACB and the Government of the Philippines. The ratification of the ACB Establishment Agreement and the Senate of the Philippines' concurrence with the ratification of the HCA contributed to the sustainability of ACB operations as the ASEAN's centre of excellence on biodiversity conservation.

Since its establishment, the ACB has undertaken various actions in the field of policy coordination and capacity building which include, among others, regional workshops on urban biodiversity, climate change and biodiversity, transboundary cooperation, enforcement of bio-safety regulations, preparation of biodiversity indicators, and a gap analysis on marine protected areas. These activities have been launched in different venues across the region.

The ACB has also established partnership arrangements with strategic international institutions like the International Union for Conservation of Nature (IUCN), Secretariat of the Convention on Biological Diversity (CBD),

Global Biodiversity Information Facility (GBIF), Institute of Southeast Asian Studies (ISEAS), Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), United Nations Environment Programme-World Conservation Monitoring Centre (UNEP-WCMC), Fishbase Information and Research Group, Incorporated, ASEAN Wildlife Enforcement Network, FREELAND Foundation, and Winrock International.

As an intergovernmental regional center of excellence, the ACB continues to facilitate cooperation and coordination among ASEAN Member States, other relevant national governments, and regional and international organizations on conservation and the sustainable use of biodiversity and the fair and equitable sharing of benefits arising from the use of genetic resources.

The ACB responds to the needs of the ASEAN Member States in the areas of Protected Area Management, Wildlife Enforcement, Peatland Management and Biodiversity, Agrobiodiversity and Biosafety, Access and Benefits Sharing, Biodiversity Information Management, Business and Biodiversity, Climate Change and Biodiversity, Ecotourism and Biodiversity Conservation, the Global Taxonomic Initiative, Invasive Alien Species, and Payment for Ecosystems Services.

As a duly recognized international organization, ACB can reinforce its efforts in implementing key measures aimed at reducing the loss of biodiversity, which is critical to the sustainable food production, health and livelihood of the region. Becoming a legitimate international organization enables the ACB to mobilize more resources and continue forging more partnerships that should enhance support for the ASEAN Member States in meeting their commitments to various multilateral environmental agreements for the reduction of the rate of biodiversity loss.

Joint Research/ Initiatives on Biodiversity

While the scientific world witnessed the escalating concern for biodiversity in recent years, there remains a shortage in biodiversity research for the ASEAN region. New knowledge and updated information on biodiversity is crucial in undertaking meaningful biodiversity management and conservation.

To generate further interest in biodiversity research, the Joint Research/Initiatives on Biodiversity (JRI), a technical assistance window for the ASEAN Member States, was established by the ACB to support worthy biodiversity research and policy initiatives from ASEAN-based research, academic, and both non-government and government institutions and agencies. The Joint Research/Initiatives on Biodiversity prioritize studies and forums on the payment for ecosystem services scheme and the economic valuation of biodiversity; food certification and biodiversity; peatland management and biodiversity; the Global Taxonomic Initiative; invasive alien species management; support to the CBD's Programme of Work on Protected Area; wildlife enforcement; regional climate change and biodiversity conservation; ecotourism and biodiversity conservation; access and fair and equitable sharing of benefits from biological and genetic resources; and managing biodiversity information and knowledge. A panel of academic and environment experts from ACB's Scientific Advisory Committee provides guidance in the selection of projects to be implemented.

Course Programs for Protected Area Workers

One of the key elements of the Programme of Work on Protected Areas of the CBD, the "Standards, Assessment and Monitoring" – includes developing and adopting minimum standards and best practices; evaluating and improving the effectiveness of protected area management; assessing and monitoring protected area status and trends; and ensuring that scientific knowledge contributes to protected area establishment and effectiveness. To do so requires a set of standards and criteria for measuring the effectiveness of management, a system for evaluating the effectiveness of management interventions, and ongoing monitoring of the status and trends of PAs and the biodiversity that they contain.

While protected areas and community-conserved areas abound in Southeast Asia, park managers and staff need to continuously enhance their technical expertise to manage these key environmental areas effectively.

In order to address this, the ACB spear-

headed the development of programmatic courses for enhancing human capacities and institutional building initiatives in the region. The ACB conducted the following regional course workshops, benefitting 105 participants coming from the ten ASEAN Member States:

1. Platform on Knowledge Sharing for Executives, 10 - 14 August 2009, Philippines. The workshop enhanced the participants' knowledge in the following topics: contemporary issues, international platform and protocols, climate change and PA management, principles of human and environmental interaction and their implications in PA management, conflict resolution and negotiation, conservation principles and international negotiations, invasive species in PA management, and project development and management. A total of 21 division chiefs and directors of PA agencies from nine countries and six experts/resource persons participated actively in the seminar-workshop. A draft curriculum for executives was developed.
2. Enforcement Ranger Basic Training Course, 9 - 22 November 2009 in Khao Yai National Park, Thailand. A total of 15 enforcement officers and rangers from seven ASEAN Member States augmented their skills in biodiversity conservation and environmental issues, protected area laws in law enforcement, basic first aid, basic navigation, weapon handling, patrolling operations, hostile engagements, arrest-and-secure, and vehicle checkpoints. The participants were trained by experts from the ASEAN Wildlife Enforcement Network (ASEAN-WEN), Freeland Foundation, and the Royal Army of Thailand.
3. Protection and Enforcement Managers for Protected Areas, 23 - 26 November 2009 in Pattaya, Thailand. A group of 15 managers and enforcement staff of PA agencies reviewed the Basic Ranger Enforcement Course and found it very relevant to their respective tasks. The forum determined that some of the topics require modification to suit country needs. The participants drafted a course program for protection and enforcement managers.
4. Regional Training on Ecotourism for Middle-level Protected Area Staff and Visit to Selected ASEAN Heritage Parks and Other Protected Areas, 7 - 19 December 2009, Malaysia. From nine ASEAN Member States, 19 representatives and ten experts/ resource persons participated in the training. The participants improved their understanding of the elements and principles of ecotourism; identified best practices on ecotourism; and drafted an ecotourism curriculum for middle-level PA staff.

After further evaluation, the ACB will refine and finalize these modules. The preparation and pilot-testing of the modules led to the development of a draft curriculum for executives; a law enforcement curriculum for park and forest rangers, protection and enforcement managers, and PA managers; a curriculum for ecotourism management effectiveness, PA integration, and access-and-benefit-sharing (ABS).

Clearing House Mechanism

Southeast Asia's wealth of biological resources makes it a treasure chest of information on biodiversity waiting to be shared, among countries, in aid of conservation. This is the rationale behind the ASEAN Centre for Biodiversity's mandate to provide a platform for information- and knowledge-sharing among all ASEAN Member States. Through its website, the ACB offers key information and updates on the ASEAN region's biodiversity resources. A vital component of the website is the ASEAN Regional Clearing House Mechanism (ASEAN CHM), which was established for the purpose of becoming the single entry point to regional biodiversity information and the national CHM websites of the ASEAN Member States. It allows faster access, easier search and better consolidation of biodiversity information at the regional level. It contributes significantly to the CBD's promotion and facilitation of technical and scientific cooperation among Parties, to other Governments and all stakeholders in general.

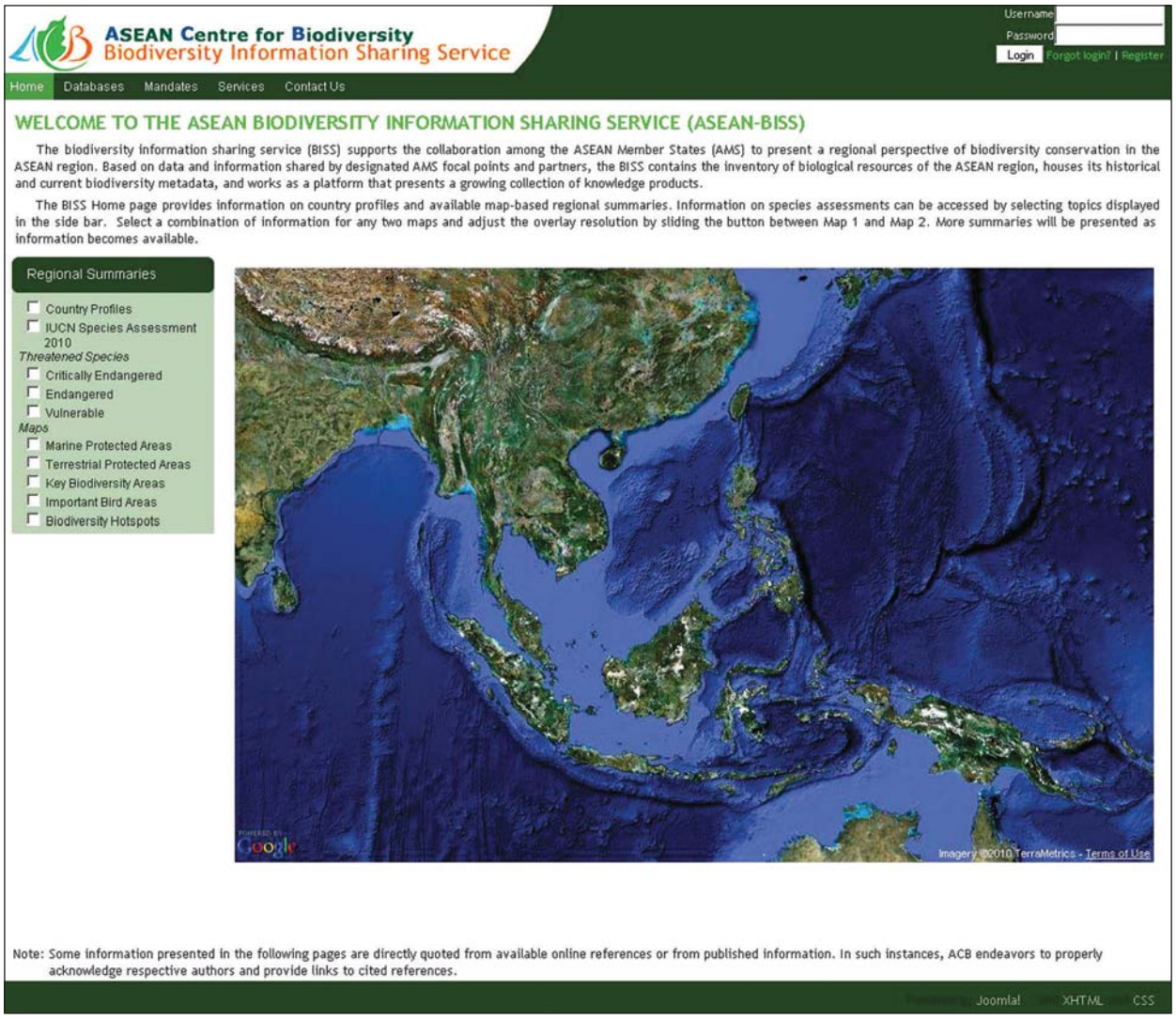
The ACB is promoting the use of the ASEAN CHM as a facility to share biodiversity information and also as an aid to effectively implement the national biodiversity strategies and action plans of each country.

Biodiversity Information Sharing Service

Enhancing data sharing capabilities is fundamental in light of the considerable number of international environment agreements and their reporting requirements that need to be met by the ASEAN Member States as parties to the Convention on Biological Diversity, the Convention on the International Trade of Endangered Species, the Ramsar Convention, the Convention on Migratory Species, and the ASEAN Declaration on Heritage Parks.

As defined in the Vientiane Action Plan, and as proposed through the program areas of the ASEAN Working Group on Nature Conservation and Biodiversity, a functional regional database or network of national databases containing the inventory of the biological resources of the ASEAN region will be established. This requirement rationalized the development of the Biodiversity Information Sharing Service (BISS), under the Biodiversity Information Management unit of the ACB.

By streamlining and facilitating the collation of various types of relevant information, the BISS aims to reduce the burden of reporting to global biodiversity treaties. It is a web-based information sharing platform for the ASEAN Member States on biodiversity information. Presently, the BISS maintains minimal datasets on critical details, e.g., species name



lists and protected area network data which are linked to global and regional data sources. The current BISS provides views of species by several taxonomic group and protected area information which are grouped into terrestrial, marine, and AHPs. Additional data gathered from the ASEAN Member States and global and regional data sources will eventually become part of the BISS platform.

The website contains a wealth of information cutting across the needs of a number of stakeholders, e.g., decision makers, policy makers, scientists, taxonomists, researchers and the general public in the region. More specifically, the website:

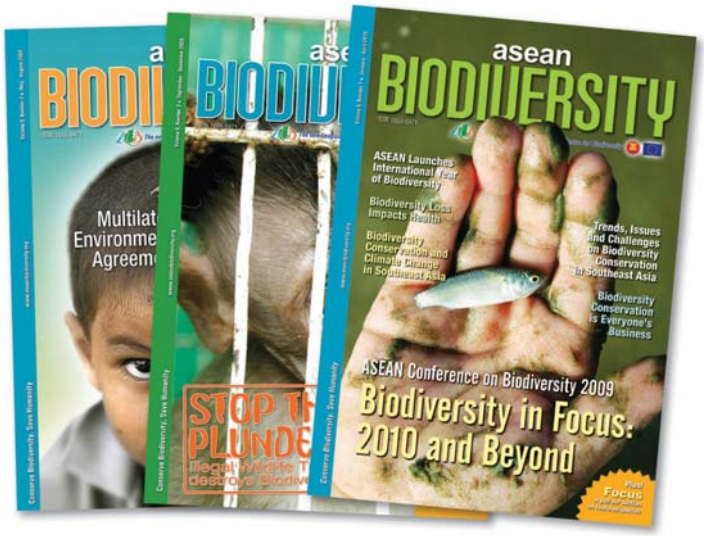
- Provides basic ASEAN-wide summary statistics, and graphs on the physical details, area coverage, and status of IUCN assessed species in the region, as an input to regional analysis;
- Gives insightful descriptions, management status, and essential ecotourism tips on the AHPs of interest to park managers, researchers, and tourists;
- Contains salient data necessary as bases in making sound management decisions on terrestrial and marine protected areas, especially for the use of PA managers;
- Provides interactive species database on amphibians, birds, butterflies, dragonflies, freshwater and marine fishes, mammals, plants, reptiles and malessian mosses where taxonomists, scientists, policy makers and researchers may obtain information on any species of interest;
- Provides access to experts in biodiversity conservation and management through the "Friends of Biodiversity (FOB) database;
- Aides the ASEAN Member States in meeting their reporting requirements in various multilateral environmental agreements (MEA), through the MEAs database;
- Provides access to various biodiversity-oriented initiatives, policies, capacity building and e-library of reports in the region; and
- Provides and uses maps to present ASEAN-level data and information on ecosystems, such as terrestrial protected areas, marine protected areas, and the distribution of international sites, e.g., ASEAN Heritage Parks, Ramsar areas, World Heritage Sites, distribution of IUCN-assessed species, Key Biodiversity Areas, Important Bird Areas, biodiversity hotspots, and the proportion of the ASEAN population below the poverty line (under the Millennium Development Goals).

Public Awareness

Published papers on biodiversity are fewer than may be expected. This plainly illustrates the dearth of information that exists, resulting to low public awareness on the values of biodiversity and conservation. Resources accorded to conservation efforts is limited, translating into a lack of critical information, education and communication resources – ranging from posters and brochures to documentaries, commercials, and other awareness-raising media – intended for the general public[45].

When the ASEAN Member States signed as Parties to the Convention on Biological Diversity, they "committed to: (a) promote and encourage the understanding of, the importance of, and the measures required for the conservation of biological diversity, as well as its propagation through media and inclusion in educational programs; and (b) cooperate, as appropriate, with other States and international organizations in developing educational and public awareness programs, with respect to conservation and the sustainable use of biological diversity."

While there is no doubt that the ASEAN Member States are committed to implementing their own public awareness programs, the level of support and availability of resources among the countries vary significantly – from countries which have sufficient resources, to those without even the basic resources to launch public information campaigns. For many ASEAN countries, the chronic budgetary shortage for public awareness is exacerbated by the multi-sectoral nature of biodiversity issues, often leading to the fragmented development of programs and plans.



The ASEAN Centre for Biodiversity's quarterly ASEAN Biodiversity Magazine *Photo by Nanie Gonzales*

Clearly, any complementary initiative that will boost the countries' efforts to further promote awareness on biodiversity beyond the current levels of resources allocated will be a valuable intervention. As a concrete response, the ACB spearheaded the Communication, Education and Public Awareness (CEPA) Program at the regional level.

The ASEAN Centre for Biodiversity looks at enhancing its strategic role by pursuing regional CEPA endeavours aimed at increasing appreciation for biodiversity conservation, while at the same time grooming advocacy champions who can mobilize the support of leaders and critical stakeholders in promoting the biodiversity agenda in all levels of society. In 2009, the ACB partnered with the CBD Secretariat for a regional workshop that sought to enhance the capability of the ASEAN Member States to implement their respective CEPA strategies and action plans.

The workshop provided a venue for sharing information on challenges met as well as best practices. It also resulted in the creation of the Southeast Asia CEPA and Media Network for Biodiversity (CEPA-Net), a knowledge network composed of about 60 media practitioners, government and NGO information officers, and communication experts from 11 Southeast Asian countries who committed to help promote the importance of biodiversity conservation in the region. Other activities that have been lined up include the publication of a compendium of best CEPA practices in the region; forums on biodiversity conservation; regular exchange of best practices on effective communication techniques for biodiversity; sharing of success stories; media advocacy programs; capacity building activities; and the establishment of national CEPA-Net chapters in all Southeast Asian countries, in the long term.

The ASEAN Conference on Biodiversity 2009

With the theme "Biodiversity in Focus: 2010 and Beyond", the ASEAN Conference

Mr. Rodrigo U. Fuentes, executive director of the ASEAN Centre for Biodiversity, addresses over 300 participants of the ASEAN Conference on Biodiversity 2009. *Photo by National Parks Board, Singapore*

Box 12. Outcomes and Recommendations of ACB2009

Climate Change and Biodiversity

The ASEAN Member States recognize the twin issues of climate change and biodiversity as among the most crucial issues facing not only the region, but also the rest of the world. Exploring the impact of climate change on a number of ecosystems (e.g., mangrove, coral reef and tropical forest), the conference recommended the following:

- To focus efforts on examining the linkage of biodiversity and climate change to three major areas: 1) the role of biodiversity and ecosystem services and the climate system; 2) impacts of climate change on ecosystem services; and 3) biodiversity adaptation measures;
- To give more emphasis on the impact of people on ecosystems and give more attention to the human dimension in ecosystem dynamics; and
- To implement ecosystem-based adaptation strategies, so that humans and ecosystems may be better able to cope with risks associated to current and future climate change.

Forest ecosystems

- To develop a more holistic accounting system on carbon credits;
- To broaden existing agreements that cover forests and carbon credits; and
- To consider going beyond the Ecosystem-based Mitigation Approach, or carbon sequestration through trees, and recognize agro-forestry as one approach that can help enhance adaptive capacities for climate change.

Marine ecosystems

- To enhance international cooperation aimed at curbing the impacts of climate change on coral reefs; and
- To study further the relationships between climate change, run-off, and over-fishing, and consider these areas as the three big issues that affect the biodiversity of marine ecosystems.

Access and Benefit Sharing

There is renewed interest to expand discussions on access and benefit-sharing (ABS) arising out of the utilization of genetic resources and the need for the ASEAN to become more actively involved in the ongoing process of global discussion. In this respect, the ACB2009 recommended the following:

- To continuously support the current consultation process on the "Draft ASEAN Framework Agreement on the Access and Fair and Equitable Sharing of Benefits Arising from the Utilization of Biological and Genetic Resources", and have the draft agreement immediately adopted in the ASEAN region;
- To urge Parties to the CBD to adopt, at the CBD COP10, the International Regime on ABS in order to provide an incentive for the two other objectives of the CBD on conservation and the sustainable use of biodiversity;
- To apply information and communication technology in tackling bio-piracy and the digitalization of biodiversity as bio-information;
- To support cross-country collaboration, capacity building and technology transfer, and likewise enhance the potential of open source and common licensing models as tools for promoting collaboration and reducing transaction costs;
- To focus ABS efforts in the region to the pharmaceutical industry, given the region's strong traditional medicinal base and potentials for drug discovery; and

on Biodiversity 2009 (ACB2009) was held on 21 - 23 October 2009 in Singapore. It was a forum for exchanging perspectives in addressing biodiversity issues in the region and discussing steps in advancing the ASEAN biodiversity agenda in the context of meeting the 2010 target: reducing the loss of biodiversity.

Specifically, the conference aimed to report on the status of ASEAN Biodiversity vis-à-vis the 2010 biodiversity target; discuss the key biodiversity issues that are important to the region, including gaps and challenges in the efforts of ASEAN Member States; and recommend a way forward in addressing the region's biodiversity challenges.

Hosted by the Government of Singapore, the ACB2009 was attended by over 300 key ASEAN stakeholders from governments, the academe, the research and scientific community, donors, civil society and the private sector – including biodiversity experts and partners from all over the world. The ASEAN Centre for Biodiversity and the National Parks Board of Singapore co-organized the three-day conference. The event featured the assessment of progress in achieving the 2010 biodiversity target of the ASEAN Member States, focusing on three thematic areas: 1) Climate Change and Biodiversity; 2) Access to Genetic Resources and the Sharing of Benefits Arising Out of Their Utilization; and 3) The Economics

- To examine closely the genuine implementation of ABS on the ground, as there remain several issues especially on benefit sharing and traditional knowledge that need to be further addressed.

The Economics of Ecosystems and Biodiversity

Valuing biodiversity and its benefits is critical. There are, however, continuing debates on how value should be attached to biodiversity resources and ecosystem services. The conference recommended the following:

- To strongly support current efforts in understanding the economics of biodiversity and ecosystems services. However, it must follow a framework wherein the incentives for people to pay or be rewarded for the protection of these resources, as well as the disincentives for the destruction of such resources, should be in place;
- To further define and refine the role of the key sectors in the process of valuing the economics of biodiversity and ecosystem services;
- To promote ecosystem services investments by the private sector and governments as a tool for risk management and for promoting competitive regional economies;
- To expand the promotion of valuation that shows the return on investments in ecosystem services, and support delimitation and management (especially of MPAs);
- To prioritize incentives and mechanisms for economic activities which rely more directly on ecosystem services, e.g., hydropower and water;
- To enhance communication among ASEAN stakeholders (i.e., policymakers, scientists and civil society) on the potential pros-and-cons of payments for ecosystem services and the economic perspectives of environmental issues;
- To ensure that incentives in the promotion of ecosystem services are backed up by complementary regulation, noting that both 'carrot-and-stick' are needed; and
- To pay attention to ecosystem services in agricultural policy and land use management.

Cross-cutting Concerns

There are cross-cutting concerns that need to be given attention, and all key sectors are encouraged to focus on these concerns, either as part of their respective programs of action or their activities. The conference recommended the following:

- To be more aggressive in public awareness campaigns and emphasize the message of conserving biodiversity and ecosystem services as a determinant of life. This effort must involve harnessing resources from all sectors and communities, (e.g., the private sector, international and regional organizations, the academe, NGOs, and other relevant sectors), for message dissemination;
- To forge the inter-phase between policy and science, integrating different fields, e.g., social sciences, biology and economics (or for trans-disciplinary research to form the basis for advocacy and decision-making support that would ensure the conservation, sustainable use and equitable sharing of the benefits of biodiversity resources); and
- To link biodiversity needs to the issues of poverty alleviation and climate change, and actively support the mainstreaming of biodiversity conservation with other sectors, e.g., agriculture, health, development, education, water, energy, private and business, and get them to commit to this cause.

of Ecosystems and Biodiversity: The ASEAN Region's Contribution.

The Conference highlighted the wealth of biological diversity in the region. Though the ASEAN region occupies only three per cent of the earth's total surface, it is recognized to be home to over 20 per cent of all known plant, animal and marine species. The rich biodiversity in the region provide food, medicine, shelter, clothing, and other biological goods and ecosystems services to over 500 million people. The region, however, confronts continuing habitat and species loss.

The Conference likewise highlighted the link between biodiversity and health. Natural products from biodiversity remain as the major source of new medicines. HIV, SARS, the Nipah virus, H1N1, and other diseases have broken out as an offshoot of biodiversity loss. The conference emphasized the high stakes on which the future resilience of ecosystems hinge, and how detrimental the current loss of biodiversity will be – more than ever requiring key priority issues to be urgently addressed along the three themes that have been defined.

The Conference urged the ASEAN region to demonstrate its support for developing new targets beyond 2010, based on lessons in achieving the 2010 target, in order to ensure setting the right directions and targets to be proposed for 2015 and 2020.

End Notes

[1] Dudley, Nigel (ed). 2008. Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86pp accessed on 1 September 2010 at http://data.iucn.org/dbtw-wpd/edocs/PAPS-016.pdf

[2] Dudley, Nigel (ed). 2008. ibid

[3] Dudley, Nigel (ed). 2008. opcit

[4] ARCBC, UP-MSI, ABC, DENR, ASEAN, 2002. Marine Protected Areas in Southeast Asia. ASEAN Regional Centre for Biodiversity Conservation, Department of Environment and Natural Resources, Los Baños, Laguna, Philippines.142 pp.

[5] ARCBC, et al. ibid.

[6] ASEAN Centre for Biodiversity. 2009. Marine Protected Areas (MPA) Gap Analysis for Philippines and Malaysia. Los Baños, Laguna, Philippines. March 2009. pp24.

[7] ASEAN Centre for Biodiversity, ibid.

[8] ASEAN Center for Biodiversity, opcit

[9] Secretariat of the Convention on Biological Diversity. 2004. Biodiversity issues for consideration in the planning, establishment and management of protected area sites and networks. Montreal, SCBD, 164 pages and i to iv. (CBD Technical Series no. 15)

[10] Pio, Dorethea. 2005. Borneo's Lost World: Newly Discovered Species on Borneo. WWF-Indonesia, Jakarta 2005 accessed on 17 March 2010 at http://assets.panda.org/downloads/newlydiscoveredspeciesonborneo25042005.pdf

[11] Department of Environment and Natural Resources. 2009. Assessing Progress towards the 2010 Biodiversity Target: The 4th National Report to the Convention on Biological Diversity. Republic of the Philippines. pp55.

[12] Coral Triangle Initiative Website accessed on 23 March 2010 at http://www.cti-secretariat.net/

[13] Pio, Dorethea. 2005. Borneo's Lost World: Newly Discovered Species on Borneo. WWF-Indonesia, Jakarta 2005 accessed on 17 March 2010 at http://assets.panda.org/downloads/newlydiscoveredspeciesonborneo25042005.pdf

[14] WWF-Cannon. 2010. Heart of Borneo: My Home, My Island, My Future. British High Commission Brunei Darussalam, CfBT, WWF, and International School Brunei accessed on 1 August 2010 at http://heartofborneo.cfbt.org/bn/Heartofborneo/images/hobpamsec.pdf

[15] Rautner, Mario, Martin Hardiono, and Raymond J. Alfred. 2005. Borneo: Treasure Island at Risk. Status of Forest, Wildlife and related Threats on the Island of Borneo. WWF Germany, Frankfurt am Main, June 2005 accessed on 17 March 2010 at http://www.worldwildlife.org/what/wherewework/borneo/WWFBinaryitem7589.pdf

[16] Pio, Dorethea. 2005. opcit.

[17] Pio, Dorethea. 2005.

[18] Pio, Dorethea. 2005.

[19] Pio, Dorethea. 2005.

[20] Rautner, Mario, et. al .2005. opcit

[21] DeVantier, Lyndon, Angel Alcala and Clive Wilkinson. 2004. The Sulu Sulawesi Sea: Environmental and Socioeconomic Status, Future Prognosis and Ameliorative Policy Options. Ambio Vol. 33 No. 1–2, Feb. 2004

[22] DeVantier et al. 2004. ibid.

[23] Sulu Sulawesi Seascape Website accessed on 23 March 2010 at http://www.conservation.org.ph/sss

[24] Sulu Sulawesi Seascape Website, ibid.

[25] Mangroves for the Future Website accessed on 17 March 2010 at http://www.mangrovesforthefuture.org

[26] ASEAN. 2000. Draft ASEAN Framework Agreement on Access to Biological and Genetic Resources, accessed on 17 April 2009 at <http://www.grain.org/brl/?docid=785&lawid=1261>

[27] Koh, K.L. 2007. ASEAN Environmental Protection in Natural Resources and Sustainable Development: Convergence and Divergence? in Macquarie Journal of International and Comparative Environmental Law, 4:43–70.

[28] Koh, K.L. 2007. ASEAN Environmental Protection in Natural Resources and Sustainable Development: Convergence and Divergence? in Macquarie Journal of International and Comparative Environmental Law, 4:43–70.

[29] ASEAN. 2000. Draft ASEAN Framework Agreement on Access to Biological and Genetic Resources, accessed on 17 April 2009 at <http://www.grain.org/brl/?docid=785&lawid=1261>

[30] Koh, K.L. 2007. ASEAN Environmental Protection in Natural Resources and Sustainable Development: Convergence and Divergence? in Macquarie Journal of International and Comparative Environmental Law, 4:43–70.

[31] De Klemm C., A. Jr. Tolentino, F. Burhenne-Guilmin F., R. Tarasofsky, L Glowka and D. Craig. 2002. Conserving Biological Diversity: The Legal and Institutional Issues, Biodiversity Conservation in the Asia and Pacific Region – Constraints and Opportunities. Page 667 in D. Craig, N. Robinson and K. K. Lian (eds), ADB Capacity Building for Environmental Law in the Asian and Pacific Region: Approaches and Resources. ADB, Manila.

[32] Government of the Philippines. 1995. Prescribing Guidelines and Establishing a Regulatory Framework for the Prospecting of Biological and Genetic Resources, They're By-product and Derivatives, for Scientific and Commercial Purposes; and for other purposes (EO 247).

[33] Government of the Philippines. 2001. Wildlife Resources Conservation and Protection Act Section 5(a).

[34] Kurukulasuriya L., and A. Robinson. 2006. UNEP International Environmental Law Manual 343.

[35] Government of the Philippines. 1997. Indigenous Peoples Rights Act (RA 8371) Section 34.

[36] Craig D., N. Robinson, and K. K. Lian (eds). 2002. ADB Capacity Building for Environmental Law in the Asian and Pacific Region: Approaches and Resources 665 – 666.

[37] Kurukulasuriya L., and A. Robinson. 2006. UNEP International Environmental Law Manual 187.

[38] La Vina A.G.M. 2002. Intellectual Property Rights and Indigenous Knowledge of Biodiversity in Asia. Page 681 in Donna Craig, Nicholas Robinson & Koh Kheng Lian (eds) ADB Capacity Building for Environmental Law in the Asian and Pacific Region: Approaches and Resources. ADB, Manila

[39] Hunter D., J. Salzman, and D. Zaelke. 3rd ed, 2007. International Environmental Law and Policy 1045 – 1046.

[40] Assessing Progress towards the 2010 Biodiversity Target: Philippines Fourth National Report to the Convention on Biological Diversity. Manila: Department of Environment and Natural Resources, 2009.

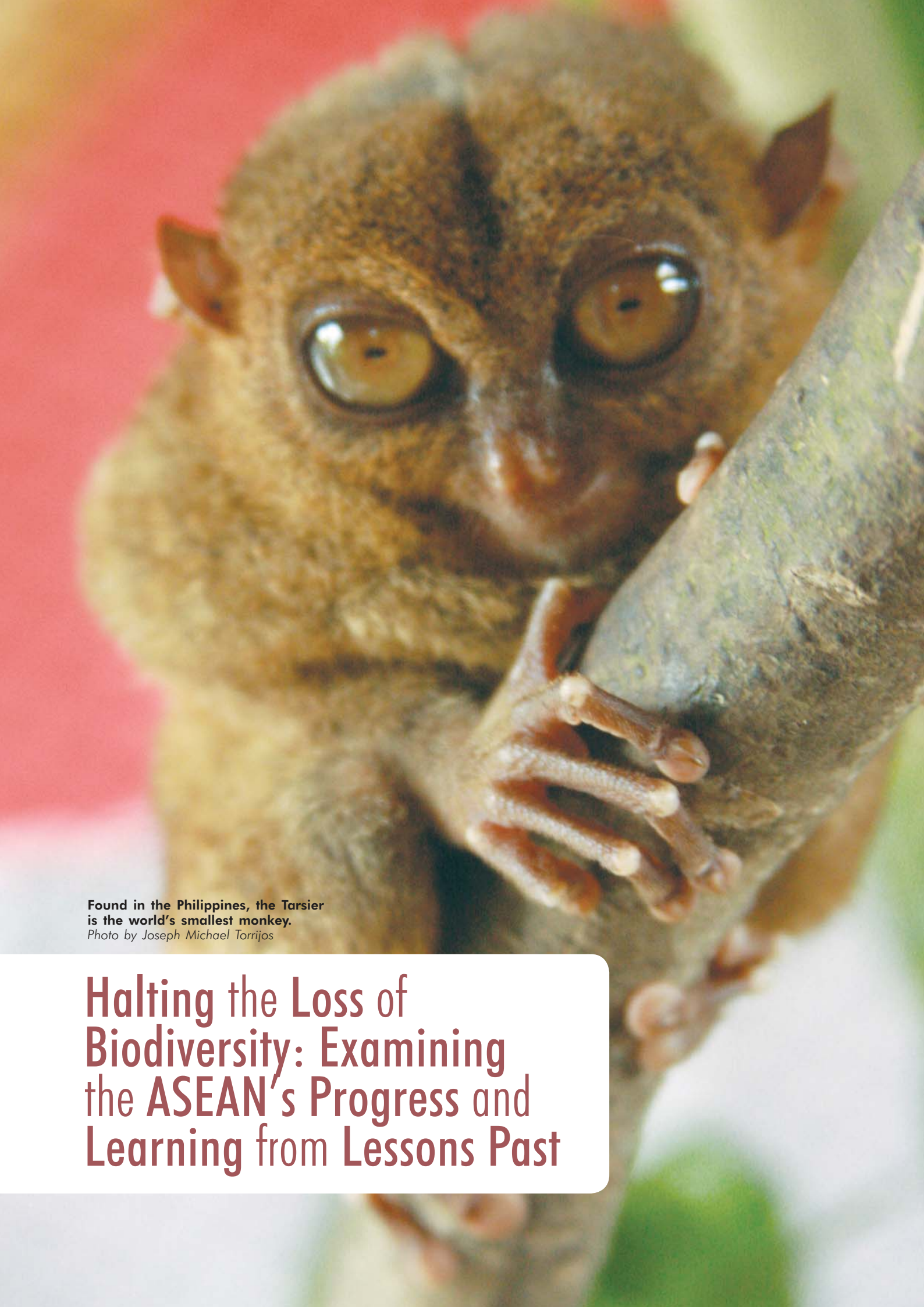
[41] Kurukulasuriya L., and A. Robinson. 2006. UNEP International Environmental Law Manual 207.

[42] Kurukulasuriya L., and A. Robinson. 2006. UNEP International Environmental Law Manual 209.

[43] Parties to the Protocol accessed on 23 December 2010 at http://bch.cbd.int/protocol/parties/

[44] Southeast Asian Regional Center for Graduate Study and Research in Agriculture. 2008. Playing the Same Tune: Harmonizing Biotechnology Regulations Across Southeast Asia accessed on 23 April 2010 at http://www.searca.org/web/e_library/policy_brief_series/pbseries-2008-4-harmonizing-biotechnology-regulations-southeast-asia.pdf

[45] Sodhi, N.S., et al. 2004. Southeast Asian biodiversity in crisis. Trends in Ecology and Evolution. 2004.



Found in the Philippines, the Tarsier is the world's smallest monkey.
Photo by Joseph Michael Torrijos

Halting the Loss of Biodiversity: Examining the ASEAN's Progress and Learning from Lessons Past

THE GBO-3[1] reported an overall failure to meet the 2010 Biodiversity Target. It did recognize, however, the progress achieved in some areas, as well as the challenges and perspectives beyond 2010 which must be pursued further.

In Southeast Asia, progress has been made mainly on conserving the components of biodiversity, particularly in terms of expanding the coverage of terrestrial and marine protected areas. However, in terms of addressing the drivers and threats to biodiversity loss, the ASEAN region remains slow in delivering progress, particularly in preventing invasive alien species, addressing the impact of biodiversity to species and ecosystems, and abating pollution and the exploitation of forests and wetlands.

The recent decade also showed that priorities were accorded by the ASEAN Member States in protecting major ecosystems and habitats through regional initiatives focusing on large, biologically rich and critical ecosystems. Biodiversity corridors covering transboundary protected areas, particularly on conserving the remaining large rainforest areas, have been launched and initiated. How these initiatives have to be sustained in the long term and in order to avert the wide range of threats to biodiversity will, however, require sustained political, technical, financial and stakeholder engagement at all levels. Efforts were also stepped up to further build capacities and expand the network of wildlife law enforcers, but reducing illegal wildlife trade remained a big challenge to the region. Barely have conservation practitioners begun to embrace the ecosystems approach, when the status of threatened species worsened consequent to the unabated degradation of habitats and ecosystems. Tropical species populations, as shown in The Living Planet Index, have declined sharply, parallel to the sharp decline in habitat loss[2].

The impacts of climate change on biodiversity remains to be better understood, and not until recently have some specific indications emerged. Therefore, enhancing the resilience of biodiversity components to adapt to climate change has become a formidable challenge. Similarly, the impacts of pollution has not been assessed and documented extensively; its impact, particularly to the various components of biodiversity and types of ecosystems, warrants further scrutiny.

Sustainable forest management has been in place in many ASEAN Member States. Community-based forest management and forest stewardship programs implemented over the past decade in the region recognize the rights of indigenous communities and migrants to provide greater security for forest-dependent communities. In some countries, agricultural biodiversity management has been integrated in agricultural economic development strategies and environmental impact assessment systems. The fisheries sector in the region continues to be characterized by overfishing and the use of the unsustainable methods of dynamite- and cyanide-fishing. Overfishing has threatened 64 per cent of Southeast Asia's coral reefs, while destructive fishing practices have endangered two-thirds of the reefs of the Philippines, Malaysia, Taiwan, and half of Indonesia's.

Actions in further developing regional and national policy frameworks on access to genetic resources and the sharing of benefits arising out of its utilization have been hampered by the impending conclusion of the finalization and agreement on the International Regime on ABS. With the adoption of the Nagoya Protocol on ABS at COP10 in October 2010, further capacity and policy actions at the national and regional levels are expected. A number of global and regional consultations and some capacity building activities were undertaken, but national efforts to sensitize stakeholders, particularly local communities and indigenous peoples, on the various aspects of access and benefit sharing are still wanting. Although the region has made some headway in developing the ASEAN Framework Agreement on ABS, this has been endorsed by only a few countries so far.

The ASEAN region, and many parts of the world, as reported in the GBO3, fell short of achieving the 2010 Biodiversity Target following the agreed upon set of indicators based on the CBD Framework. Table 32 provides a summary of where the ASEAN region fares in achieving the 2010 biodiversity target.

Table 32. Status of progress in achieving the 2010 biodiversity target in the ASEAN region

Goal 1. Promote the conservation of the biological diversity of ecosystems, habitats and biomes		
	**1.1:** At least 10% of each of the world's ecological regions effectively conserved	Up to 12.6% of the ASEAN region's terrestrial land has been designated as protected areas. Six ASEAN Member States have exceeded the 10% target; of the six, Brunei Darussalam, Cambodia and Thailand have set aside more than one fifth of their total land area for protection and conservation. However, efforts need to be directed in improving management effectiveness. Focus should also be made in establishing more marine protected areas given that the region has vast marine and coastal-based resources.
	**1.2:** Areas of particular importance to biodiversity protected	Key ecosystems in the ASEAN region were accorded priority conservation status (e.g., Heart of Borneo, Coral Triangle, Greater Mekong Subregion, Sulu Sulawesi and the ASEAN Heritage Parks). There is a need to expand the planning of key biodiversity areas, which could enhance the protection of areas that are known to have populations of wild and endemic plant and animal species.
Goal 2. Promote the conservation of species diversity		
	**2.1:** The decline of populations of species of selected taxonomic groups restored, maintained or reduced	Partial efforts have been undertaken but not sufficient to significantly avert the decline in population of some selected species under protection. Initiatives are continuously pursued with the end view of sustaining efforts and also expanding it to include other targeted species.
	**2.2:** Status of threatened species improved	Current efforts are not adequate to avert the possible extinction of threatened species. While the further decline of a number of protected and threatened species have been arrested in some countries, the challenges of sustaining the initiatives remain very high. Ecosystem degradation as a result of deforestation and conversion of mangroves and wetlands in many parts of the region will aggravate the current situation further.
Goal 3. Promote the conservation of genetic diversity		
	**3.1:** Genetic diversity of crops, livestock, and of harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained	Not much effort has been undertaken in the region in protecting the genetic diversity of crops, livestock, trees, fish and wildlife. Although some ex-situ initiatives have been started, most have been small projects and not taken on a programmatic basis. Initiatives to record indigenous and local knowledge on the conservation of genetic diversity have been started in a few ASEAN Member States.
Goal 4. Promote sustainable use and consumption		
	**4.1:** Biodiversity-based products derived from sources sustainably managed, and production areas managed consistent with the conservation of biodiversity	For a number of countries, certification systems for forest and fishery products have been applied. However, this approach is not widespread in the region and efforts further need to be launched to promote and connect sustainable consumption and production patterns with the conservation of biodiversity resources. Mainstreaming biodiversity into national development plans and sectoral plans has been slow.
	**4.2:** Unsustainable consumption of biological resources, or consumption that has an impact upon biodiversity, reduced	Regional efforts to address this are quite slow.
	**4.3:** No species of wild flora or fauna endangered by international trade	Significant efforts are being pursued, recognizing that illicit wildlife trade is a major problem among many countries. Many ASEAN Member States are signatories to CITES and are committed to curbing the illegal trade of wildlife. Capacity building activities on wildlife enforcement have been pursued among the ASEAN Member States to combat illegal wildlife trade.

Goal 5. Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced		
	**5.1:** Rate of loss and degradation of natural habitats decreased	Significant efforts are being undertaken in the region, but the challenge of halting the rate of loss and degradation of natural habitats remains formidable. Although significant progress has been attained in certain ecosystems (i.e., forest) in some countries, overall, the region faces serious problems in reducing the rate of habitat loss.
Goal 6. Control threats from invasive alien species		
	**6.1:** Pathways for major potential alien invasive species controlled	Efforts to address this matter are in its nascent stages.
	**6.2:** Management plans in place for major alien species that threaten habitats, ecosystems or species in place	Efforts to address this matter are in their early stages. Management plans for a few economically threatening invasive species were initiated to prevent further assaults on the environment.
Goal 7. Address challenges to biodiversity from climate change, and pollution		
	**7.1:** Resilience of the components of biodiversity to adapt to climate change maintained and enhanced	Countries are fully aware of the need to adapt to climate change. Most ASEAN Member States have already initiated programs that would address this issue, including activities that will enhance the resilience of ecosystems to the possible impact of climate.
	**7.2:** Pollution and its impacts on biodiversity reduced	Pollution reduction has been one of the cornerstone activities for environmental management in all ASEAN Member States. However, linking pollution reduction with biodiversity conservation was recognized only recently. Efforts are underway in many countries to explore this connection.
Goal 8. Maintain capacity of ecosystems to deliver goods and services and support livelihoods		
	**8.1:** Capacity of ecosystems to deliver goods and services maintained	The notion of ecosystem services is now being recognized in the region. While it is clear that the pressure on many of the critical ecosystems that provide public good to society is escalating, there are efforts to ensure that these services are continuously provided and maintained.
	**8.2:** Biological resources that support sustainable livelihoods, local food security and health care, especially of poor people maintained	The ASEAN Member States acknowledge that many communities, particularly the marginalized sectors and the poor, rely heavily on biological resources for their well-being. As such, many programs have been developed to respond to these issues. While a number of countries face challenges in sustaining its initiatives, programs now build in designs to ensure that communities would have the capacity to continue relying on these resources, through more sustainable means.
Goal 9. Maintain socio-cultural diversity of indigenous and local communities		
	**9.1:** Traditional knowledge, innovations and practices protected	Given the cultural diversity of the region, many ASEAN Member States are taking actions to protect their traditional knowledge and practices. For most of the countries, the protection of traditional knowledge is a major source of income (i.e., ecotourism and cultural tourism).
	**9.2:** The rights of indigenous and local communities pertaining to their traditional knowledge, innovations and practices, including their rights to benefit sharing, viably protected	Most ASEAN Member States have specific laws and activities that recognize the rights of indigenous and local communities, including their culture and way of life. Initiatives are underway to develop processes that include indigenous communities in the negotiation of their rights for the benefits derived from biological resources and ecosystems services in their areas.

Continued next page

Goal 10. Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources		
	**10.1:** All transfers of genetic resources in line with the Convention on Biological Diversity, the International Treaty on Plant Genetic Resources for Food and Agriculture, and other applicable agreements	Some countries have clear laws regarding the transfer of genetic materials which conform to the Bonn Guidelines. Others are starting to develop their respective regulations and/or are awaiting developments on the ABS regime. For international organizations operating in the region, e.g., the International Rice Research Institute, these agreements are closely being adhered to. For transactions that are commercial in nature, these are subject to existing laws and agreements of the host country.
	**10.2:** Benefits arising from the commercial and other utilization of genetic resources shared with the countries providing such resources	
Goal 11. Parties have improved financial, human, scientific, technical and technological capacity to implement the Convention		
	**11.1:** New and additional financial resources transferred to developing country Parties to allow for the effective implementation of their commitments under the Convention, in accordance with Article 20.	Many countries in the region, particularly the developing countries, have been recipients of numerous ODAs aimed to improve their capacity to meet their commitments to the CBD and other biodiversity-related conventions. Although it is acknowledged that resources are not sufficient, it is significant enough to start a number of critical activities supporting biodiversity conservation.
	**11.2:** Technology transferred to developing country Parties to allow for the effective implementation of their commitments under the Convention, in accordance with its Article 20, paragraph 4	Access to technology continues to be a key challenge for many ASEAN Member States. Although some countries have been able to access particular technologies, additional effort is needed to expand the access of developing countries to technologies that would significantly support their efforts in conserving biodiversity resources in the region.

 Condition partially complied or initiative has just been undertaken.

 Condition significantly complied with corresponding significant progress.

 Condition fully complied and progress is significant.

 Condition not complied.

Learning from Lessons Past: The ASEAN experience

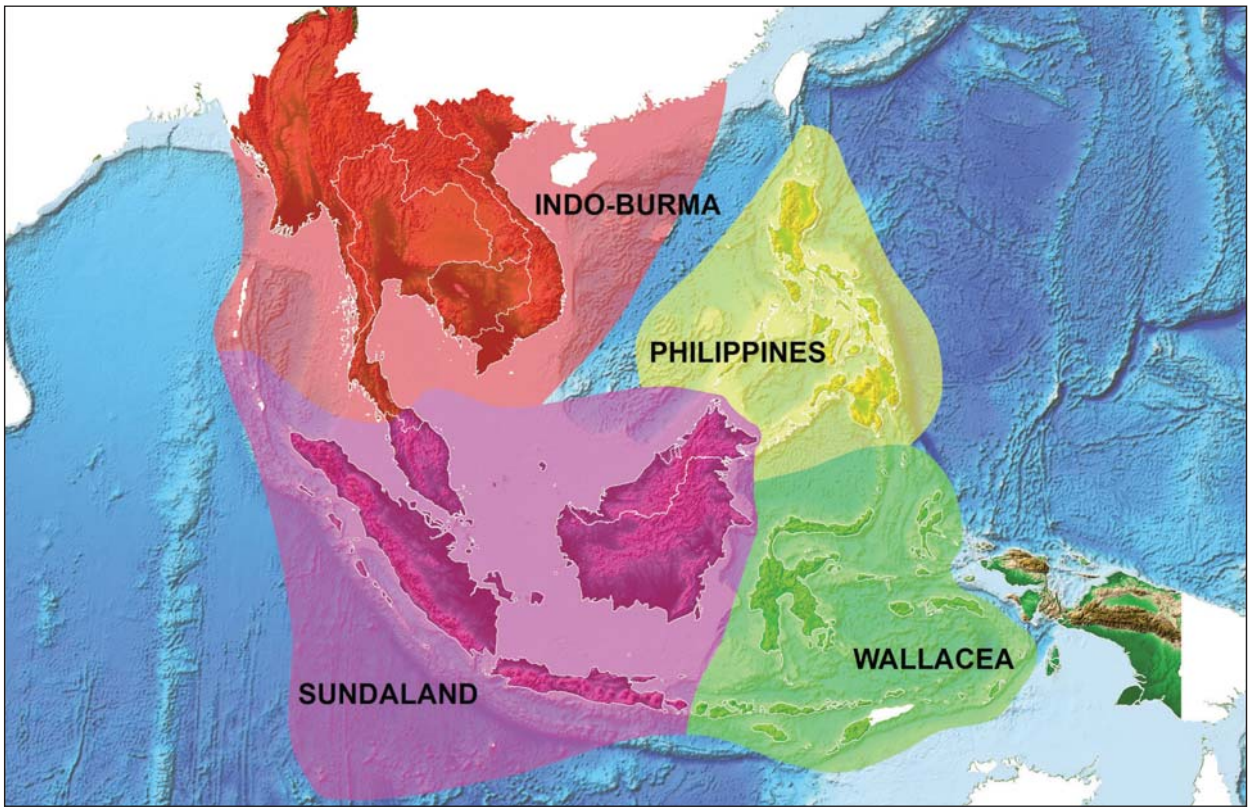
To halt biodiversity loss would require a re-visiting of lessons and experiences which could help the global community move forward in collectively achieving the new Biodiversity Target. Chapter 2 and the summary of progress presented in Table 33 above clearly illustrate the continuing trend in biodiversity loss and ecosystems degradation. While progress was recorded in some areas, *e.g.*, through regional and national responses to address threats, further collective action is needed at the global, regional and national fronts, both in policy and practical terms.

The Millennium Ecosystem Assessment, the study on The Economics of Ecosystems and Biodiversity, the third edition of the Global Biodiversity Outlook, and the regional assessment presented in this report, all convey the grave concern on the impacts of biodiversity loss to human well-being. Advances made in some areas should provide further impetus and inspiration for the global and local communities to continue to launch unprecedented efforts and achieve real progress. The following section provides an analysis of key lessons and actions based on the triumphs and failures in the region.

Sustaining Current Efforts on Ecosystems Approach to Biodiversity Conservation: Capitalizing on political support to large regional programs

The momentum gained at the political level through the major regional programs in the Heart of Borneo, Sulu Sulawesi, and the Greater Mekong Subregion provided impetus for a continuing agenda focused on these large ecosystems. The ecosystems approach must be applied systematically to these regional programs and expanded to cover key ecosystems to achieve the integrated management of natural resources inasmuch as, notably, the region has four of the world's 34 biodiversity hotspots.

Figure 30. Southeast Asia's biodiversity hotspots: Indo-Burma, the Philippines, Sundaland, and Wallacea



Compiled and digitized from Conservation International's online maps found in http://www.biodiversityhotspots.org/xp/hotspots/Pages/default.aspx
Subpages:
Indo-Burma: http://www.biodiversityhotspots.org/xp/hotspots/indo_burma/Pages/default.aspx
Sundaland: http://www.biodiversityhotspots.org/xp/hotspots/sundaland/Pages/default.aspx
Philippines: http://www.biodiversityhotspots.org/xp/hotspots/philippines/Pages/default.aspx
Wallacea: http://www.biodiversityhotspots.org/xp/hotspots/wallacea/Pages/default.aspx

Taking Pride on the Natural and Cultural Heritage of the ASEAN Member States: Sustaining the ASEAN Heritage Parks Programme

The ASEAN Heritage Parks Programme demonstrates the unique mechanism whereby governments at the regional level, through the intergovernmental network, could establish and maintain regional representative systems of protected areas. There is clearly a need to provide the ASEAN Heritage Parks (AHPs) with continued support so that countries can demonstrate that they can effectively manage the parks. This could encourage more partners to support on-the-ground projects that will benefit the parks directly.

The 3rd ASEAN Heritage Parks Conference held in June 2010 in Brunei Darussalam reiterated the need to support the network of AHP managers by developing an information portal for AHPs; linking up with global sites and databases through the ASEAN Biodiversity Information Sharing Service; enhancing information displays in the AHP visitor centers of all 28 AHPs; and distributing information materials about other AHPs.

These efforts will contribute in strengthening AHP management and the attainment of a strong network of parks in the ASEAN region. Table 33 shows on-the-ground priorities as agreed during the conference.

Table 33. On-the-ground priority activities in ASEAN Heritage Parks by year (2011-2013)

Country	Activities	Year		
		2011	2012	2013
Brunei Darussalam	Upgrade existing interpretation material	X		
	Train in park management/park ranger	X	X	
	Collaborate with local university on biodiversity survey for baseline data		X	X
	Conduct studies of Lepidoptera (Faunal Study)		X	X
	Expand accommodation facilities		X	
	Conduct education awareness/outreach programs (media, schools)			
Cambodia	Develop capacity of PA staff for the effective management of AHPs	X	X	X
	Provide environmental education and awareness for communities	X	X	X
	Establish an appropriate management plan for AHPs	X	X	X
	Provide a community agriculture project to increase local communities' income and change attitudes in the wasteful use of natural resources	X	X	X
	Promote AHP ecotourism	X	X	X
	Develop a research program for AHP management and biodiversity conservation	X	X	X
	Manage natural resources used by local communities in AHPs	X	X	X
	Assess threats in AHPs for further development of management and intervention	X	X	X
	Allocate sustainable financing mechanisms in AHPs	X	X	X
	Develop action plan for endemic and endangered species in AHPs	X	X	X
Indonesia	Enhance capacity of PA officials, staff and stakeholders towards effective management of AHPs		X	X
	Raise awareness on the value of AHPs	X	X	X
	Promote ecotourism at AHPs	X	X	X
	Hold a national workshop/ coordination meeting on AHPs	X	X	X
	Develop and disseminate information materials on the value of AHPs	X	X	X

Table 33. On-the-ground priority activities in ASEAN Heritage Parks by year (2011-2013) (continuation)

Country	Activities	Year		
		2011	2012	2013
The Lao PDR	Develop and implement strategy and action plan for AHPs and national protected area management plan	X	X	
	Build capacity of PA officials, staff and concerned stakeholders	X	X	X
	Implement sustainable financing mechanism approach		X	X
	Raise public educational and environmental awareness	X	X	X
	Encourage local communities' participation in PA management and biodiversity conservation	X	X	X
	Implement AHP management response to climate change	X	X	X
	Develop ecotourism	X	X	X
	Implement payment for ecosystem services and benefit sharing		X	X
Malaysia	Enforce patrolling	X	X	X
	Conduct workshop on sustainable financing program	X		
	Train park managers and staff	X	X	X
	Hold national conference on AHP	X		
	Monitor wildlife			X
	Conduct training course for nature guides			X
Singapore	Establish the AHP website and other communications media	X		
	Resolve wildlife-human conflict	X	X	X
	Promote the tourism package for AHPs (AHP Corner)	X		
	Train personnel (in cooperation with ACB)	X	X	X
Thailand	Establish the AHP website and other communications media	X		
	Compile baseline data – key species of plant and wildlife	X	X	X
	Restore habitat / resolve wildlife-human conflict	X	X	X
	Promote tourism package of AHPs			X
	AHP Corner and AHP membership card – Promote privileges of the cardholder – Develop the AHP Corners in all AHP sites (personnel and other services should be provided by the ACB or the ASEAN Secretariat)		X	
	Develop capacity of personnel (in cooperation with ACB)	X	X	X
	Conduct competition on AHP management			X
	Create Transboundary PAs		X	X
	Develop the tourism management of marine parks		X	
	Implement a wildlife exchange program (to restore some endangered species)			X
Viet Nam	Set up a new management plan for AHPs	X		
	Build capacity of MB staff and managers in biodiversity conservation	X	X	X
	Promote ecotourism and environmental education	X	X	X
	Strengthen community participation in biodiversity conservation activities	X	X	X
	Develop and implement action plan for endangered and key species	X	X	X
	Promote information network with other AHPs in Viet Nam and other ASEAN countries	X	X	X

Source: Report of the Third ASEAN Heritage Parks Conference held on 23-25 June 2010 in Brunei Darussalam. ASEAN Centre for Biodiversity.

Preaching to the Unconverted: Engaging a greater number of biodiversity stakeholders in conservation initiatives and mainstreaming biodiversity into sectoral development plans

One of the key challenges in halting biodiversity loss is the involvement of the larger stakeholder base beyond environment and conservation practitioners. Awareness campaigns must also target not only the general public, but also those outside of the environment sector, primarily the economic development sectors.

Biodiversity ought to be mainstreamed outside of the environment domain into all relevant and sectoral policies and plans. As the economic sector begins to embrace biodiversity and adopt sustainable strategies, direct impact on biodiversity is reduced and ecosystems services are enhanced. The implementation of national biodiversity strategies and action plans (NBSAPs) must occur at all sectors and integrate biodiversity into national policies and programs on fisheries, forestry and trade; and into national poverty and development plans, including MDG strategies.

This strategy would also garner support from policy makers to understand the contribution of ecosystems and biodiversity to alleviate poverty and contribute to national economic growth.

Valuing Biodiversity and Ecosystems Services: Translating biodiversity into economic terms

A better understanding of the value of biodiversity can significantly boost political support to effect changes in the way we do things and further mobilize financial resources to address the threats and drivers of biodiversity and ecosystems loss. The Economics of Ecosystems and Biodiversity (TEEB) 2009[3], a landmark document on promoting the value of natural wealth from ecosystems services, must continue to earn recognition and understanding at the highest political level and among the economic sectors. The TEEB highlights the inextricable link between poverty and the loss of ecosystems and biodiversity, and that failing to account for the value of these losses would lead to wrong choices and decisions in addressing sustainable development challenges.

Table 34. The wealth and losses of ecosystems: some facts and figures

Global Figures
Global forest area has shrunk by approximately 40% since 1700. Forests have completely disappeared in 25 countries[a]
Since 1900, the world has lost about 50%of its wetlands[b]
Some 20% of the world's coral reefs have been effectively destroyed by fishing, pollution, disease and coral bleaching. Approximately 24% of the remaining reefs in the world are under imminent risk of collapse through human pressures.[c]
In the past two decades, 35% of mangroves have disappeared. Some countries have lost up to 80% from conversion for aquaculture, overexploitation and storms.[d]
The rate of species extinction is estimated to be 100 to 1,000 times more rapid than the "natural" extinction rate.[d]
The loss of natural areas over the period 2000 to 2050 is 7.5 million km2, broadly equivalent to the total area of Australia.
The value of Illegal, Unreported and Unregulated Fishing (IUU fishing) at the global scale was estimated to be between USD10 to 23.5 billion annually.[e]
Regional and Country Figures
Coral reefs provide genetic resources for medical research, and ornamental fish and pearl culture are extremely important for the economies of some insular states, such as French Polynesia. The reefs protect coastal areas in many islands: this vital service has been estimated to be worth USD55 to 1,100/ hectare/ year in Southeast Asia.[f]
The value of the watershed protection provided by intact coastal ecosystems, such as mangroves and other wetlands, has been estimated at USD845 per hectare/year in Malaysia and USD1,022 per hectare/ year in Hawaii, United States of America. Overall, the values of the multiple watershed services tend to range from USD200 to 1,000 per hectare/year.[g]
Economic valuation of the Leuser Ecosystem in Sumatra, Indonesia benefiting from conservation over a period of 30-year would result to local economy gains of USD5.4 billion.[h]
Philippine losses to poaching by foreign vessels and blast- and cyanide-fishing amounted to Php26.5 billion (approximately USD 0.6 billion) in 2008.[i]

Sources:
[a] FAO. 2001
[b] Ramsar Secretariat
[c] Wilkinson. 2004
[d] Millennium Ecosystem Assessment. 2005
[e] Torell, et al. 2010
[f] Burke et al. 2002
[g] Mullan and Kontoleon. 2008
[h] ARCBC Biodiversity Magazine. June 2002
[i] BFAR. 2008

The wealth of biodiversity in Southeast Asia and its continuing loss must be valued and appreciated in order to effect appropriate policy changes and solutions. The TEEB underscored four key solutions: to halt deforestation and forest degradation; to protect tropical coral reefs; to save and restore global fisheries; and to recognize the deep link between ecosystem degradation and the persistence of rural poverty.

Managing and investing in natural capital, as espoused by the TEEB study, provides a number of opportunities on investments to mitigate and adapt to climate change. Expanding REDD to the REDD-plus instrument could create a revenue stream for national governments to meet emission reduction targets[4]. In Southeast Asia, there is a great potential for raising revenues from REDD in Indonesia and Cambodia. There is, however, a need to undertake major improvements in the institutional capacities of REDD countries for such potential revenues to be realized (Box 13).

Box 13. Reducing Emissions from Deforestation and Forest Degradation

THE FOREST is home to nearly 90 per cent of the world's biodiversity (World Bank 2004)[5]. Local communities depend on forests as a source of fuel, food, medicines and shelter. It directly supports the livelihoods of 90 per cent of the 1.2 billion people living in extreme poverty (World Bank 2004). Forests also provide essential ecosystem services such as watershed protection, water flow regulation, nutrient cycling, rainfall generation and disease regulation (Global Canopy Foundation 2009)[6]. Old growth forest absorbs carbon dioxide from the atmosphere, offsetting man-made emissions.

Previous approaches to reduce emissions have been unsuccessful. A new framework, Reducing Emissions from Deforestation and Forest Degradation (REDD), was conceptualized with the basic idea being that "countries that are willing and able to reduce emissions from deforestation should be financially compensated for doing so[7]".

REDD is primarily about emission reductions. The UNFCCC (2007) COP13 reports that to mitigate climate change, REDD should include the following: policy approaches and positive incentives on issues relating to the reduction of emissions from deforestation and forest degradation in developing countries; and the role of conservation, the sustainable management of forests, and enhancement of forest carbon stocks in developing countries.

More recently, the "+" in REDD+ has attracted increasing attention towards activities related to the conservation and enhancement of carbon stocks. This could address climate change and rural poverty while conserving biodiversity and sustaining vital ecosystem services.

During the ASEAN Conference on Biodiversity in October 2009, it was acknowledged that deforestation leads to loss of species, as well as the increase of greenhouse gas emissions to the atmosphere. The conference participants generally agreed to pursue REDD as a key strategy to climate change adaptation and mitigation efforts, as well as biodiversity conservation in the region, provided that the approach be applied to all ecosystems and not on terrestrial ecosystems alone; and that it should be focused more towards regional perspectives rather than mainly at the country and local levels. Numerous issues surrounding REDD remain under negotiation. Significant messages that came out of the conference were:

- The definition of "forest" must be reviewed in light of the UNFCCC definition, which considers "plantations" of any tall growing monoculture (e.g. oil palm) as "forest."
- REDD+ has to pursue long-term goals with ambitious targets, that is: to halve the gross deforestation/forest degradation by 2010 and halt it by 2030. Its long-term approach should include all land uses; but for the short- to medium-term: to review and implement the previous agreements on REDD before expanding its scope further.
- REDD mechanisms must begin by having firm agreements at the smallest-scale and most local level before it is elevated to higher ground.
- Communication and public awareness activities on REDD must be enhanced; more involvement and participation from key stakeholders, including indigenous peoples and the business sector, must be encouraged on climate change and other environmental agenda.
- Financing mechanisms and schemes must be studied thoroughly to determine whether to continue under government support or move towards self-financing.
- A general framework is needed – flexible enough to meet the different countries' needs.

Box 14. REDD Initiatives in Southeast Asia: Examples from Cambodia and Viet Nam[8]

Cambodia[9]

The REDD project in the Seima Biodiversity Conservation Area (SBCA) is the second REDD pilot site in Cambodia, but the first one in a conservation area. The area used to be a logging concession prior to the creation of the SBCA in 2002. It is inhabited by the Bunong minority, an indigenous peoples group that is described as having low literacy, small in numbers and of weak political clout. In determining the success of a REDD project, accurate predictions of deforestation rates must be determined. This can provide sound estimates of tons of carbon that can be saved. Furthermore, the REDD management system must be able to provide strong additionality, and law enforcement activities and community incentives for forest protection must be included in the strategy. The project officially began in October 2008. The first activities included staff training, actual data collection for carbon stock surveys, and baseline analysis to record and project deforestation rates. Fundraising for implementation is ongoing, along with the writing and certification of the Project Design Document. In six to twelve months, the first credits will be ready to be brought to market.

Viet Nam[10]

In Viet Nam, there exists the potential and willingness on the part of government to include REDD as part of its strategy on climate change response. A national framework has been developed, particularly in linking it with the existing policy on PES. Start-up activities include partnering with international donor agencies in reviewing REDD methodologies and setting up national institutional mechanisms. Capacity building activities are being undertaken, from technical workshops to public awareness-raising and the establishment of public-private partnerships. Prospects are bright for REDD to be established in the country. However, there are a number of challenges and constraints that need to be overcome in order to meet Viet Nam's REDD targets. In terms of implementation issues, for instance, purchases are made at the global level, making monitoring much harder and more complex. There are also issues on co-benefits, how to put proper systems in place to allow the proper assessment of benefits, and where carbon sequestration efforts can be undertaken to optimize co-benefits within the country. Agencies primarily responsible for REDD have to be established. There is also the need to establish governance mechanisms that will allow proper measurement and the equitable transfer of payments from the buyers to all stakeholders. REDD activities may lead to losses or costs in other conservation programs or areas, thus resulting in leakage. One way to avoid this is to establish a national accounting system to take all benefits and costs into account. Viet Nam is interested in cooperating with its neighbors to start work on an international accounting system in order to avoid leakage at the international level.

Dwelling Sustainably in Expanded Cities

The cities of the world cover two per cent of land space worldwide. Cities are responsible for most of the consumption of the world's resources. As of 2007, more than half of the global population lived in cities, posing threats to biodiversity in the form of development, pollution, and competing land use[11].

City dwellers can bring about significant impacts in reversing the trends of environmental degradation by improving their lifestyle and consumption patterns. Likewise, the spaces within cities can be improved – and local and regional authorities play a big role in managing cities and connecting it to surrounding ecosystems.

In collaboration with the CBD Secretariat, Singapore is developing a grading system to measure how cities worldwide are conserving their plant and animal species (Box 15). The City Biodiversity Index aims to promote biodiversity conservation among cities globally. The index will help chart how cities manage their range of flora and fauna.

Medenilla *Photo by Rhia Galsim*

Box 15. Singapore Index on Cities' Biodiversity[12]

ACCORDING to the United Nations, the world urban population is expected to increase dramatically from 3.3 billion in 2007 to 6.4 billion in 2050. The population growth, the UN report states, will be absorbed by the urban areas of less developed regions[13]. With the rising urbanization, human activities are expected to exert an even greater pressure on countries' biological resources. Thus, the city dwellers' role in promoting biodiversity conservation strategies is seen as a crucial component of global conservation efforts. Seeing the need for an effective methodology to benchmark the biodiversity stewardship of cities, Mr. Mah Bow Tan, Singapore's Minister for National Development, proposed to develop a "City Biodiversity Index" (CBI) as an evaluation tool during the Ninth Meeting of the Conference of the Parties to the Convention on Biological Diversity (COP9) in Bonn, Germany in 2008. The index is a grading system designed to monitor and measure biodiversity conservation efforts in cities.

A year later, in 2009, the National Parks Board (NParks) of Singapore, the Secretariat of the Convention on Biological Diversity (SCBD) and the Global Partnership on Cities and Biodiversity (GPCB) hosted the first experts' workshop on the development of the City Biodiversity Index in Singapore. The workshop sought to assist national governments and local authorities in benchmarking biodiversity conservation efforts in the urban context, and help evaluate progress in reducing the rate of biodiversity loss in urban ecosystems. The experts who participated in the workshop agreed on three components for the index: (1) native biodiversity in the city, (2) ecosystem services provided by native biodiversity in the city, and (3) governance and management of native biodiversity in the city.

In recognition of Singapore's innovative contribution, the SCBD named the index "The Singapore Index on Cities' Biodiversity" (CBI). At the second expert workshop in July 2010, the participants refined and improved the indicators of the CBI based on the essence of the components that was agreed upon during the first workshop. They also reviewed the draft User's Manual for the CBI. The manual, prepared by a Technical Task Force, is posted on the website of the CBD: http://www.cbd.int/doc/groups/cities/cities-draft-user-manual-singapore-index-2009-07-01-en.pdf)[14]. It includes a reporting format with templates in biodiversity profile, methodology and scoring system.

The indicators of the CBI are:

Indicator 1	Proportion of natural areas in city
Indicator 2	Connectivity measures or ecological networks to counter fragmentation
Indicator 3	Native biodiversity in built-up areas (bird species)
Indicators 4 to 8	Change in number of native species
Indicator 9	Proportion of protected natural areas
Indicator 10	Proportion of invasive alien species (as opposed to native species)
Indicator 11	Regulation of quantity of water
Indicator 12	Climate regulation: carbon storage and the cooling effect of vegetation
Indicators 13 to 14	Recreational and educational services
Indicator 15	Budget allocated to biodiversity
Indicator 16	Number of biodiversity projects implemented by the city annually
Indicator 17	Rules, regulations and policy – existence of a local biodiversity strategy and action plan
Indicators 18 to 19	Institutional capacity
Indicators 20 to 21	Participation and partnership
Indicators 22 to 23	Education and awareness

On 27-29 April 2010, twenty local government representatives from 17 cities in the Association of Southeast Asian Nations (ASEAN) region gathered in Singapore for a workshop on the Singapore Index on Cities' Biodiversity. Organized by the ASEAN Centre for Biodiversity and the National Parks Board (NParks), the three-day workshop sought to facilitate the test-bedding of the Singapore Index among ASEAN cities. Local government representatives from Indonesia, Cambodia, The Lao PDR, Malaysia, Philippines, Thailand and Viet Nam, were introduced to the index and how it could be a self-assessment tool to monitor and measure biodiversity conservation efforts in their cities.

As of September 2010, 15 cities – Bandung (Indonesia), Bangkok (Thailand), Brussels (Belgium), Chiang Mai (Thailand), Curitiba (Brazil), Edmonton (Canada), Frankfurt (Germany), Krabi (Thailand), London (United Kingdom), Montpellier (France), Nagoya (Japan), Phuket (Thailand), Singapore, Tallinn (Estonia) and Waitakere (New Zealand) – have test-bedded the CBI. Their experiences helped greatly in improving the indicators of the CBI.

Twenty other cities are in varying stages of test-bedding, among them are Phnom Penh and Siem Reap in Cambodia, Padang and Pekanbaru in Indonesia; Vientiane and Xayaboury in The Lao PDR; Kuantan and Sibu in Malaysia; Iloilo City, Puerto Princesa City and Quezon City in the Philippines; and Danang and Hanoi in Viet Nam. The CBI has been incorporated into the draft Plan of Action on Cities, Local Authorities and Sub-national Governments for Biodiversity (2011-2020), which will be tabled for endorsement by the Parties at COP10. The User's Manual for the City Biodiversity Index can be found at: http://www.cbd.int/doc/groups/cities/cities-draft-user-manual-singapore-index-2009-07-01-en.pdf).

A hunter prepares for a feast consisting of birds shot in a rice field adjacent to the Philippines' Laguna Lake. Some of the birds end up being sold as exotic fare to motorists along the national highway. *Photo by Al Benavente*

Access and Benefit Sharing: Learning from global negotiations

The ASEAN Member States' common interest to realize the value of biological and genetic resources is reflected in the ASEAN Framework Agreement on Access to Biological and Genetic Resources.

A few countries in the ASEAN have developed their national ABS policies. The Philippines has developed an ABS national policy which prescribes guidelines and procedures for the prospecting of biological and genetic resources (discussed more extensively in Chapter IV). Singapore, on the other hand, issues research permits in compliance with the Bonn Guidelines and enters into contractual agreements on benefit sharing[15].

In Malaysia, the National Policy on Biological Diversity (1998)[16] and the National Policy on Biotechnology (2005)[17] have identified the sustainable utilization of biodiversity as a new source for wealth creation and social well-being. One of the ways to accrue benefits from the use of biological diversity through biotechnology, among others, is by putting an access and benefit sharing framework in place. Two states in Malaysia, Sarawak and Sabah, have laws on ABS. Box 16 describes the Sarawak's ABS Framework, which aims to avoid the misappropriation of traditional knowledge and the claim of intellectual property over these biodiversity resources[18].

With the conclusion of the ABS Protocol at COP10 in Nagoya, it is hoped that progress will continue in developing national policies to address ABS issues. The region and other countries of the world, however, may benefit from what has been put in place in some states. The State Legislative Assembly has passed the Sarawak Biodiversity Centre Ordinance 2003 to conduct intensive biotechnology-based research and development on its biological resources, particularly those that have been initiated by indigenous communities. The policy will also facilitate the documentation of the fast disappearing traditional knowledge of indigenous communities[19].

The experiences of the Philippines and Sarawak could provide guidance to other ASEAN Member States in developing national policies in the context of conflicting resource uses and recognizing the rights of indigenous peoples in

the use of traditional knowledge and sovereign natural resources.

The Business of Biodiversity: Engaging the private sector to invest in ecosystems services

Biodiversity, in providing society and the economy with ecosystem services and benefits, significantly contributes to business and development.

Engaging the business community and the private sector in promoting biodiversity and business initiatives has been one of the emerging key strategies to halt the loss of biodiversity. A number of businesses and private sector groups have engaged in sound corporate social responsibility (CSR) investment to promote and advocate biodiversity conservation and natural resources management. The business sector increasingly understands that biodiversity provides their much-needed raw materials for technology and business opportunities. Business thrives on biodiversity – pharmaceuticals, petroleum, biotechnology or manufacture – all are in one way or another, beneficiaries of the components of biodiversity.

Big companies engaging on CSR investments, such as support to rehabilitation of degraded ecosystems, must be acknowledged and promoted. PTT Thailand has shown an excellent example of how big businesses may support, through innovative means, the global cause to halt biodiversity loss (Box 17).

The TEEB for Business (2010)[21] has reaffirmed that the business opportunity for biodiversity and the natural ecosystems is getting stronger. According to the new TEEB report, just as climate change has stimulated carbon markets and new business models, biodiversity and ecosystems services also offer opportunities for investors and entrepreneurs.

Box 16. Sarawak Case: Protecting Traditional Knowledge and Conserving Biodiversity[20]

SARAWAK, Malaysia is one of the ASEAN region's pillars in developing an institutional framework for the access and benefit sharing of genetic resources. Sarawak is the first state in Malaysia to pass an Access and Benefit Sharing (ABS) Law in 1997. This law was amended in 2003 to establish the Sarawak Biodiversity Council and the Sarawak Biodiversity Centre. By 2004, the Sarawak Biodiversity Regulations have been enacted.

The Sarawak Biodiversity Centre (SBC) is a state statutory body established in 1998 to facilitate the documentation of traditional knowledge, propagate indigenous plants for conservation and public awareness, conduct consciousness-raising on biodiversity-biotechnology, implement research and development programs on bioprospecting, and regulate research of potential commercial viability.

The SBC regulates biodiversity research to determine the potential for medicinal, pharmaceutical, therapeutic, nutritional or agricultural properties. It also regulates ethnobiological research and research on protected resources. A Research Permit System and a Research Agreement are also instruments being employed, applicable to both local and foreign entities and institutions. The Research Permit System covers application and evaluation, while the Research Agreement concerns data transfer and specimen handling at the SBC, report submission, and the sharing of benefits with the SBC/State Government, and with indigenous communities under any particular ethnobiological research.

Under the Access to Genetic Resources, academicians are required a permit for the collection of any biological resource, either for taxonomic or experimental purposes. The Sarawak Forest Department is the issuing authority for the permit, and a copy of the approved permit is extended to the SBC. Meanwhile, for research on biological resources (*i.e.*, medicinal, pharmaceutical or commercial, as defined in the Sarawak Biodiversity Regulations of 2004), a research agreement from the Sarawak Biodiversity Council must be obtained. Moreover, an expert's permit is also required if a particular research will be conducted outside of Sarawak.

Compensation must also be given to the indigenous community if traditional knowledge was used. In relation to the benefit sharing of traditional knowledge and indigenous and local community rights as provided for in the Sarawak Biodiversity Regulations of 2004 and the SBC Agreement, payment to the locals as reward for knowledge or information must be provided. If the traditional knowledge leads to the development of products (*i.e.*, medicinal, pharmaceutical, health or nutritional), intellectual property rights must be shared with the locals who provided the traditional knowledge, or adequate compensation in monetary value and/or the benefits arising from these must be provided. As for the SBC's Traditional Knowledge and Research and Development Programs, the SBC buys raw materials from indigenous communities (*i.e.*, the owners of traditional knowledge) for research and development. Concomitantly, the indigenous communities are given an opportunity to engage in contract farming for the production of bulk raw materials. The SBC is therefore also responsible for connecting communities with entrepreneurs for product development.

Box 17. Biodiversity conservation in business: Key to success for sustainability[22]

OVER the past three decades, the PTT Public Company Limited (PTT) has been strengthening national energy and economic security in parallel stewardship with the society, community and the environment so that all sectors can prosper in unison in a sustainable manner. PTT believes that its contribution to a sustainable development, i.e., business conduct with commitment to maintain the balance of corporate social responsibility (CSR), corporate governance (CG), and commitment to a high performance organization (HPO), will enable the company, together with other sectors, to sustainably overcome all obstacles. PTT's strategy is committed to developing its CSR operation based on international standards. A framework and approach of activities, as well as related practical standards, have been carefully defined. Biodiversity was chosen into PTT's CSR framework under the theme "Social Investment and Community Development." It covers six important strategies: education, community development, urban environment, spiritual volunteer, network development and biodiversity.

Biodiversity conservation and reforestation

The One Million Rai Reforestation Project in honor of the King of Thailand on the occasion of the 50th Anniversary of his accession to the throne in 1994 has become a well-known project that makes PTT a major volunteer on biodiversity conservation. The company has planted one million Rai (360,000 acres; 2.5 Rai is equivalent to 1 acre) in 416 Forest Plantation Targets covering 48 provinces nationwide. The environmental assessment of the reforested area under the project found the outcome impressively remarkable. From 1994 to 2008, the trees absorbed a cumulative volume of 18.17 million tons of carbon dioxide and time released 14.5 million tons of oxygen.

Natural life returns

FPT 29 and 29/3 cover an area of 786 Rai in Pak Nam Pran subdistrict, Pranburi District, Prachuapkhirikhan Province, which used to be an abandoned shrimp farm. After the concession issued by the government had expired, the area was included in the FPT under the One Million Rai Reforestation Project in 1997. Before the tree planting, soil improvement was conducted with guidance from experts.

The newly-planted mangrove trees grew very well. With a large number of new trees, both flora and fauna returned to the area. Upon accomplishment of the project, PTT bestowed the land to the King on 16 November 2001, along with an area of one million Rai forest nationwide.

Today, the once-abandoned shrimp farm has been turned into a lush mangrove area with rich mangrove natural resources and biodiversity. PTT invited Dr. Sanit Aksornkoae, a reputable researcher, and his team to conduct a research from 2004 to 2005. The research showed that various kinds of species that disappeared during the shrimp farm period have returned. Twenty species of flora, 65 species of marine benthos, 15 species of birds and 19 species of fishes were found in the Sirinath Rajini Mangrove Ecosystem Learning Center's area.

Volunteers help plant mangroves *Photo courtesy of Advanced Thailand Geographic*

Sirinath Rajini Mangrove Ecosystem Learning Center

On the occasion of the Queen's 72nd birthday in 2004, PTT constructed a mangrove ecosystem learning center. The Queen bestowed the center with the name "Sirinath Rajini" (which means the Queen with dignified grace and manner, and protection and assistance for her subjects). The center formally opened in August 2006. At the learning center, visitors can discover the story of how the mission was realized. The exhibition showcases a history of revitalization and forest plantation, the benefits from mangrove forests, Pranburi life, and plants and animals found in the area.

Participatory management

A key factor in the project's success was the collaboration with the local community and consideration of public opinion. A public forum was conducted to brainstorm ideas from all stakeholders which showed the need to establish a mangrove ecosystem learning center.

From the past to present and into the future

Approximately 100,000 visitors come to the center every year. PTT joined hands with the International Union for the Conservation of Nature to raise the potential of the Sirinath Rajini Committee in their studies on wastewater management, lifestyle and local wisdom of the Pranburi fishing community, lessons learned from rehabilitating mangroves in an abandoned shrimp farm, solid-waste management to reduce effects to mangrove forests, and the development of biodiversity site-specific management. (www.pttplc.com)

Championing Biodiversity: Communicating and Educating Society at Large

Biodiversity captures media coverage and public awareness and gains the attention of leaderships primarily when driven by unusual and extraordinary events. On a regular basis, sustained and concerted campaigns necessary to contribute significantly to reducing ecosystems and biodiversity loss are sorely lacking. Recognizing the day-to-day efforts of concerned groups and individuals that make a difference requires proactive and systematic methods.

The ASEAN region is not only home to biologically significant species and ecosystems, but also to globally significant and worthy individuals and groups who can champion the cause of conservation. The ASEAN Centre for Biodiversity heralds those little but worthwhile initiatives that civil society organizations, the youth, and regular individuals are able to do to impact on society at large (Box 18).

Box 18. Champions in Their Own Rights: Communicating biodiversity

Brunei Darussalam
Princess Rashidah Young Nature Scientist Award

The Princess Rashidah Young Nature Scientist Award (PRYNSA) provides secondary school students an opportunity to experience close contact with nature. Every year, organizers invite students to submit research proposals that inculcate love for the forest and the natural environment to the young generation. The organizers choose one awardee that best exemplifies youth involvement in conservation.

Indonesia
Sahabat Alam

Sahabat Alam, or "Friends of Nature," is an educational program and action for young people designed specifically to enhance their love for nature and the environment. The activities of Sahabat Alam include planting coral reefs, freeing hawksbill turtles (Eretmochelys imbricata), breeding fish, planting mangroves, promoting ecotourism, cleaning up marine debris, planting native Indonesian plants, freeing native Indonesian birds, conserving butterflies, organizing biodiversity exhibitions and seminars and producing films.

The Lao PDR
Community Outreach and Conservation Awareness Program

The Watershed Management and Protection Authority (WMPA) conducts its Community Outreach and Conservation Awareness Program at the Nakai Nam Theun National Protected Area. The WMPA team discusses with village folks ways to improve conservation methods in the protected area. To make the learning process interactive and informative, games, demonstrations and role playing are employed.

Myanmar
Forestry Journal

The ecologically complex forests of Myanmar (Burma) are rich and diverse in flora and fauna. The government is implementing an information campaign that seeks to encourage citizens to protect the country's vast forest resources. One information material used is the quarterly Forestry Journal that features the various environmental protection activities of the Ministry of Forestry and various biodiversity conservation initiatives that encourage greater community participation.

Philippines
Dalaw-Turo Program

The Dalaw-Turo (Visit-and-Teach) Program in the Philippines is an information, education and communication tool that teaches various stakeholders, particularly upland dwellers, about the need to conserve biodiversity. The program uses street theater, creative workshops, exhibits, games and ecological tours to stimulate creative thought and motivate learners to act on environmental issues.

Singapore
TeamSeagrass

TeamSeagrass is a volunteer-based monitoring program which employs methods established by Seagrass-Watch, a global scientific, non-destructive, seagrass assessment and monitoring program. It is a partnership activity among the National Parks Board (NParks), Seagrass-Watch, Schering-Plough, the Raffles Girls' School, Ria Tan and Siti Maryam Yaakub. Volunteers regularly monitor seagrass sites, gathering data that will help better understand and manage Singapore's seagrass meadows. Through its Outreach and Public Awareness component, TeamSeagrass has managed to increase knowledge and awareness about seagrass habitats and its importance.

Thailand
Sirinath Rajini Mangrove Ecosystem Learning Center

The Sirinath Rajini Mangrove Ecosystem Learning Center was built by the PTT Public Company from a once-abandoned shrimp farm that has been turned into a lush mangrove area. At the learning center, visitors can discover the story of how the area was revitalized. A one-kilometer long natural trail enables visitors and the local community to learn about the importance of mangroves. Visitors learn mangrove management through lectures, study tours, international forums, interactive exhibits and IEC materials.

End Notes

[1] Secretariat of the Convention on Biological Diversity. 2010. Global Biodiversity Outlook 3. Montréal, 94 pages.

[2] Secretariat of the Convention on Biological Diversity. 2010. Global Biodiversity Outlook 3 Montréal, 94 pages.

[3] The Economics of Ecosystems and Biodiversity. 2009.

[4] The Economics of Ecosystems and Biodiversity for Policy Makers. Executive Summary accessed on 30 September 2010 at http://www.teebweb.org/LinkClick.aspx?fileticket=dYhOxrQWffs%3d&tabid=1019&mid=1931

[5] The World Bank. Sustaining Forests: A Development Strategy 2004.

[6] Parker, C. A. Mitchell, M. Trivedi, and N. Mardas.2nd ED. 2009. The Little REDD+ Book. Global Canopy Programme. John Krebs Field Station. Oxford Ox2 8QJ UK.

[7] Scholz, I. and L. Schmidt. 2008. Reducing Emissions from Deforestation and Forest Degradation in Developing Countries: Meeting the Main Challenges Ahead. Deutsches Institut f□r Entwicklingspolitik.

[8] Summary Report, ASEAN Regional Workshop Series on Payments for Ecosystem Services Payment for Environmental Services: Tangible Incentives for Improving Economic Policy, Biodiversity Conservation, and Natural Resource Management Target Performance, 29 June – 01 July 2009, Co-organized by ASEAN Centre for Biodiversity, Asian Development Bank, Asia Regional Biodiversity Conservation Programme - USAID, and UNESCAP.

[9] Carbon credits from avoided deforestation: A pilot project in the Seima Biodiversity Conservation Area, Cambodia. Presentation by Mark Gately, Director, Cambodia Program, Wildlife Conservation Society at PES Workshop, Bangkok, Thailand, July 2009.

[10] Prospects and Challenges in the REDD Implementation: Viet Nam's experience towards REDD readiness and country initiatives by Dr. Pham Manh Cuong of MARD presented by Tim Boyle, UN-REDD Program at PES Workshop, Bangkok, Thailand, July 2009.

[11] ICLEI – Local Governments for Sustainability. 2008.

[12] The Singapore Index on Cities' Biodiversity. Secretariat of the Convention on Biological Diversity. 2009. Accessed on 29 September 2010 at http://www.cbd.int/authorities/gettinginvolved/cbi.shtml. .

[13] The Singapore Index on Cities' Biodiversity - Roadmap. Media Fact Sheet. 2009. National Parks Board, Singapore. Accessed on 28 September 2010 at http://www.news.gov.sg/.../media.../Media%20Factsheet%20on%20Singapore%20Index%20(Dec%2009).doc.

[14] User's Manual for the City Biodiversity Index. 2010. National Parks Board, Singapore.

[15] Fourth National Report to the Convention on Biological Diversity. 2010. Singapore.

[16] National Policy on Biological Diversity of Malaysia accessed on 30 September 2010 at www.arbec.com.my/NBP.pdf

[17] National Policy on Biotechnology of Malaysia accessed on 30 September 2010 at http://www.bic.org.my/?action=localscenario&do=policy

[18] K. Nagulendran, 2009. Paper presented at the ASEAN Conference on Biodiversity, October 2009, Singapore. In Proceedings, ASEAN Conference on Biodiversity, ACB.

[19] Fourth National Report to the Convention on Biological Diversity. 2009. Malaysia.

[20] *Ibid.*

[21] The Economics of Ecosystems and Biodiversity for Policy Makers. Executive Summary accessed on 30 September 2010 at http://www.teebweb.org/LinkClick.aspx?fileticket=ubcryE0OUbw%3d&tabid=1021&language=en-US

[22] Excerpts from paper presented by Prasert Salinla-umpai and *Srisurang Massirikul, PTT Public Company Limited (Thailand) at the ASEAN Conference on Biodiversity, Singapore, October 2009.* In Proceedings of ASEAN Conference on Biodiversity 2009, ASEAN Centre for Biodiversity.

A speedboat cuts through Brunei's jungle waters. Found in the northwest coast of the island of Borneo, Brunei Darussalam is known for its 130-kilometer coastline bordering the South China Sea, which consists of high-profile sandy beaches with a complex estuarine mangrove and mudflat zone in the northeast.
Photo by Rudolf Portillo

The ASEAN Biodiversity Outlook: Beyond 2010 and Its Prospects

A Malayan egg fly pupa. While the ASEAN Biodiversity Outlook confirms the finding that the region failed to meet the global target of significantly reducing biodiversity loss, hope remains. Biodiversity loss can still be prevented if factors driving the loss are addressed now. *Photo by Wong Ah Kim*

THE GBO-3 concludes that the challenges for biodiversity and the accompanying degradation of a broad range of ecosystems services shall remain daunting throughout this century. With the best available information and methodologies for analysis, the prognosis indicate that species extinction above the historic rate, transformation of natural habitats and significant changes in the distribution of species shall continue, unless humans take pro-active and bold actions to avert such crises from taking place. There are reasons to be concerned. Certain indicators show that there are conditions that are nearing threshold levels or tipping points – beyond reversibility and therefore the abilities of human beings to adapt may already be compromised. The implications to human-well being can be profound, affecting not only human societies' way of life, but its very existence as well. No one will be spared from the impacts of biodiversity loss and the degradation of ecosystem services, but the first one who will bear the heaviest burden will be the poor and marginalized whose lives are strongly linked with the environment.

The ASEAN Biodiversity Outlook (ABO) benefited from numerous bodies of work available, particularly, the Millennium Ecosystem Assessment, earlier and recent editions of the Global Biodiversity Outlook, the ASEAN Member States' National Reports to the CBD, the ASEAN State of the Environment Report, and results from studies supported by the ASEAN Centre for Biodiversity in the region. The ABO tried to clearly establish the inextricable connection between biodiversity change and human well-being. The Outlook also acknowledges its shortcomings, underscoring the need for supporting studies and research work within the region that will build a robust knowledge base to better understand the complex dynamics of the biodiversity-climate change-human well-being nexus.

The GBO-3 drew four principal conclusions which will be referenced as the anchor point for placing into context the implications of biodiversity loss and degradation of ecosystems services in the ASEAN region. These conclusions are described below:

- *Continuing biodiversity and habitat loss* – Projections of the impact of global change on biodiversity show continuing and often accelerating species extinctions, loss of natural habitat, and changes in the distribution and abundance of species, species groups and biomes over the 21st century.
- *Varying thresholds with high degrees of uncertainty and predictability* – There are widespread thresholds, amplifying feedbacks and time lagged effects leading to "tipping points", or abrupt shifts in the state of biodiversity and ecosystems. This makes the impacts of global change on biodiversity hard to predict, difficult to control once they begin, and slow, expensive or impossible to reverse once they have occured.
- *Functioning ecosystems services have inextricable connections with abundance and distribution of keystone species* – Degradation of the services provided to human societies by functioning ecosystems are often more closely related to changes in the abundance and distribution of dominant or keystone species, rather than to global extinctions; even moderate biodiversity change globally can result in dispropportionate changes for some groups of species (e.g., top predators) that have a strong influence on ecosystems services.
- *Biodiversity loss and degradation of ecosystems can be prevented by strong actions at all levels* – Biodiversity and ecosystem changes could be prevented, significantly reduced or even reversed (while species extinctions cannot be reversed) if strong action is applied urgently, comprehensively and appropriately, at international, national and local levels. This action must focus on addressing the direct and indirect factors driving biodiversity loss, and must adapt to changing knowledge and conditions.

With key assessments on the state, condition and trends of biodiversity vis-a-vis ecosystems discussed in the earlier chapters, the outlook for the ASEAN region is summarized as follows:

Terrestrial ecosystems

The forest ecosystems of the region shall continue to play the crucial role of providing ecological stability to the ASEAN countries and globally. It likewise remains to be a key natural asset for most of the ASEAN Member States. However, the current pressure point is that vast forest areas are being converted to other land uses. Deforestation and land use conversion to pave way for agricultural crops and biofuels and urban expansion poses the most serious threat for this critical ecosystem. Its implications to biodiversity cannot be understated. Forests are natural habitats for thousands of species of plants and animals. Their ecosystems service functions are far more valuable to the survival of human societies. The degradation and fragmentation of this ecosystem could spell the extinction of many species of plants and animals. As climate change is an imminent issue, the capacity of human societies to adapt to its impact can be limited by the continued degradation of the diverse tropical forests of the region.

Next to forest ecosystems are the agroecosystems. As a landscape, these two ecosystems are patently connected. Their roles and values may differ but the ecosystems functions they provide are very much linked with each other. With increasing demand for food from an expanding population, pressure on agroecosystems is projected to also intensify. The short-term approach to meeting the growing demand is to intensify agriculture and expand more areas for agricultural use. This approach, however, has serious implications to biodiversity. The intensification of agriculture has also narrowed down the genetic diversity of many valuable species of agricultural crops and breeds of livestocks. This will certainly affect the abilities of communities to adapt to the projected impacts of climate change on agroecosystems.

Addressing the pressures on these two ecosystems is critical for a region like the ASEAN. It will involve the taking of multiple measures that should be linked to enhancing the productivity from existing crop and pasture lands, reducing post-harvest losses, sustainable forest management and changing excessive and wasteful consumption.

The countries in Southeast Asia will also need to take steps that would fully account for greenhouse gas emissions with the large-scale conversion of forests and other ecosystems into cropland; avoid the introduction of incentives that would perversely encourage land use changes in favor of biofuel crops in the name of climate change adaptation; expand the use of payments for ecosystems services; and encourage the application of Reducing Emissions from Deforestation and Forest Degradation (REDD) Plus mechanisms.

New approaches to conservation, both inside designated protected areas and beyond their boundaries, will have to be pursued. This could involve the upgrading of institutional capacities for managing national parks, developing landscapes that would act as biodversity corridors, and expanding the connectivity of the ASEAN Heritage Parks comprised of national parks linking up to become a regional network of national parks that is effectively managed.

Inland water ecosystems

Inland water ecosystems in the ASEAN region are considered to be high value areas. These cover wetlands, peatlands and freshwater bodies; areas that are unique ecosystems which provide critical provisioning and regulating functions. Unfortunately, these ecosystem functions are often undervalued, consequently placing the rich biodiversity resources in these areas at imminent risk. Conversion of these areas for urban needs, agriculture use and industrial purpose poses the most serious threat and, unless carefully planned, could alter the ecological balance for many of these areas. The value of these ecosystems to biodiversity and as a critical provider of ecosystems services cannot be overemphasized. Apart from being home to some unique habitats for keystone species, these ecosystems play a critical role in provisioning and regulating freshwater and storing carbon.

As many of these areas are the initial frontiers for conversion for development expansion, there will be an increasing need for an integrated management of the ecosystems. By approaching the development of these areas in such a manner, the potential negative impacts

from competing pressures can be minimized or averted. The requisite for spatial and landscape planning and protected area networks will increase, as there will be recognition of the need to adapt more specifically to the needs of freshwater systems, safeguarding the essential processes in rivers and wetlands, and their interactions with terrestrial and marine ecosystems. Minimizing the impacts on water quality and reducing the risk of eutrophication, through investment in sewage treatment, wetlands protection and restoration, and control of agricultural run-off, will become primary development objectives in the region.

Approaches that will restore disrupted processes such as reconnecting floodplains, managing dams to mimic natural flows and re-opening access to fish habitats blocked by dams, will become key considerations in planning development in many of these areas. The efforts, for instance, in managing the Greater Mekong Area which now are exploring the use of payments for ecosystems services, protecting upstream watershed through the conservation of riparian forests, and mobilizing communities that will ensure continued provisions of those services to users of inland water resources in different parts of a basin, will become common features of conservation and sustainable use of inland freshwater ecosystems. Maintaining the connectivity of habitats within river basins will be increasingly important to provide adaptive mobility for keystone species to respond to adverse changes in the environment. These approaches will become all the more important in the face of climate-proofing these ecosystems from the impending impact of climate change.

Marine and coastal ecosystems

Marine and coastal ecosystems are considered as one of the most valuable natural assets of the ASEAN region. The contribution of these ecosystems to supplying food, functional buffer zones for natural weather disturbances, and providing livelihood for communities and ecotourism are highly valued by many ASEAN Member States. Recognizing their economic and ecological value, these ecosystems are also very vulnerable to anthropogenic pressures. The impacts of climate change can exacerbate the situation, adding stress to these ecosystems. Viewed in this light, there will be a compelling need for the more rational management of the coastal and marine ecosystems in the ASEAN region. The direction that is currently being pursued by many ASEAN Member States for increasing the number of marine protected areas and supporting the Coral Triangle Initiative are actions that are expected to gain momentum. But as a complementary effort to these intiatives, governments in the region need to intensify their drive for the stricter enforcement of existing rules to prevent illegal, unreported and unregulated (IUU) fishing. GBO-3 scenarios suggest that the decline of marine biodiversity could be stopped if fisheries management focuses on rebuilding ecosystems rather than maximizing catch in the short-run. The challenge for the region is how this can be achieved given that many of the fishers are among the poorest of the poor. Similarly, there will be an expanding need for promoting the development of low-impact aquaculture which should contribute to helping meet the rising demand for fish without adding pressure on wild stocks and without converting more mangrove areas.

The reduction of stress on the region's coral systems and making them less vulnerable to the impacts of acidification and climate change will become a primary objective for many countries. Efforts that augur well with the drive to protect coral reefs are initiatives that seek to reduce coastal pollution, rehabilitate coastal ecosystems to increase their resilience from adverse changes in the environment, and target critical habitats for conservation. There will also be an urgency to promulgate policies that allow marshes, mangroves and other coastal ecosystems to persist and even migrate inland to make these ecosystems more resilient to the impact of sea level rise, and thus help protect the vital services they provide.

Reducing biodiversity loss and enhancing the ecosystem services in ASEAN: The way forward

Given the magnitude and extent of the issues surrounding biodiversity management and ensuring that ecosystems services will continue to be provided, ASEAN governments

are committed to maintaining the integrity of their environment. Member states are fully aware of the need to balance the development needs of their constituencies. Taking off from the menu of recommendations cited by the GBO-3, the ways forward for the region are identified as follows:

- *Targeting efforts to critical areas and ecosystems.* Well-targeted policies focusing on critical areas, species and ecosystems services can help to avoid the most dangerous impacts on people and societies from biodiversity loss. Concerted and effective action needs to be applied in support of agreed short-term objectives and a long-term vision. Countries need to be encouraged to develop their respective strategic plans which set time-bound targets to stimulate the action required to achieve them. As an essential element of the process, target setting must be inclusive, engaging the public and private sector as well as the critical civil society stakeholders to warrant full support to the targets agreed and provide legitimacy to the process.
- *Mainstreaming biodiversity in the national development processes.* Maintreaming biodiversity in the national development process will need to be placed as an urgent agenda. One of the critical lessons from the failure to meet the 2010 biodiversity target is that the urgency of a change of direction has not been conveyed clearly to critical decision-makers so far involved in the biodiversity convention. There is a genuine need to make the entire government machinery understand that the future of human well-being depends on defending the natural infrastructure. The current efforts in climate-proofing by the government machinery are a good foundation to start with. It will be necessary, however, to to link biodiversity and ecosystems services concerns in these efforts in order to provide a more holistic approach to development. It will be stressed upfront that trade-offs between conservation and development are inevitable. What is emphasized, however, is for decision making to be based on informed choices using the best available information and mindful of the need to bring into the process all critical stakeholders.
- *Connecting biodiversity management with climate change efforts.* Systematic proofing of policies for their impact on biodiversity and ecosystem services would ensure not only that biodiversity is better protected, but that climate change itself is more effectively addressed. Conservation of biodiversity and the restoration of ecosystems are cost-effective interventions for both mitigation and adaptation to climate change, often with substantial co-benefits. Addressing the multiple drivers of biodiversity loss will have to be understood as a vital form of climate change adaptation. This understanding will give many ASEAN Member States more options, including the targeting of ecosystem pressures over which states have more immediate control, thus, ensuring that ecosystems will continue to be resilient and prevent some dangerous tipping points from being reached.
- *Taking pride on the current efforts and building on them for designing future efforts.* There are many laudable efforts that are being pursued in the region, such as the Coral Triangle Initiative, the Greater Mekong Program, Heart of Borneo, and the ASEAN Heritage Parks, to name a few. These efforts are in the right direction and merit full support from the region if only to accentuate the benefits of regional collaboration. The full value of these benefits can best be understood as well if they are linked with climate change initiatives, giving a more holistic approach to addressing global issues at regional and national levels.
- *Supporting efforts that will lead to the adoption of the ABS regime in the region.* It is recognized that the development of systems for access and benefit-sharing (ABS) has been slow, and negotiations on an international regime to regulate such agreements have been long

and protracted. However, it is also acknowledged that important incentives for the conservation of biodiversity can emerge from systems that ensure the fair and equitable sharing of benefits arising out of the use of genetic resources. The new ABS Regime adopted at COP10 is particularly important to the ASEAN as many member states see themselves as the provider of these important resources the benefits of which can be shared to the world. Governments need to put a regime that is rules-based and one that warrants fair play wherein the agreements reached will strike a fair balance between facilitating access to companies or researches seeking to use genetic material, and ensuring that the entitlements of governments and local communities are respected, including the granting of informed consent, prior to access taking place, and the fair and equitable sharing of benefits arising from the use of genetic resources and associated traditional knowledge.

Complementing these key areas for moving forward are the following recommendations taken from the GBO-3 but adapted to the priorities of the ASEAN region as elements of future strategy:

- In developing the respective strategic plan for biodiversity, the actions that will be identified must address both the direct and indirect drivers of biodiversity loss.
- Efficiency in the use of a natural resource must be balanced with the need to maintain ecosystem functions and resilience.
- Where multiple drivers are combining to weaken ecosystems, aggressive action to reduce those more amenable to rapid intervention can be prioritized, while longer-term efforts continue to moderate more intractable drivers, such as climate change and ocean acidification.
- Avoid unnecessary tradeoffs resulting from maximizing one ecosystem service at the expense of another.
- Continue direct action to conserve biodiversity, targeting vulnerable and culturally-valued species and habitats, and critical sites for biodiversity, combined with priority actions to safeguard key ecosystem services, particularly those of importance to the poor such as the provision of food and medicines.
- Take full advantage of opportunities to contribute to climate change mitigation through the conservation and restoration of forests, peatlands, wetlands and other ecosystems that capture and store large amounts of carbon.
- Use national programs or legislation to create a favorable environment to support effective "bottom-up" initiatives led by communities, local authorities, or businesses. This also includes empowering indigenous peoples and local communities to take responsibility for biodiversity management and decision-making.
- Strengthen efforts to better communicate the links among biodiversity, ecosystems services, poverty alleviation and climate change adaptation and mitigation through education and the more effective dissemination of scientific knowledge.

Addressing biodiversity loss is a shared responsibility for all humanity. While it is recognized that the challenges are daunting, involving foremost a major shift in perception and priorities in societies' current lifestyles, it is an imperative shift to carry out the actions identified in this outlook at the necessary scale and address the underlying causes of biodiversity loss. The continued failure to avert the current trends of biodiversity loss and the degradation of ecosystems services is simply unacceptable. What is needed are cogent and comprehensive actions that will replace the current business-as-usual effort for addressing the issues. This will require political will and collective actions with a clear focus that the rewards will be great. The ASEAN Member States have already taken many bold steps in this direction. The challenge is to push the envelop further, mindful that striking a balance between having a healthy life, secured livelihood and prosperity coupled with protected biodiversity resources and ecosystems is achievable if humans put their heart into it.

References

Altoveros, Nestor C. and Teresita H. Borromeo. 2007. The State of the Plant Genetic Resources for Food and Agriculture of the Philippines (1997-2006). A Country Report. Department of Agriculture, Bureau of Plant Industry. January 2007.

Biswas, S.R., Mallik, A.U., Choudhury, J.K. and Nishat, A. 2009. A united framework for the restoration of Southeast Asian mangroves- bridging ecology, society and economics. Wetlands Ecology and Management 17, 365-383.

Casey, M. Associated Press. November 2009. http://blog.taragena.com/pet/2009/11/18

Chan, H. T. 1996. Mangrove reforestation in Peninsular Malaysia. In Restoration of Mangrove Ecosystems (Ed.) C.D. Field, 64-75. International Society for Mangrove Ecosystems, Okinawa, Japan.

Danish International Development Agency (DANIDA). Hon Mun Marine Protected Areas Pilot Project (TF023877-GEF/ TF023886-DANIDA), accessed on 27 April 2010 at http://cmsdata.iucn.org/downloads/hon_mun_aide_memoire.pdf.

De Leon, R.O.D., and White, A.T. 1999. Mangrove rehabilitation in the Philippines, 37-42.

Ellison, Joanna. 2009. Climate change impacts on, and vulnerability and adaptation of mangrove ecosystems. Paper presented in the ASEAN Conference on Biodiversity 2009, Singapore. 21-24 October 2009.

FAO. 1997. The State of the World's Plant Genetic Resources for Food and Agriculture. accessed on 4 June 2009 at http://www.fao.org/ag/AGP/AGPS/PGRFA/pdf/swrfull.pdf

FAO. 2007. Subregional report on animal genetic resources: Southeast Asia. Annex to The State of the World's Animal Genetic Resources for Food and Agriculture accessed on 2 April 2010 at ftp://ftp.fao.org/docrep/fao/010/a1250e/annexes/Subregional%20Reports/Asia/SouthEastAsia.pdf .

FAO. 2007. Country report of The Lao PDR. Annex to The State of the World's Animal Genetic Resources for Food and Agriculture accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/a1250e/annexes/CountryReports/LaoPDR.pdf

FAO. 2008. Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e00.pdf

FAO. 2008.: The International Treaty on Plant Genetic Resources for Food and Agriculture in Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e01.pdf

FAO. 2008. Pollination in agriculture in Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e02.pdf

FAO. 2008. Livestock diversity in The Lao PDR in Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e05.pdf

FAO. 2008. Enhancing food security through sustainable management plan for non-wood forest products in Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e06.pdf

FAO.2008. Environmental impact assessment: integrating agricultural biodiversity in Agricultural Biodiversity in The Lao PDR accessed on 18 January 2010 at ftp://ftp.fao.org/docrep/fao/010/ai759e/ai759e08.pdf

FAO. 2010. Domestic Animal Diversity Information System (DAD-IS). Available online at http://dad.fao.org/ accessed on 6 April 2010.

FAO. 2010. International Treaty on Plant Genetic Resources for Food and Agriculture accessed on 4 May 2010 at http://www.fao.org/Legal/treaties/033s-e.htm

FAO. 2010. International Plant Protection Convention accessed on 4 May 2010 at http://www.fao.org/Legal/TREATIES/004s-e.htm

Fast Facts. February 2010. The Greater Mekong Subregion: Core Environment Programme and Biodiversity Corridor Initiative. GMS Environment Operations Centre, ADB. Bangkok, Thailand.

Fast Facts. March 2009. Biodiversity Conservation Initiative (CEP-BCI). GMS Environment Operations Centre, ADB. Bangkok, Thailand.

Gilman, E., Ellison, J., Duke, N.C., Field, C., Fortuna, S. (2008) Threats to mangroves from climate change and adaptation options: A review. Aquatic Botany 89, 237-250.

GMS-CEP. January 2008. Environmental Assessment of Economic Corridors and Sectors: Implementation Status Report. GMS Environment Operations Centre, ADB. Bangkok, Thailand.

Hong, P.N. 1994. Reafforestation of mangrove forests in Viet Nam. In Proceedings of an International Timber Organisation Workshop: development and dissemination of Reafforestation Techniques of Mangrove Forests, 141-165. Japanese Association for Mangroves, Okinawa.

http://www.conservationmeasures.org/CMP/Site_Page.cfm?PageID=32

http://highered.mcgraw-hill.com/sites/0070294267/student_view0/glossary_e-l.html

International Strategy for Disaster Reduction. 2010. Accessed on March 2010 at http://www.unisdr.org.

IUCN. 2009. Redlist of Threatened Species accessed on November 2009 at http://www.redlist.org.

IUCN-CMP. 2006. Unified Classification of Conservation Actions accessed on March 2010 at http://www.forestencyclopedia.net .

IUCN-CMP. 2006. Unified Classification of Direct Threats, Version 1.0.
http://conservationmeasures.org/CMP/Site_Docs/IUCN-CMP_Unified_Direct_Threats_Classification_2006_06_01.pdf

Jackson, Louise, Kamal Bawa, Unai Pascual and Charles Perringsa. 2005. AgroBIODIVERSITY: A new science agenda for biodiversity in support of sustainable-agroecosystem. DIVERSITAS Report No. 4. 40 pp.s accessed on 8 April 2010 at http://www.agrobiodiversity-diversitas.org/documents/Jackson%20et%20al%20Science%20plan%20agroBIODIVERSITY.pdf

Le Doan Dung. 2009. Nha Trang Bay marine protected area, Viet Nam: Initial trends in coral structure and some preliminary linkages between these trends and human activities (2002 – 2005). Aquatic Ecosystem Health and Management, 12(3):249-257.

PEMSEA website. EO 533: A Big Step Forward for ICM Implementation in the Philippines accessed on 27 April 2010 at http://www.pemsea.org/about-pemsea/pemsea-news/eo-533-a-big-step-forward-for-icm-implementation-in-the-philippines/view.

Polidoro, B., Carpenter, K., Collins, L., Duke, N., Ellison, A.M., Ellison, J.C., Eong, O.J., Farnsworth, E., Fernando, E., Kathiresan, K., Koedam, N.E., Livingstone, S., Miyagi, T., Moore, G., Nam, V.N., Primavera, P., Salmo III, S.G., Sanciangco, J., Spalding, M., Sukardjo, S., Yong, J.W.H., Wang, Y. (under review). The loss of species: mangrove extinction risk and failure of critical ecosystem services. PLoS One.

Wood, A., Stedman-Edwards, P. and Mang J. 2000. The Root Causes of Biodiversity Loss. Earthscan Publications, London and Sterling, VA. 399 pages. www.earthscan.co.uk.

Ramsar Sites Information Service. 2009. Accessed on November 2010 at http://ramsar.wetlands.org.

Appendices

Appendix 1. Distribution of true mangrove species in Southeast Asia, 2006.

Mangrove Species	Brunei Darussalam	Cambodia	Indonesia	Malaysia	Myanar	Philippines	Singapore	Thailand	Viet Nam
Acanthus ebracteatus	●	●	●	●	●	●	●	●	●
Acanthus ilicifolius	●	●	●	●	●	●	●	●	●
Acanthus volubilis		●	●	●	●		●	●	
Acrostichum aureum	●	●	●	●	●	●	●	●	●
Acrostichum speciosum	●	●	●	●	●	●	●	●	●
Aegialitis annulata			●						
Aegialitis rotundifolia		●			●			●	
Aegiceras corniculatum	●	●	●	●	●	●	●	●	●
Aegiceras floridum		●	●	●		●			●
Amyema anisomeres			●						
Amyema gravis			●	●					
Amyema mackayense			●						
Avicennia alba	●	●	●	●	●	●	●	●	●
Avicennia eucalyptifolia			●			●			
Avicennia lanata			●	●		●	●		
Avicennia marina	●	●	●	●	●	●	●	●	●
Avicennia officinalis		●	●	●	●	●	●	●	●
Brownlowia argentata			●	●	●	●	●		
Brownlowia tersa	●	●	●	●	●	●	●	●	
Bruguiera cylindrica	●	●	●	●	●	●	●	●	●
Bruguiera exaristata			●						
Bruguiera gymnorrhiza	●	●	●	●	●	●	●	●	●
Bruguiera hainesii			●	●	●		●		
Bruguiera parviflora	●	●	●	●	●	●	●	●	●
Bruguiera sexangula	●	●	●	●	●	●	●	●	●
Camptostemon philippinense			●	●		●			
Camptostemon schultzii			●						
Ceriops decandra		●	●	●	●	●		●	●
Ceriops tagal	●	●	●	●	●	●	●	●	●
Excoecaria agallocha	●	●	●	●	●	●	●	●	●
Heritiera fomes					●				
Heritiera globosa	●		●	●					
Heritiera litoralis	●	●	●	●	●	●	●	●	●
Kandelia candel	●	●	●	●	●	●	●	●	●
Lumnitzera littorea		●	●	●	●	●	●	●	●
Lumnitzera racemosa	●	●	●	●	●	●	●	●	●
Nypa fruticans	●	●	●	●	●	●	●	●	●
Osbornia octodonta		●	●			●			
Oberonia rhizophoreti			●	●					

Appendix 1. Distribution of true mangrove species in Southeast Asia, 2006 (continuation)

Mangrove Species	Brunei Darussalam	Cambodia	Indonesia	Malaysia	Myanar	Philippines	Singapore	Thailand	Viet Nam
Pemphis acidula			●	●		●	●	●	
Rhizophora apiculata	●	●	●	●	●	●	●	●	●
Rhizophora mucronata	●	●	●	●	●	●	●	●	●
Rhizophora stylosa			●	●		●	●		●
Scyphiphora hydrophyllacea	●	●	●	●		●	●	●	●
Sonneratia alba	●	●	●	●	●	●	●	●	●
Sonneratia apetala					●				
Sonneratia caseolaris	●	●	●	●	●	●	●	●	●
Sonneratia griffithii		●		●	●				●
Sonneratia ovata		●	●	●		●	●	●	●
Xylocarpus granatum	●	●	●	●	●	●	●	●	●
Xylocarpus moluccensis		●	●	●	●	●	●	●	●
Xylocarpus rumphii		●	●	●		●			
Total	25	34	48	42	34	38	33	33	31

Legend: ● - Indicates the presence of the species in the country.

Source: Giesen, Wim, Stephan Wulffraat, Max Zieren and Liesbeth Scholten. 2006. Mangrove Guidebook for Southeast Asia, RAP Publication 2006/7. FAO and Wetlands International 2007, pp 7-8, accessed on 9 April 2010 at ftp://ftp.fao.org/docrep/fao/010/ag132e/.

Appendix 2. Rank of Southeast Asian Countries vs. the World's Coral Reef Area/Coastal and Marine Resource Diversity in the ASEAN Region

	Coral Reef Area (km^2)		Rank		Per cent of World Total		Reef Building Resources			
	Global Estimates	Country Estimates	Based on Global Estimates[2]	Based on Country Estimates[b]	Based on Global Estimates	Based on Country Estimates	Number of reef building coral species	Number of nearshore fish species	Number of Seagrass Species	Number of Algal/ Seaweed Species
Indonesia	50,875[1]	35,664[1]	1	2	17.86%	13.28%	590[1]	2,057[11]	13[15]	782 algal species (green, brown and red)[18]
Philippines	25,819[1]	27,000[3]	3	3	9.06%	10.05%	464[1]	1,755[3]	16[15]	820 algae species[3]
Malaysia	4,006[1]	4,006[1]	17	15	1.41%	1.49%	435[9]	700[12]	15[15]	289 seaweed species[9]
Myanmar	1,686[1]	1,686[1]	27	29	0.59%	0.63%	64[1]		9[16]	
Viet Nam	1,122[1]	1,122[1]	35	39	0.39%	0.42%	400[1]	2,000[13]	14[15]	
Thailand	2,130[1]	153.5[5]	26	67	0.75%	0.06%	400[5]	600[5]	12[15]	
Brunei Darussalam	187[1]	45[6]	65	64	0.07%	0.02%	400[10]	150[6]	4[17]	
Singapore	50[1]	30[7]	71	71	0.02%	0.01%	256[7]	856[7]	12[7]	
Cambodia	150[1]	28[8]	75	72	0.05%	0.01%	70[8]	435[14]	8[15]	
ASEAN Region	**86,025**	**69,734.5**			**30.20%**	**26.03%**				
India	5,790[2]	5,790[2]	10	10	2.03%	2.16%				
Japan	2,900[2]	2,900[2]	23	23	1.02%	1.08%				
China	1,510[2]	1,510[2]	31	30	0.53%	0.56%				
OECD	**10,200**	**10,200**			**3.58%**	**3.80%**				
World Coral Reef Area	**284,845[a]**	**268,555[b]**			**100.00%**	**100.00%**				

Notes:

[a] Figure based on updated World Atlas of Coral Reefs reported in Status of Coral Reefs of the World, GCRMN 2008.

[b] Based on size of coral reef areas reported.

Sources:

[1] Wilkinson, C. 2008. Status of coral reefs of the world: 2008. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia, pp296 accessed on 6 April 2010 at http://www.reefbase.org/resource_center/publication/main.aspx?refid=27173&referrer=GCRMN

[2] UNEP 2001. World Coral Reef Atlas, accessed on 6 April 2010 at http://coral.unep.ch/atlaspr.htm#Coral%20Reef%20Area%20Statistics

[3] Ministry of Environment, Indonesia 2009. Fourth National Report to the Convention on Biological Diversity. pp24.

[4] Department of Environment and Natural Resources, Philippines 2009. Assessing Progress Towards the 2010 Biodiversity Target: The 4th National Report to the Convention on Biological Diversity. pp45.

[5] Ministry of Natural Resources and Environment, Thailand. 2010. Marine Gap Analysis for Thailand.

[6] Uychiaoco, Andre Jon, Catherine Cheung and Sabri Haji Mohd. Taha. 2004. Marine Protected Areas in Southeast Asia -Brunei Darussalam. ARCBC website 2004 accessed on 27 April 2010 at http://www.arcbc.org.ph/MarinePA/bm.html.

[7] National Parks Board, Singapore. 2010. Singapore – 4th National Report to the Convention on Biological Diversity. September 2010. pp19.

[8] Ministry of Environment, Cambodia 2009. Report on National Marine Gap Analysis for Cambodia. GDANCP-Ministry of Environment, Government of Cambodia. pp4.

[9] Ministry of Natural Resources and Environment, Malaysia. 2007. 4th National Report to the Convention on Biological Diversity. Government of Malaysia. 2009. pp5.

[10] Forestry Department, Ministry of Industry and Primary Resources, Brunei Darussalam, undated. 4th National Report to the Convention on Biological Diversity, Government of Brunei Darussalam.

[11] Allen, Gerald R. and Mohammed Adrim, 2003. Coral Reef Fishes of Indonesia. Zoological Studies 42(1):1-72 (2003), accessed on 15 April 2010 at http://www.sinica.edu.tw/zool/zoolstud/42.1/1.pdf.

[12] Burke, Loreta, Elizabeth Selig and Mark Spalding, 2002. Reefs at Risk in Southeast Asia. World Resources Institute. 2002, accessed on 5 April 2010 at http://pdf.wri.org/rrseasia_full.pdf.

[13] WEPA website. State of Water Environmental Issues – Viet Nam Seas, accessed on 25 April 2010 at http://www.wepa-db.net/policies/state/Viet Nam/seaareas.htm.

[14] Arceo, Hazel and Catherine Cheung with contributions from Kol Vathana and Has Vibol. 2004. Marine Protected Areas in Southeast Asia -Cambodia, ARCBC website 2004 accessed on 27 April 2010 at http://www.arcbc.org.ph/MarinePA/khm.html.

[15] United Nations Environment Programme. 2004. Seagrass in the South China Sea. UNEP/GEF/SCS Technical Publication No. 3. pp10, accessed on 10 April 2010 at http://www.iwlearn.net/iw-projects/unepscs/reports/SCS_Seagrass_Booklet.pdf .

[16] Fortes, Miguel. 1990. Seagrass: A Resource Unknown in the ASEAN Region. International Centre for Living Aquatic Resources and Management. 2004. pp 5-6.

[17] Soe-Htun, U., U San-Tha-Htun, Daw Mu-Mu Aye, Daw Ni-Ni-Win, Daw Lei-Lei-Win, Masao Uno. Notes on Seagrasses along Myanmar Coastal Regions, Bulletin on Maine Science and Fisheries, Kochi University. No 21. pp.13-22. 2001. accessed on 12 April 2010 at https://ir.kochi-u.ac.jp/dspace/bitstream/10126/4380/1/marine21-013.pdf.

[18] Uychiaoco, Andre J. and Catherine Cheung with contributions from Suharsono, Lida Pet-Soede and Rili Djohani. 2004. Marine Protected Areas in Southeast Asia –Indonesia. ARCBC website 2004 accessed on 27 April 2010 at http://www.arcbc.org.ph/MarinePA/idn.html.

Appendix 3. Summary of country projects/ initiatives on coral reef and biodiversity-related projects in Southeast Asia

Country	Description/Objectives/Targets	Year	Project Title	Funding/Implementing Agency
Brunei Darussalam	Integrated Coastal Management Plan requiring tourism projects to have Environmental Impact Assessments*			Brunei Government
Indonesia	Rehabilitated 0.3 km2 coral reef areas[1]	2005-2007	Rehabilitation of Coral Reef and Mangrove Resources in the Special Province of Nanggroe Aceh Darussalam Project	Japan Fund for Poverty Reduction
	Conservation and sustainable management of coral reef areas[2]	1999-2002	Coral Reef Rehabilitation and Management Project in Indonesia	Indonesian Institute of Sciences and ADB
	A 15-year initiative to strengthen the conservation and sustainable management of coastal resources, including the establishment of a coral reef management system in 5 priority areas focused on strengthening management capacity and inter-agency coordination, capacity building and establishing information networks.[3]	1998-2004	Indonesia-Coral Reef Rehabilitation Project I (COREMAP Phase I)	National Development Planning Board, Indonesian Institute of Sciences and GEF
	Australian component focused on capacity building in coastal and resource management.[4]	2000-2004	Coral Reef Rehabilitation and Management Programme in Indonesia	LIPI and Australian Government
	Aims to place 4,725 km2 of coral reef in 6 priority areas, 2 national marine parks and at least 6 regional marine parks under sustainable community-driven collaborative management by 2009[5]	2007-2009	Indonesia-Coral Reef Rehabilitation Project II (COREMAP Phase II)	Ministry of Marine Affairs and Fisheries, Indonesia and GEF/World Bank
Malaysia	Aims to ensure improved marine resource conservation and management in the Malaysian east coast by improving the existing management of MPAs – with a target area of 1,650 km2 of coastal marine ecosystems under improved management.[6]	2007-2011	Conserving Marine Biodiversity Through Enhanced Marine Park Management and Inclusive Sustainable Island Development	Ministry of Agriculture, Malaysia and UNDP
Philippines	The project's coastal and marine component aims to promote coastal and marine biodiversity conservation and the sustainable use of 3.5 km2 of coastal waters of the Paril-Sangay Protected Seascape and Bongo Island, Parang Maguindanao, and 2 biodiversity hotspots threatened by massive illegal and destructive fishing. [7]	1999-2005	Coastal and Marine Biodiversity Conservation in Mindanao	World Bank and Department of Environment and Natural Resources, Philippines

Appendix 3. Summary of country projects/ initiatives on coral reef and biodiversity-related projects in Southeast Asia (continuation)

Country	Description/Objectives/Targets	Year	Project Title	Funding/Implementing Agency
Philippines	This project addresses the priorities of the Philippine National Biodiversity Action Plan (NBSAP), the Philippine Marine Policy, and the Philippine Agenda 21. It also complements past initiatives, such as the CVRP Phases I and II, International Coral Reef Initiative, ASEAN Marine Science Program, etc.[8]	2001-2007	Biodiversity Conservation and Management of the Bohol Islands Marine Triangle	Foundation for Filipino Environment and UNDP
	Through a participatory approach, the project seeks to improve the management and conditions of coastal and marine resources and biodiversity, and to reduce poverty in coastal communities that in a cyclical fashion contribute to further resource depletion and degradation.[9]	2007-2012	Integrated Coastal Resources Management Project	Department of Environment and Natural Resources and ADB
Singapore	Ex-situ conservation of corals by isolating naturally occurring "corals of opportunity" (corals fragmented by impact) and maximizing their survivability.[10]	2007-2010[10]	The Coral Nursery Project[10]	Singapore Government, National University of Singapore, Keppel Corporation[10]
Thailand	Aims to overcome barriers to effective management and the sustained financing of Thailand's protected area system, including 409 PAs, 27 of which are marine national parks.[11] Declared MPAs covering 40% of coral reef areas*	2009-2015	Catalyzing Sustainability of Thailand's Protected Area System	National Park, Wildlife and Plant Conservation Department and Office of Natural Resources and Environment Policy and Planning and UNDP
Viet Nam	This project supported the conservation of critical marine biodiversity values at Hon Mun island and its surrounding waters through the development of a zoned, multiple-use MPA that protects globally important examples of Viet Nam's best remaining coral reef, mangrove and seagrass ecosystems. [12]	2000-2005	Hon Mun Marine Protected Area Pilot Project	World Bank
	The project will implement the management plan for marine areas of Con Dao National Park, including development programming, zoning, boundary demarcation, park infrastructure and human resource development; monitoring and rehabilitation of marine resources and degraded ecosystems.[13]	2007-2010	Biodiversity Conservation and Sustainable Use of the Marine Resources at Con Dao National Park	World Wildlife Fund

Continued next page

Appendix 3. Summary of country projects/ initiatives on coral reef and biodiversity-related projects in Southeast Asia (continuation)

Country	Description/Objectives/Targets	Year	Project Title	Funding/Implementing Agency
Regional – Cambodia, China, Indonesia, Malaysia Philippines, Thailand and Viet Nam	Maintain the area of following coastal resources in the 1998 levels in the region: (a) coral reef to more than 50%; (b) mangrove to 90%; (c)seagrass cover to 80%; adopt a management plan for wetlands[14].	2001-2006	Regional (Cambodia, China, Indonesia, Malaysia, Philippines, Thailand and Viet Nam): Reversing the Degradation Trends in the South China Sea and Gulf of Thailand – Non-Oceanic Coral Reef Sub-Component	UNEP/GEF/SCS and the Governments of Cambodia, China, Indonesia, Malaysia, Philippines, Thailand and Viet Nam.

* Adapted from Reefs at Risk in Southeast Asia, 2008.

Sources:

[1] Asian Development Bank. 2005. Rehabilitation of Coral Reef and Mangrove Resources in the Special Province of Nanggroe Aceh Darussalam Project. ADB JPFR:INO 39115 accessed on 22 April 2010 at http://www.adb.org/Documents/JFPRs/INO/jfpr-ino-39115.pdf.

[2] ADB. 2005. Project Completion Report Coral Reef Rehabilitation and Management Project, ADB PCR:INO 29313, July 2005 accessed on 22 April 2010 at http://www.adb.org/Documents/PCRs/INO/pcr-ino-29313.pdf.

[3] Global Environment Facility, GEF Project Details: Indonesia-Coral Reef Rehabilitation and Management Project I accessed on 22 April 2010 at http://gefonline.org/projectDetailsSQL.cfm?projID=116.

[4] AUSAid Indonesia. 2003. Coral Reef Rehabilitation and Management Project accessed on 27 April 2010 at http://www.indo.ausaid.gov.au/completedprojects/coralreefrehabilitation.html.

[5] Global Environment Facility, GEF Project Details: Indonesia-Coral Reef Rehabilitation and Management Project II accessed on 22 April 2010 at http://gefonline.org/projectDetailsSQL.cfm?projID=1829.

[6] Global Environment Facility, GEF Project Details: Malaysia-Conserving Marine Biodiversity through Enhanced Marine Park Management and Inclusive Sustainable Island Development accessed on 23 April 2010 at http://gefonline.org/projectDetailsSQL.cfm?projID=1201.

[7] Global Environment Facility, GEF Project Details: Philippines-Coastal and Marine Biodiversity Conservation in Mindanao accessed on 23 April 2010 at http://gefonline.org/projectDetailsSQL.cfm?projID=653.

[8] Global Environment Facility, GEF Project Details: Philippines- Biodiversity Conservation and Management of the Bohol Islands Marine Triangle accessed on 23 April 2010 at http://gefonline.org/projectDetailsSQL.cfm?projID=913.

[9] Global Environment Facility, GEF Project Details: Philippines- Integrated Coastal Resources Management Project accessed on 23 April 2010 at http://gefonline.org/projectDetailsSQL.cfm?projID=1185.

[10] National Parks Board, Singapore 2010. Singapore – 4th National Report to the Convention on Biological Diversity. September 2010. pp29.

[11] Global Environment Facility, GEF Project Details: Thailand- Catalyzing Sustainability of Thailand's Protected Area System accessed on 25 April 2010 at http://gefonline.org/projectDetailsSQL.cfm?projID=3517.

[12] Global Environment Facility, GEF Project Details: Viet Nam- Hon Mun Marine Protected Area Pilot Project accessed on 25 April 2010 at http://gefonline.org/projectDetailsSQL.cfm?projID=4.

[13] Global Environment Facility, GEF Project Details: Viet Nam- Biodiversity Conservation and Sustainable Use of the Marine Resources at Con Dao National Park accessed on 25 April 2010 at http://gefonline.org/projectDetailsSQL.cfm?projID=1031.

[14] Global Environment Facility. 2001. Regional (Cambodia, China, Indonesia, Malaysia, Philippines, Thailand, Viet Nam): Reversing Degradation Trends in the South China Sea and Gulf of Thailand. UNEP/GEF/SCS. 2001 accessed on 22 April 2010 at http://www.icran.org/pdf/gef/Lessons%20Learned%20and%20Best%20Practices%20in%20the%20Management%20of%20Coral%20Reefs%20-%20Summary%20Brief.pdf.

Appendix 4. Protected areas (based on the IUCN classification)

Country	IUCN Classification														ALL	
	Ia		Ib		II		III		IV		V		VI		No.	Total Area (km²)
	Strict Nature Reserve		Wilderness Area		National Park		Natural Monument or Feature		Habitat/Species Management Area		Protected Landscape/ Seascape		Protected Area With Sustainable Use of Natural Resources			
	No.	Area (km²)	No.	Area (km²)	No.	Area (km²)	No.	Area (km²)	No.	Area (km²)	No.	Area (km²)	No.	Area (km²)		
Brunei Darussalam	15*	498*			2*	540*					5*	9*			22*	1,047
Cambodia					7	7,423	1	103	16	30,930	3	97[a]	3	4,040	30	42,592
Indonesia	98	17,123	7	11,069	34		2	0.42	45	35,939	35	7,744	45	35,407	266	247,269
The Lao PDR													23[a]	36,992[a]	23	36,992
Malaysia	163	4,678			71	11,569	2	1	17	4,677	7	1,034	3	219	263	22,178
Myanmar														0	43*#	49,456*#
Philippines			4	125	53	8,678	4	245	19	23,360	44	9,922	232	12,161	356	54,491
Singapore	4*	33*			2*	1*								0	6	34
Thailand					136	70,992	13	2,031	57	35,935				0	206	108,958
Viet Nam					30[a]	9,850[a]			11[a]	858[a]	39[a]	2,153[a]	48[a]	12,556[a]	128[a]	25,417
ASEAN	280	22,332	11	11,194	335	249,039	22	2,381	165	131,700	133	20,959	354	101,375	1,343 ^	588,434 ^

* Updated by the ASEAN Member States
a Fourth National Report to the Convention on Biological Diversity
Total Protected Areas (number and extent) include both notified and proposed. Protected areas in Myanmar have not been categorised into IUCN classification.
^ Total ASEAN inclusive of Myanmar's protected areas.

Source: Fourth ASEAN State of the Environment Report 2009. Jakarta: ASEAN Secretariat, October 2009.

Appendix 5. Protected areas as percentage of total land area

ASEAN Member State	Land Area (km2)	Total PAs (as of 2008) (km2)	Per cent of PA of total land area (as of 2008)
Brunei Darussalam	5,765	1,047	18.2*
Cambodia	181,035	42,592	23.5
Indonesia	1,890,754	247,269	13.1
The Lao PDR	236,800	36,992	15.6
Malaysia	330,252	22,178	6.7
Myanmar	676,577	49,456#	7.3*
Philippines	300,000	54,491	18.2
Singapore	710.2	34	4.8
Thailand	513,120	108,958	21.2
Viet Nam	329,315	25,417	7.7
ASEAN	4,464,328	588,434	13.2

* Updated by the ASEAN Member States.
# Protected Area Systems described represent both 3.93% of notified and 3.37% of proposed. Protected areas in Myanmar have not been categorised into International Union for Conservation of Nature (IUCN) classification.

Source: Fourth ASEAN State of the Environment Report 2009. Jakarta: ASEAN Secretariat, October 2009.

Appendix 6. Some distinctive features of the AHPs

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Brunei Darussalam				
Tasek Merimbun National Park	78	The lakes in Tasek Merimbun form the largest black water body in the country; the black lakes, fragile freshwater ponds, grass marshes and swamps are habitats rarely found in Borneo. It has an exhibition hall (Dusun house), camp sites, walkway, lakeside gazebos, guest quarters and multi-purpose hall.	• 50 species of freshwater fish • 68 species of mammals • 148 species of birds • 54 species of herpetofauna • 181 species of Lepidoptera • 54 species of dragon and damsel flies • 8 species hornbills • At least 800 species of plants	• One endemic species of damselfly, *Euphaea ameeka* • The smallest *(Nannophya pyhmaea)* and the biggest species *(Tetracanthagyna plagiata)* of dragonfly • 4 species of pitcher plants (*Nepenthes ampullaria, N mirabilis, N bicalcarata,* and *N gracilis)* • Gaharu *(Aqualaria beccariana)* • Ramin *(Gonystylus maingayi* • Purun *(Lepironia articulate),* a native plant
Cambodia				
Preah Monivong (Bokor) National Park	3,325	The site is developed as a famous altitude resort; covered with moist tropical evergreen forests, with mangroves in the south and a dwarf mountain on top of a mountainous plateau.	• Over 300 bird species • 3 species of hornbills • 11 species of amphibians • Flora is rich	• Large animals such as elephants, tigers, leopards, sunbears, sambar deer, gaur, binturong and pileated gibbon *(Hylobates pileatus)* • Flowering plant, *Burretiodendron hsienmu*
Virachey National Park		A high percentage of ethnic minority peoples live around the park. Some plants and animals are used for cultural ceremonies and rites. Dense semi-evergreen lowland and montane forest dominate the park's vegetation; harbors about 75 per cent of Cambodia's "humid medium elevation" habitats. The remoteness and the "wilderness feel" of the park is its biggest aesthetic and tourism value.	• 15 mammal species • 26 amphibian species • 35 reptile species • 37 fish species • 19 katydid species • 30 ant species	• Germain's peacock pheasant, a restricted-range species • Wild dog dhole • Elephant, tiger, gaur, banteng, sunbear, black bear and gibbons

Continued next page

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Indonesia				
Leuser National Park	10,926.96	The park encompasses a number of smaller nature reserves. It is significant because orangutans, tigers, elephants, rhinoceros and leopards live together here.	• 10,000 plant species • Around 200 species of mammals • 350 species of birds, including 36 Sundaland endemics • Up to 194 reptiles and amphibians	• Megafauna such as Sumatran rhinoceros, Sumatran tiger and the Asian elephant • Spectacular plant species: *Rafflesia* and *Amorphophallus*
Kerinchi Seblat National Park	14,000	Largely mountainous, this park is the most important habitat for tigers. It has seven forest types, as well as freshwater and peat swamps. One of its unique ecosystems is the Gunung Tujuh Lake, which is a deep volcanic mountain surrounded by seven hills. The park offers excellent access to hill and montane rainforest avifauna and endemic Sumatran species. Bird watching is a very popular activity here. A climb to Gunung Kerinchi gives an awesome view from the top.	• 4000 species of flora • 80 species of mammals • 376 species of birds • 9 species of primates • 56 species of amphibians • 50 species of reptiles	• Endemic species: Sumatran ground cuckoo, red-billed partridge, blue-masked leafbird, Sumatran cochoa, blue thrush, Stremann's scope owl, Schneider's pitta, Sumatran peacock pheasant and spot-necked bulbul • World's tallest flowers, *Amorphophallus titanium* and *A gigas* • *Rafflesia arnoldi*, world's largest flower
Lorentz National Park	25,056	Snow-capped mountains and glaciers are linked with mangroves and tropical seas. The park has two distinct zones: the swampy lowlands and a high mountain area. The highest peak of the Himalayas is the Puncak Jaya. Its summit consists of several peaks. The indigenous community comprises eight to nine tribal groups.	• 123 species of mammals • 411 species of birds • 150 species of amphibians and reptiles • Over 100 freshwater fishes • Tens of thousands of insect species • Thousands of vascular plant species	• Ant house plants *(Myrmecodia sp)*, ferns *(Lecanopteris mirabilis)* and carnivorous pitcher plants *(Nepenthes sp)* • Endemic to snow mountain: mountain quail, snow mountain robin, and the long-tailed paradiagalla • World's monotremes: short-beaked Echidna, long-beaked Echidna

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Indonesia				
Nam Ha National Biodiversity Conservation Area	2,224	The park is an extremely important watershed that contains an important evergreen forest, a mosaic of grasslands, spectacular views, caves and waterfalls, and is home to several minority groups; ecotourism is widely promoted. There's a high population of mammals and birds; it ranks 3rd for birds and 5th for large mammals in the country. Nam Ha ranks 3rd in the national management priority index based on biodiversity and watershed values, ecotourism potential and level of pressure on the site. Trekking, hiking, kayaking, rafting, biking, mountain biking and boat tours through the villages are some of the activities managed by the locals.	• About 2000 plant species • 200 species of non-timber forest products • 37 species of large mammals • 288 species of birds	• *Aquilaria* trees whose red infected heart is prized for making incense • Cardamom, jewel orchid, bamboo and rattan • Three large cat species: clouded leopard, leopard and tiger • Gaur, muntjac and Asian elephants • Birds, butterflies
Malaysia				
Kinabalu National Park	750	Mt. Kinabalu is the tallest mountain in Malaysia. The lowest elevation is at Poring Hot Springs. It offers visitors the chance to bathe in natural hot springs, see the butterfly house, ethnic garden and mini-zoo; and experience the canopy walkway. The park has six major unique major topographic features: peaks and plateaus, gullies, rivers, streams and waterfalls, hot springs, caves and granite slabs. The granitic massif of Mt. Kinabalu offers a range of opportunities for hikers, scramblers and rock climbers. The park is intimately connected with the folklore and local traditions of Sabah.	• 5000-6000 vascular plant species with over 200 families and 1,000 genera which include the following: – 1000 orchid species in 121 genera – 608 fern species – 9 Nepenthes species – 24 *Rhododendron* species – 78 *Ficus* species – 30 ginger species – 6 bamboo species – 2 *Rafflesia* species • 90 species of lowland mammals which include: • 21 species of bats • 22 species of montane mammals • 306 species of birds • 9 families of fishes • Around 61 species of frogs and toads • Some 200 species of butterflies • About 112 'macro' moth species • 8 families of beetle fauna	• Famous slipper orchid, Paphiopedilum rothschildianum • Endemic species such as • *Nepenthes species: N burbidgeae, N rajah and N villosa, Rhododenron speciesendemi: R ericoides, R buxifolium, R fallacium, R stenophyllum, R abietifolium* • 13 Ficus species

Continued next page

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Malaysia				
Mulu National Park	528.66	Gigantic limestone caves, tropical karsts and very high biodiversity are the most recognized features of the park, which also has the second highest mountain peak in Sarawak. Its large limestone caves, the most extensive and spectacular on earth, are the roosting places of millions of swiftlets and bats. The most spectacular is Gua Payau or Deer cave, which is also considered as the world's largest natural cave passage. The Sarawak Chamber is the world's largest natural chamber in a cave, said to be able to accommodate eight Boeing 747 aircrafts lined up nose to tail. Deer Cave, Lang's Cave, Wind Cave and Clearwater Cave have been developed for visitors; all have cemented and timber walkways and electric lighting. The 108-km long Clearwater Cave System is the longest in Asia.	• 3,500 species of vascular plants with 111 species and 20 genera of palms • 1,700 species of liverworts and mosses • Home to 170 species of wild orchids including slipper orchids • 10 species of insectivorous pitcher plants *(Nepenthes sp)* • 81 mammalian species • 270 bird species • 83 reptile species • 76 amphibian species • 50 fish species • Around 20,000 invertebrate species • 28 species of bats • 40 snake species	• Endemic liverworts and mosses: *Stereodontopsis flagellifera, Coryphopteria andersonii, Hypnodendron beccarii* and *H. vitiense*. • Endemic to alluvial plain: *Calamus neilsonii* and *Salacca rupicola* • Endemic to limestone mountain: *Areca abdulrahmanii* • Important wild sago *(Eugeissona utilis)* • Very rare bogmoss, *Sphagnum perichaetiale* • An important snake species that only breeds in the fluid of pitcher plants, *Philautus sp*
Taman Negara National Park	4,343	Aside from being one of the world's oldest rainforests, it has the most extensive protected area of pristine, lowland, evergreen rainforests. The highest point is Gunung Tahan at 2,187 meters above sea level. Salt licks occur naturally on the ground surface where mineral salts are found. The most popular activities are river cruises and jungle trekking. The world's longest canopy walk is a must-see. Simple huts built above the ground afford guests to stay overnight. Observation hides and cave explorations are also available. Visitors can experience cultural life at the Orang Asli settlement.	• 185,000 fauna species which include 250 non-migratory birds, 58 reptiles and 56 amphibians • 109 fish species • 8,000 species of flowering plants • 22 endemic flora	• Endemic fauna species: crested argus, mountain pheasant; endangered is the world's smallest rhinoceros • 15 endemic fish species • Lowland dipterocarp forest contains about 57.6 per cent of the plants in the park

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Myanmar				
Alaungdaw Kathapa National Park	1,597.61	The park is hilly, with accented valleys; and the terrain rises from 204 to 1280 meters. It offers excellent opportunities for study and recreation, including worship. Other interesting activities are observing butterflies, plants and orchids; riding elephants; and trekking. There are guest houses, log cabins and campsites in the park.	• 168 species of birds • 77 reptile species • 240 butterflies	• Common timber species include teak, ironwood, Burmese paduak, Burmese rosewood, *Shorea obtusa* and *S siamensis* • A wealth of large mammals including elephants, leopard, clouded leopard, bear, gaur, banteng, sambar and barking deer, serow, goral, wild boar, wild dogs and primates
Inlay Lake Wildlife Sanctuary	642	This is the second largest lake in Myanmar. People use traditional boats for transportation and the locals shop at "floating bazaars", which form the only floating market in Myanmar. Lake dwellers practice traditional floating agriculture. There are floating landscapes known as water gardens. Other interesting activities in the lake include visiting archaeological sites, famous pagodas and natural hot springs.	• 250 bird species; about 14 are migratory • 20 species of snails • 43 species of fish, 16 of which are endemic • 527 medicinal plant species • 108 orchids	• wetland sedge, reeds and evergreen flora. • *Dalbergia spinosa, Hypericum prunizolium, Coladium spp, Desmodium oblongum, Enhydra zluctuans, Panicum sarmentosum* • *Salix tetrasperma, Ficus spp., Crataexxa nuvala, Mitragyna parvizolia, Salmalia malabarica, Bombax malabaricum* found in shallow waters or on the shores
Indawgyi Lake Wildlife Sanctuary	775.25	This is the largest inland lake in Southeast Asia, and the 3rd largest in the world. Travelers can view wildlife and walk through the lush forests. Bird watching is very popular. Visitors can also participate in or view traditional fishing practices, or pass through the historically famous shrine, the Shwe myint Zu Pagoda.	• 37 mammals • Around 326 forest bird species • 80 species of amphibians • 50 butterfly species • 64 species of fish; 3 are endemic to Myanmar.	• Wild elephant, leopard, bearserow, gaur, banteng, red goral, gibbon, sambar and barking deer, wild dog, golden jackal and civet • Hundreds of ruddy shelduck, bar-headed goose, greyleg goose and brown headed gull • Rare species of birds like red-crested Pochard, greyheaded lapwing

Continued next page

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Myanmar				
Khakaborazi National Park	3,812.46	The park is the largest natural park in Myanmar; it features Mt Khakaborazi, Myanmar's highest mountain. Main attractions are the black orchid and rare butterflies. Other attractions are climbing the challenging Mt Khakaborazi; exploring the Ayeyawady River and its headwaters; and observing the traditional culture and customs of the Kachin hill tribes.	• 42 mammals • 370 bird species • Nearly 80 amphibians and reptiles • 297 tree species • 106 orchids	• Rare mammal species in the park such as takin, musk deer, blue sheep, black barking deer and phet gyi *(Muntiaus putaoensis)* • Rare orchids: Black orchid *(Paphiopedillium wardii), Cymbidium, Plejone maculata* and *Dendrobium nobile* • Beautiful, colorful and rare species of butterflies: yellow and black *Papillionidae* butterflies, bright orange colored *Pieridae* and yellowish brown butterflies with black and white spots on their bodies and the *Nymphalid* butterflies
Lampi Marine National Park	204.84	There are a number of sandy beaches, bays and inlets. There are large caves and plenty of freshwater sources on the island and major coral formations around the smaller islands. At the northern end of Lampi, the superbly protected anchorage of Salet Galet offers jungle walks, great fishing, snorkeling and kayaking and the chance for an encounter with the Moken Sea Gypsies. Surfing and diving in coral reefs are also popular activities.	• 42 mammals • 370 bird species • Nearly 80 amphibians and reptiles • 297 tree species • 106 orchids • Wildlife is plentiful • Lowland forests are dominated by dipterocarps, especially *Dipterocarpus alatus*	• Epiphytic species, including lianas • Beach forest, some with pure stands of *Casuarina equisetifolia* • Notable birds include nicobar pigeon and edible nest swiftlet • Large colonies of flying foxes and small herd of wild elephants • Wild orchids and ferns • A myriad of crabs, mudskippers, weaver ants and archer fish • Fireflies
Meinmahla Kyun Wildlife Sanctuary	137	This is a refuge for estuarine crocodiles, as well as for resident and migratory water and shore birds. Mangrove forests serve as breeding ground particularly for fish and prawn. Visitors can go bird watching and observe the abundance of wildlife.	• 29 mangrove species • 53 species of medicinal plants • 88 bird species • 2 freshwater turtles • 15 mammal species • 59 fish species • 12 prawn species • 10 crab species • 26 snake species • One crocodile species	• Freshwater turtles such as mangrove terrapin and Burmese roofed turtle • Freshwater dolphins

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Philippines				
Mt. Apo National Park	769	Mt Apo is a volcano. It is the last stronghold of the latest population of the Philippine eagle *(Pithecophaga jefferyi)*. There are 19 major rivers and 21 creeks that drain into the park's eight major watersheds. The "Blue Lake" and Lake Venado are famous camping and stopover sites for mountaineers near the peak. Some of the ecotourism destinations in the park are lakes and waterfalls, hotsprings, the Philippine Eagle Centre/ Camp, orchid farms and gardens, Buddhist and Tao temples, and a museum showcasing a gallery of paintings, sculptures and ethnic crafts.	• 126 species of flora • 53 species of mammals • 272 species of birds • 17 species of amphibians • 36 species of reptiles	• Endemic species of genera Pipturus, Sauravia and Poikilospermum • Endangered species are Lithocarpus submonticolus and Paperonia elmeri • Endemic Cypholopus microphyllus and Nepenthus copelandi • 6 indigenous groups: Manobo, Bagobo, Ubos, Atas, K'lagans and the Tagacaolo
Mts. Iglit-Baco National Parks	754.45	This is home to the tamaraw *(Bubalus mindorensis)*, a type of water buffalo. Local eco-tourism destinations and activities include: Tamaraw-watching at the gene pool in Manuot, bird-watching of the blue shortwing, island thrush tardus and other birds, and climbing Mt. Iglit.	• About 200 tamaraws • Wild pig and Philippine deer in the grasslands • Endemic bird species • Rare and endangered plant species	• *Themeda triandra* and *Imperata cylindrica* Endemic bird species: Mindoro bleeding heart pigeon, Mindoro imperial pigeon, Mindoro scops owl, black hooded caucal, scarlet collared flowerpecker, and Mindoro hornbill • The endangered jade vine
Mt Kitanglad Range National Park	472.70	This is the 2nd highest mountain in Mindanao, with more than a dozen mountain peaks, densely forested slopes, a number of caves, several waterfalls and a hot spring. Some eco-cultural activities: hiking to the Mt. Kitanglad Summit through the Intavas trail or the Luplagan trail; getting to the Mt Dulang-Dulang Summit through the Bol-ogan trail or the Dalwangan Route; camping at the Cinchona Forest Reserve, habitat of the rare Green Maya and *Ratus ratus rabori,*	• 159 bird species • 131 species of butterflies • Numerous bat species • 58 mammalian species • 13 of the 14 bird species endemic to Mindanao • 3 main indigenous communities	• Pygmy fruit bat: the first fruit bat species known in Asia • *Tmesipteris lanceolata,* an endangered rootless vascular plant

Continued next page

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Philippines				
		the only rat of its kind in the world; a chance to observe the school of living tradition in Lantapan, where the Talaandig community showcases its culture through various craft products, the art of weaving, handicraft production, rituals, dance and music; bird watching; and hiking to Lusok Falls and the Nabitag Falls and Hot Springs.		
Singapore				
Sungei Buloh Wetland Reserve	1.3	Singapore's first and only protected wetland reserve. There are mudflats in the intertidal areas, a network of brackish water ponds, freshwater ponds, grasslands and patches of secondary forests. The site serves as a centre for outdoor nature learning for students and families. There is a migratory site along the East Asian-Australian Flyway, particularly for water birds. Showcases bird ringing and color flagging activities.	• 223 species of birds • 100 species of fish • 35 species of dragonflies	• Mangrove species *Sonneratia, Rhizophora, Bruguiera and Avicennia* • Sea hibiscus (Hibiscus tiliaceaus): a plant that grows up to 13m tall and has heart-shaped leaves • Tui *(Dolichandrone spathacea):* a small tree that grows up to 5m with beanpod like fruits • Sea teak *(Podocarpus polystachyus):* coniferous tree that grows up to 20m and produces cones as reproductive structures • Cattail or bulrush *(Typha angustifolia):* an aquatic grass like herb that grows up to 3m with tiny fruits that are dispersed by wind • Water lettuce *(Pistia stratiotes):* floating plant that bears small, white flowers • Water banana *(Ludwigia adscendens):* a plant that bears two types of roots; one looks like a banana and the other anchors the plant to the soil

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Thailand				
Ao Phang-Nga Marine National Park	400	One of the most frequently visited marine national parks in Thailand, it is also the second-ranked seacoast national park famed for its rich folklore, prehistoric rock arts and natural beauty. The park consists of a coastal forest and a series of karst limestone hills flooded by the sea to form some islands with high cliffs, rock overhangs, caves, coral gardens and some scrub. The area is known as the village of sea gypsies.	• 17 mammal species • 88 bird species • 18 reptile species • 3 amphibian species • 24 fish species • 14 shrimp species • 15 crab species • 16 manta ray and shark species	• Crab-eating macaques on the beaches and islands • Dusky leaf monkeys and gibbons in the deeper island forests • Giant fruit bats roosts, monitor and other lizards • A variety of marine, coastal and forest birds
Mu Ko Surin National Park	141.25	The park is 76 per cent sea and has five islands. It has very rich coral reefs containing myriad species of dazzling fishes.	• 91 types of birds with about 57 local species • 22 species of mammals with 12 species of bats and 6 types of reptiles • Very rich in marine life • The 3 types of forests are covered with trees.	• Green imperial, orange-breasted and nicobar pigeons • Pig-tailed macaques and wild pigs • Numerous types of hard and soft corals, seafeathers, starfish, spiny lobster, giant clam, sea anemone and seapens • Olive Ridley and green sea turtles □ *Dipterocarpus spp, Hopea odorata, Anisoptera cochinchinensis, Michelia champaca, Sterculia foetida* and rattan
Mu Ko Similan Marine National Park	140	The park includes 16 sq km of land and 11 islands. Visitors can enjoy the beach life, swim with wild turtles, snorkel and scuba dive, watch birds, learn about traditional culture of sea gypsies, and witness ancestor worship ceremonies during the full moon in March.	• 31 species of small mammals • 16 species of bats • 3 species of squirrels • 4 species of rats • 36 reptiles • 73 species of birds • Soft and hard corals	• Bush-tailed porcupine, common palm civet, flying lemur, bottlenosed dolphin, yellow Lajah rat, vampire bat and black-beard tomb bat • Hairy-leg mountain crab • Staghorn corals *(Acropora echinata)* and cauliflower shaped corals *(Seriatopora hystrix)*

Continued next page

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Thailand				
Kaeng Krachan National Park	4,373	The park is home to a huge number and range of birds, making bird-watching a popular activity. The park includes the Kui Buri National Park, Chaloem Ohrakiat Thai Prachan National Park and the Maenam Phachi Wildlife Sanctuary. There are also several waterfalls in the park. Other attractions include: the Kaeng Krachan Dam and reservoir, with 20-30 islands dotting the water surface; and the Khao Tao Mo Cave, with spectacular stalagmites and stalactites within a hall-like chamber.	• 2,500 – 3,000 plant species • 450 species of birds • 250 species of butterflies • 80 species of mammals • 87 fishes	• Hanging lianas, ferns and orchids • Oaks, chestnuts and maples • Large mammals include elephants, gaur, banteng bears, Indo-Chinese tigers, leopards and Fea's muntjac • Ratchet-tailed treepie • Oriental pied and wreathed hornbills
Khao Yai National Park	2,168	This is Thailand's third largest natural park. It boasts of towering trees draped with mosses, climbers and epiphytes; tangled trunks of strangling figs; drooping lianas and spiny rattan palms; delicate ferns, multi-colored lichens and an ever-changing array of fungi. The Hew Narok and Hew Suwat waterfalls are located here. Bird watching is popular.	• 71 mammal species • 38 reptile species • 23 amphibian species • More than 318 bird species • More than 215 insect species	• Elephants, tigers, deer, gibbons, hog badger, clouded leopard, Asiatic black bear, Javan mongoose, and hornbills • Silver and Siamese fireback pheasants mountain imperial pegion, orange-breasted and red-headed trogons, great and wreathed hornbill
Tarutao National Park	1,490	The park is composed of 51 islands, of which Ko Tarutao is the largest, occupying over 60 per cent of the park. A number of nature trails lead to panoramic views and superb beaches. Visitors can also enjoy the many pristine beaches, take boat rides or kayaks, and go island hopping, snorkeling and scuba diving. Spelunkers will enjoy the park's caves. Bird watchers and avid photographers will revel in the stunning wildlife inhabiting the park.	• Over 100 birds including 3 species of hornbills • Over 13 insular subspecies • At least 9 insular subspecies of squirrels, 5 common treeshrew species, and 3 lesser mouse deer • About 25% of the world's fish species • 3 species of migratory sea turtles	• Dusky langurs, crab-eating macaques, mouse deer and wild pig • Slow loris, otters, civets, flying lemurs, fishing cats, soft-shelled turtles, monitor lizards, phytons, cobras, coral snakes and vipers • Dugong, common and Irawaddy dolphins, sperm and minke whale

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Viet Nam				
Ba Be National Park	100.48	The park is a continuous body of water with numerous small islets and inlets, regarded as the "Halong Bay" of the mountains. Visitors can also enjoy the following: boat tours around Ba Be Lake and Nang River; treks through the valleys, forests, and caves; and visits to local villages, markets and musical performances. Other interesting features are waterfalls, ponds and the rest of the islands.	• 65 mammal species including 27 bat species • 233 bird species: 7 species in Sino-Malayan subtropical forests; 6 species in Indochinese moist tropical forests; and 3 species in Indo-Malayan tropical dry zone • 6 diurnal and 3 nocturnal raptor species • 43 reptile and amphibian species • 106 species of fish	• Francois' langur and Owston's branded civet. • Vietnamese salamander (Paramesotriton deloustali)
Chu Mom Ray National Park	566.21	The park has many interesting sights and hill tribe villages. The Seminary, the Ethnic Hill Tribe Museum, the Wooden Church and the Kontum Prison on the bank of the Dakbla River are worth a visit. A number of nearby villages provide insights into the life of local ethnic tribes.	• 1,494 plant species in which 131 species are listed as rare; 425 are medicinal and 2 endemic orchids • 115 mammal species • 272 bird species • 62 reptile and amphibian species • 20 freshwater fish species • 179 insect species	• Two endemic orchids: *Coelogyne schitesii* and *Bulbophyllum amitinandii*. • German's peacock pheasant and the black-hooded laughingthrush • Tigers, elephants, gaur and banteng
Hoang Lien Sa Pa National Park	298.45	The park contains Viet Nam's highest mountain, Phan Xi Pang, also known as Fansipan. Clouds cover the Fansipan Mountain all year round and temperatures often drop below zero. The park has these to offer visitors: the Ham Rong Orchid Garden, comprised by a series of ornamental gardens linked by pathways, provide for careful and responsible bird exploration. The Thac Bac waterfalls, Thuy Cong grotto, Gio cave, Troi gate and truc forest are sightseeing delights. Sa Pa town is famous for its flowers and is known as the capital town of orchids. It is also known for its valuable medicinal herbs.	• Nearly 2,850 floral species, of which 400 are medicinal • 350 bird species • 1/3 of Viet Nam's known amphibian species	• Rare plant and animal species including the globally-threatened Fujian cypress and the Bac Xanh tree • Endemic conifers *Amentotaxus yunnanensis, Calocedrus macrolepus, Cupressus duclouxiana* and *Taiwania cryptomeriodes* • Endemic animals such as the soc trau Squirrel), doi tai so (bat) and vuon den tuyen tay bac (gibbon)

Continued next page

ASEAN Member State AHP	Total area (km^2)	Distinctive features and eco-cultural activities	Recorded species	Important species
Viet Nam				
Kon Ka Kinh National Park	417.80	The park offers scenic landscapes and other natural features of interest to visitors, such as waterfalls, springs, lakes, particularly the Bien Ho (To Nung Lake), which is located on top of an extinct volcano. Bien Ho is called the "Pearl of Pleiku", as its waters are so clear that fish can be seen swimming deep underneath.	• 652 vascular plant species, of which 238 are timber species, 110 with known medicinal uses and 38 with potential economic value as ornamentals • 41 mammals • 160 birds • 29 reptiles • 22 amphibians • 209 butterfly species	• Timber species with high economic value: *Decussocarpus fleuryi, Afzelia xylocarpa, Pterocarpus macrocarpus, Dalbergia cochinchinensis,* and *Chukrasia tabularis.* • Medicial plants of high economic value: *Aquilaria crassna, Coscinium fenestratum. Fibraurea tinctoria, Anoectochilus lyfei* and *A roxburghii*

Appendix 7. Status of ASEAN Member States' compliance with the Cartagena Protocol on Biosafety

Cambodia

Biosafety is a new issue for Cambodia. The Government has been trying hard to put biosafety into a formal framework for implementation through its National Biodiversity Strategy and Action Plan, which consists of 98 priority actions and 17 thematic plans. One of the priority actions is a strategy for the development and implementation of a biosafety framework. In 2008, the National Law on Biosafety was implemented. The law consists of articles dealing with the transboundary movement of living modified organisms (LMOs) and risk assessment and management mechanism for the release of LMOs into the environment, including all functions pursuant to the Cartagena Protocol on Biosafety; handling, transport, packaging and identification; intentional introduction into the environment; LMOs for use as food or feed or for processing; public awareness and participation; transboundary movement; transit; and contained use. A National Biosafety Clearing-house was also created in 2006 under the Cambodia Development of National Biosafety Framework.

Indonesia[1, 2]

Indonesia ratified the Cartagena Protocol in 2001 but since 1985, the Indonesian Government has placed a high priority on the development of biotechnology in order to address the need for sufficient food production in a more sustainable and performing agricultural system.

The Indonesian Government first established a national committee for biotechnology in 1993 at the State Ministry for Science and Technology. The purpose of the committee was to formulate policies and programs relating to biotechnology which were overseen through a system consisting of four national centers for excellence in agriculture and industrial and medical biotechnology. As a result of this initiative, Indonesia now has plant transformation programs carried out at public and private research institutes, a public university and an industrial laboratory.

Indonesia's biotechnology efforts are focused on a long-term strategy that involves drug discovery, genomics, conservation of germ plasma, genetic improvement of agriculture output, and marine and environmental biotechnology.

Also in 1993, the State Ministry on Research and Technology released guidelines for genetic engineering research in order to control research in GMOs/LMOs. The guidelines included specific provisions that cover plants, cattle, fish and microbes.

In 1997, Indonesia adopted biosafety regulations through a decree by the Ministry of Agriculture on the Provisions on Biosafety of Genetically Engineered Agricultural Biotechnology Products (or the "Biosafety Decree"). The decree was established because of the absence of a policy directly related to agriculture. In order to include food safety aspects, the decree was revised to become a Joint Decree of Four Ministers on Biosafety and Genetically Engineered Agricultural Products. In addition, the country also adopted specific food safety laws and regulations, including mandatory labelling for genetically engineered food. The decree established Indonesia's Biosafety Commission, which advises government on the safe release of GMOs/LMOs. The Biosafety Decree also created an expert technical team to assist the Biosafety Commission in the evaluation and implementation of procedures on GMOs/LMOs release.

At present, the main laws and regulations in place are: Government Regulation No. 21, Year 2005 on the Biosafety of Genetically Engineered Products, and the Joint Decree of Four Ministers on Biosafety and Genetically Engineered Agricultural Products.

The Lao PDR

The National Biodiversity Frameworks of The Lao PDR is a combination of policy, legal, administrative and technical instruments that are set in place to address safety for the environment and human health in relation to biotechnology. It covers the government policy on biosafety; the regulatory regime for biosafety; administrative systems for biosafety, mechanisms for public education, awareness and participation; capacity building programs to implement the Cartagena Protocol; and the priorities of the government to implement the Biosafety Framework. At the moment, there are no biosafety regulations in place in the country, although in 2005, a Draft Biosafety Law was developed which covers all functions pursuant to the Cartagena Protocol regarding animals, fishes, micro-organisms, plants and human health.

Malaysia

Malaysia ratified the Cartagena Protocol in 2003. However, biosafety was already given primary importance as part of biological diversity in its National Policy on Biological Diversity of 1998. The policy stated that "the creation, transportation, handling of genetically modified organisms carry certain environmental, safety and health risks that are still inadequately understood. For instance, the introduction of GMOs could have adverse effects on ecological stability in forests and farms, in unintended or unpredictable ways, if the process is not properly controlled. Genetically modified plants may interbreed with wild relatives and their progeny could become pests. The release of GMOs may have adverse natural feedback as our knowledge of their population dynamics is limited. Biosafety concerns should thus receive high priority. In the development of biotechnology, especially genetic engineering, there must be corresponding development of an adequate regulatory framework for biosafety".

For this reason, the National Biosafety Act, as a national policy document, was passed in 2007. In 2009, the regulations to support the National Biosafety Act were approved by the House of Representatives (ISAAA, 2009)[3]. Under this law, the Ministry of Natural Resources and the Environment (MNRE) was given the mandate to set up a National Biosafety Board (NBB) with the responsibility to regulate the release, importation, exportation and contained use of any living modified organism derived from modern biotechnology and products of such organisms. The Chairman of the Board is the Secretary General of the MNRE, while the composite membership of the board is represented by seven other relevant ministries. The Biosafety Core Team was formed under the MNRE to implement the National Biosafety Act under the NBB. The team is the lifeline of biosafety regulatory activities for Malaysia[4].

Myanmar

Myanmar is yet to develop a national biosafety framework and neither does it have a national policy, law or regulation outlining biosafety in the context of the Cartagena Protocol. However, the Government of Myanmar has in place other policies related to agriculture, forestry, food, public health, environment and sustainable development that can serve as a basis for a biosafety policy.

Philippines[5]

The Philippines was the first ASEAN country to formulate a national policy on biosafety. In 1990, Executive Order 430 was issued creating the National Committee on Biosafety of the Philippines (NCBP) that will formulate, review and amend national policy on biosafety and craft guidelines on the conduct of activities on genetic engineering. The following year, the Philippine Biosafety Guidelines were put in place, even before the country became a party to the Cartagena Protocol.

In 2001, the Philippines issued the Policy Statement on Modern Biotechnology, reiterating the government policy on promoting the safe and responsible use of modern biotechnology. Later in 2002, the Department of Agriculture (DA) issued Administrative Order (AO) No. 8, which pertains to the implementing guidelines for the Importation and Release into the Environment of Plants and Plant Products Derived from the Use of Modern Biotechnology.

The Philippines ratified the Cartagena Protocol in 2006 and that same year, Executive Order 514 was issued establishing the National Biosafety Framework (NBF), prescribing guidelines for the implementation, strengthening and reorganizing of the National Committee on Biosafety of the Philippines (NCBP), and for other purposes. The NCBP now involves more government agencies such as Science and Technology, Agriculture, Environment and Natural Resources, and Health, to reflect the breadth and complexity of issues related to modern biotechnology. Other departments involved are: Foreign Affairs, in promoting and protecting Philippine interests on biosafety in bilateral, regional and multilateral forums; Trade and Industry, in relation to biosafety decisions which have impact on trade, intellectual property rights, investments and consumer welfare and protection; National Commission on Indigenous Peoples, in relation to biosafety decisions which have a specific impact on indigenous peoples and communities; and Interior and Local Government, in relation to biosafety decisions which have impact on the autonomy of local government units.

Worth pointing out is the Philippines' experience in closing gaps in the coverage of existing legislation. The NBF, which was created only after the NCBP was already in place, came up with a solution through the issuance of the Department of Agriculture's AO No. 8. While the DA's administrative order applies to plants and plant products derived from modern biotechnology and regulates its importation for contained use, importation for direct use for food, feed and processing; for the conduct of field trials; and for commercial release of new varieties, the NCBP principally covers biosafety guidelines for the contained use of genetically engineered and potentially harmful exotic organisms. The experience highlights that success in biodiversity conservation achieved through interagency coordination and action can extend to other areas of government as well.

Thailand

In 2005, Thailand ratified the Cartagena Protocol but the development of the National Biosafety Frameworks (NBF) has been initiated since 2001 by the National Biosafety Committee. One of the frameworks is the National Biosafety Policy Framework which covers eight key principles as guide to how biosafety legislation and management should be assessed. The eight guidelines include: sustainable use and conservation of biotechnology; risk assessment and management; risk classification; cautionary preparedness; freedom of choice; domestic capacity building; encouraging education; and public comment. There is also the National Biosafety Legal and Regulatory Framework which drafted the Biosafety Act in 2003. Additionally, there is also the National Biosafety Institutional Framework, the National Biosafety Handling Framework, and the National Biosafety Technical Guidelines Framework. The main objective of the NBF is to bring together various agencies and institutions, their authority, responsibility and information relevant and applicable to biosafety in modern biotechnology and to consolidate and integrate these systematically into a single and unique biosafety framework. Other biosafety-related legislation are the: Biosafety Guidelines in Genetic Engineering and Biotechnology for Laboratory Work; and Biosafety Guidelines in Generic Engineering and Biotechnology for Field Work and Planned Release.

Viet Nam

In 2007, Viet Nam approved the creation of its Biosafety Framework, a comprehensive strategy to strengthen its management capacity for the biosafety of GMOs, including goods and products originating from them. The country's national framework covers the implementation of the Cartagena Protocol until 2010. The plan targets various aspects of biosafety, such as setting up, issuing and completing a legal and regulatory framework on biosafety; promoting management capacity in biosafety from the center to the local communities; setting up of national information systems of biosafety; capacity building in biosafety research and analysis; raising public awareness; and information sharing and public participation in biosafety management.

References

Fast Facts. February 2010. The Greater Mekong Subregion: Core Environment Programme and Biodiversity Corridor Initiative. GMS Environment Operations Centre, ADB. Bangkok, Thailand.

Fast Facts. March 2009. Biodiversity Conservation Initiative (CEP-BCI). GMS Environment Operations Centre, ADB. Bangkok, Thailand.

GMS-CEP. January 2008. Environmental Assessment of Economic Corridors and Sectors: Implementation Status Report. GMS Environment Operations Centre, ADB. Bangkok, Thailand.

End Notes

Kurukulasuriya L., and A. Robinson. 2006. UNEP International Environmental Law Manual 214 – 215.

Indonesia Fourth National Report to the Convention on Biological Diversity. Jakarta: Ministry of Environment, 2009.

(Endnote: International Service for the Acquisition of Agri-Biotech Applications. 2009. Malaysian Biosafety Act in Force accessed on 22 April 2010 at http://www.isaaa.org/kc/cropbiotechupdate/article/default.asp?ID=5116)

Government of Malaysia. Biosafety Clearing House Mechanism accessed on 22 April 2010 at <http://www.biosafety.nre.gov.my>

Assessing Progress towards the 2010 Biodiversity Target: Philippines 4th National Report to the Convention on Biological Diversity. Manila: Department of Environment and Natural Resources, 2009.

ASEAN CENTRE FOR BIODIVERSITY






















ASEAN CENTRE FOR BIODIVERSITY
3/F ERDB Building, UPLB Forestry Campus,
Los Baños, Laguna 4031, Philippines
Telephone numbers: +6349 536-3989
and +6349 536-1739
Telefax number: +6349 536-2865
E-mail: contact.us@aseanbiodiversity.org
Website: www.aseanbiodiversity.org