

Helpdesk report, 4th of May 2021

Biodiversity in the Asia/Pacific region

Input to the strategy proposal



Photo: IPBES

Authors:

Göran Ek

Submitted to:

Embassy of Sweden, Bangkok

www.sidaenvironmenthelpdesk.se

Contact: sidaenvironmenthelpdesk@slu.se

Team Leader: Gunilla Ölund Wingqvist, gunilla.wingqvist@wexus.se

Quality Manager: Eva Stephansson, eva.stephansson@slu.se

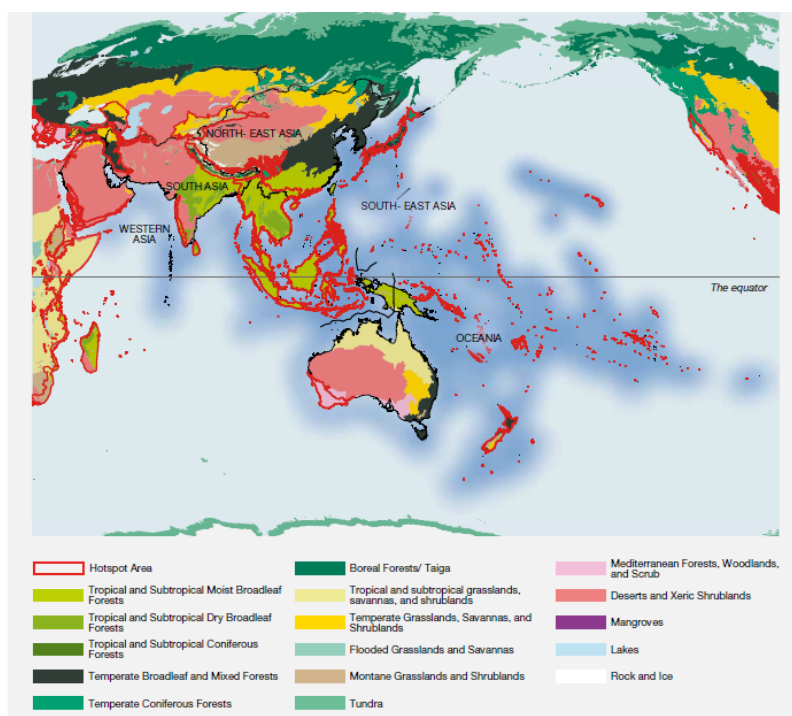
Sida's Helpdesk for Environment and Climate Change is a government agency collaboration between the Swedish University of Agricultural Sciences (SLU), University of Gothenburg (GU) and Sida to promote enhanced integration of environmental issues and perspectives in Swedish development cooperation.

Executive summary

The Asia-Pacific region is blessed with rich biodiversity

The Asia-Pacific region is one of the most diverse regions in the world in social, cultural, biological, climatic and geo-morphological terms. The region has the world's highest mountains and deepest ocean floors, as well as vast alluvial plains, coastal and arid landscapes, moreover, innumerable small and large islands. It hosts a high number of endemic¹ species and unique ecosystems of tremendous biological diversity, containing 17 of the 36 global biodiversity hotspots and 7 of the 17 megadiverse countries². It has the greatest marine diversity globally, with half of the world's largest islands and the longest and most diverse coral reef systems in the world and more than half of the world's remaining mangrove areas.

One reason explaining the tremendous biodiversity of the Asia and the Pacific is that it encompasses so many different ecoregions and biomes. It also contains four of the world's major bio-geographical realms (Australian, Indo-Malayan, Oceanian and Palearctic). These terrestrial realms contain dramatically different assemblages of plants, animals and globally important numbers of endemic³ species.



Major ecoregions and the five geographical subregions of the Asia-Pacific region as defined by IPBES.⁴

¹ Endemic species are plant and animal species that are found in a particular geographical region and nowhere else in the world.

² Ibid.

³ Endemism is the state of a species being native to a single defined geographic location, such as an island, state, nation, country or other defined zone; organisms that are indigenous to a place are not endemic to it if they are also found elsewhere

⁴ IPBES 2018



Golden langur. Asia harbors one third of the world's recognized biodiversity hotspots. Photo: IUCN

The marine region is also diverse and contains some globally outstanding areas, for example, the Southeast Asian coral reefs are the most diverse and endemic-rich on the planet. There are also important concentrations of endemism in the various islands of the region, ranging from Australia and New Zealand to the smaller archipelago regions in the Pacific Ocean.



Photo: IPBES

Nevertheless, biodiversity and ecosystem services are under pressure

The exceptional biodiversity in Asia and the Pacific continues to decline. In the last three decades, modernization and globalization in the Asia-Pacific region have markedly impacted lifestyles, consumption patterns, Indigenous and Local Knowledge (ILK) systems and cultures of local people and are having a profound effect on the demand for ecosystem services as the exceptional biodiversity in Asia and the Pacific continues to decline.

On the other hand, recent changes in this region together with rapidly economic growth and significant scientific and technological advances constitute new opportunities (not least through better access to and communication of information) for the sustainable development of regional

countries especially for the developing countries. The 2030 Agenda and new mechanisms for climate or development finance provide avenues for more investment in developing economies. Economic growth and infrastructure development are required for achieving a successful poverty alleviation in the region but need to be pursued in harmony with nature if they are to be sustainable. Many countries in the Asia-Pacific region are still facing persistent poverty, and so are seeking fast economic development through expansion of industries, agriculture and trade. However, agriculture intensification and production for global markets need not compromise the progress already made in forest restoration and protected area expansion. Better application of scientific knowledge and technology has the potential to improve food, water and energy security while reducing pressure on ecosystems in many countries in the region.

However, while waiting for this “paradigm shift” towards more sustainable policies on combating poverty and promoting economic growth; challenges remain for governments on the audacious endeavour to sustain biodiversity and ecosystem services in the Asia-Pacific region for the benefit of human well-being. Combinations of human-induced factors are a key driver of biodiversity loss.

Direct and indirect drivers acting synergistically are accelerating the loss of biodiversity and posing an increasing risk to sustaining the ecosystem services to people in the Asia-Pacific region, but there are opportunities to counter them. Direct drivers, such as unsustainable use, illegal trade in wildlife, conversion of habitats, invasive alien species, pollution and climate change, are combining with indirect drivers such as socioeconomic and demographic changes to create stress.

Some of the most important drivers are:

- Deforestation and forest degradation.
- Rapid growth in demand for wildlife products is fuelling unsustainable trade, with impacts inside and outside of the region.
- Invasive alien species create particular pressures on the oceanic islands.
- Marine ecosystems are vulnerable to growth in commercial and artisanal fisheries.
- The negative impacts of climate change on species and ecosystems are exacerbating the effects of other pressures on Asia and the Pacific’s biodiversity.
- Building of water infrastructure in the region’s great rivers is, when not carefully planned and executed, affecting freshwater ecosystem services, particularly inland fisheries, negatively.

Nonetheless, a number of important initiatives and responses to these threats have taken place in recent years and are increasingly benefitting sustaining of ecosystem services for human well-being and poverty alleviation. They provide hope for mitigating the impacts of the aforementioned drivers but the overall trends affecting biodiversity negatively are still strong.

- Protected area networks are increasing steadily with some countries in the region at the forefront of the designation of marine reserves.
- Interest is growing in trans-boundary collaboration for protecting areas of high biodiversity conservation value.

- Countries are increasingly mobilizing resources to implement their National Biodiversity Strategic Action Plans (NBSAPs) using schemes that had better recognize the values of biodiversity and ecosystem services.

There are many risks for human well-being related to biodiversity loss

In the Asia-Pacific region, ecological degradation has affected mainly the poor people especially in rural areas where poverty is intrinsically linked to the loss of biological resources⁵.

Poor people depend more on ecosystem services such as fuel woods, non-timber forest products, bush meats, and fish for their subsistence as they are less able to access or pay for alternative sources for their livelihoods.

In some developing Asia- Pacific countries (e.g. Vietnam, Indonesia and India), poor households depend on non-timber forest products (NTFPs) for more than 20 per cent of their income.⁶

A number of political frameworks are related to biodiversity restoration and preservation.

The Asia-Pacific countries region have accelerated and strengthened their environmental cooperation ever since the 1992 Rio Earth Summit. There are a great number of regional, subregional and trans-boundary initiatives alliances, and agreements that aim to achieve the many targets related to biodiversity conservation in the region.

The inception of so many initiatives has largely been influenced by the collective realization that the environmental impacts of socio-economic development (dam building, deforestation, overfishing and the like) in the region have far exceeded the capability of any individual country to handle.

Multitudes of actors active in the region are working on promoting sustainable management of biodiversity

Aside from the political frameworks that mostly are organised as intergovernmental state-to-state collaborations there are a great number of actors complementing these initiatives working on specific issues related to biodiversity. They include multilaterals like UN institutions and development banks, intergovernmental bodies and programs like the ASEAN Centre for Biodiversity⁷, and a multitude of NGOs working on a wide array of biodiversity sectors: forestry, freshwater, coastal management, indigenous peoples' rights, wildlife and the biodiversity/human rights nexus.

These actors play an important role in supporting the regional frameworks with expertise, platforms for experience sharing, and funding and in the case of the NGOs; build capacity among local communities and help make their voices heard by decision-makers on how to develop sustainable and equitable policies for biodiversity management. Many of the most important actors in this field in the region are partners to Sweden.

A new global biodiversity framework will be an important policy instrument in the region

In October 2010, the Convention on Biological Diversity (CBD) signed up to a 10-year framework, the Strategic Plan for Biodiversity 2011–2020. This represented a major step to ensure that by 2050

⁵ Squires 2014

⁶ IPBES 2018

⁷ <https://aseanbiodiversity.org/>

biodiversity would be ‘valued, conserved, restored and wisely used in a world where people live in harmony with nature’, according to the vision stated in the strategic plan.

Underpinning the plan were the so-called 20 Aichi targets⁸ aiming to articulate the specific areas of intervention to achieve a set of broad strategic goals — addressing the causes of biodiversity loss and promoting its sustainable use, safeguarding ecosystems, ensuring all would benefit from biodiversity and promoting implementation through participatory planning. The CBD referred to the targets as ambitious but achievable.



A new global biodiversity framework will be finalized at the CBD's COP 15 meeting in Kunming, China, in October this year. Photo: IISD

A decade later, in October 2020, signatories to the CBD were due to discuss progress towards the Aichi targets at the fifteenth Conference of the Parties (COP 15) in Kunming, China, but the meeting was postponed until October 2021 due to the impacts of the COVID-19 pandemic. As COP 15 to the CBD is also the gathering where the parties will agree on a post-2020 biodiversity framework, it is crucial for them to learn from past mistakes. Indeed, the parties have been working to define a new framework and a new set of targets, this time for 2030. Back in October 2019, in preparation for the COP, a revised draft of the new set of biodiversity targets was released.⁹

At the CBD COP 14 in Egypt 2018, it was agreed that regional and thematic consultation workshops would take place as a platform for the discussions on developing a “robust” post-2020 global biodiversity framework. Governments in the Asia Pacific answered the call and already in January 2019 met for a Regional Consultation Workshop in Nagoya, Japan. Representatives of the Parties to the Convention from the region, as well as relevant organizations, including CSOs, attended the workshop.

A report from the workshop is available at the CBD website¹⁰. It forms a comprehensive overview of perspectives and views by the region's stakeholders on how they wish the post-2020 global biodiversity framework should be developed to address the region's needs to sustain biodiversity and ecosystem services.

⁸ CBD 2011

⁹ CBD 2020

¹⁰ <https://www.cbd.int/conferences/post2020/post2020-ws-2019-01/documents>

The new strategic plan confirmed at the next CBD meeting will be an important policy instrument for governments and other actors in the region when it comes to setting national targets for biodiversity management and conservation. Each country's National Biodiversity Strategic Action plan (NBSAP) will be a significant tool in this endeavour.

Contents

Executive summary	ii
Definitions: Environment and Climate Change	ix
Introduction.....	1
1. Key characteristics of biodiversity in Asia and the Pacific.....	1
1.1. A brief description of sub-regional contexts	4
1.1.1. The Pacific.....	4
1.1.2. South East Asia	6
1.1.3. South Asia	7
2. The main drivers for biodiversity loss in the region	9
2.1. Main direct drivers	10
2.2. Main indirect drivers	15
3. What are the risks related to biodiversity loss?.....	18
4. A sample of legal/political frameworks/commitments related to biodiversity restoration and preservation.	23
4.1. Major regional biodiversity initiatives in the Asia-Pacific region.....	23
4.2. Some legal regional agreements and conventions	27
4.2.1. South Asia	27
4.2.2. Southeast Asia	27
4.2.3. The Pacific.....	27
4.3. NBSAPs – the foremost national instruments for management of biodiversity	28
4.3.1. A vast variety of national initiatives complementing the NBSAPs.....	30
5. Regional organisations and actors active in the region that could be of relevance for Swedish support to biodiversity management.	31
List of References	32

Definitions: Environment and Climate Change

- **Environment:** The concept has a wide coverage including natural resources, land use, biodiversity and ecosystem functions and services, and encompasses aspects related to climate change, resource depletion, environmental degradation and pollution. Climate change is included when environment is mentioned, even if it is not always explicitly expressed.
- **Climate change** is a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (UNFCCC, Article 1)
- **Environmental integration** (or environmental mainstreaming) refers to the systematic integration of environment into all domains. It is understood as a “strategy to make environment an integral dimension of the organisation’s design, implementation, monitoring and evaluation of development policies and programmes”¹¹. Sida’s view on environmental integration includes measures to identify and i) reduce negative impacts, ii) enhance opportunities and iii) reduce/manage environmental impacts on the sustainability of the contribution. Sida’s requirements on environmental integration is further detailed in Sida’s Green Toolbox.
- **A crosscutting issue** is an issue that is linked with, or related to, other concerns. Although sometimes seemingly unrelated, the crosscutting issue can be affected by, or influence the outcomes of, interventions in a different area or sector. The underlying perspective is that different parts of a system are interconnected. Environment is treated as a crosscutting issue that permeates sectors, projects, and activities, rather than being the main focus of the activities.
- **Direct environmental impacts:** impacts that derive directly from the organisation and its staff, and direct activities, e.g. travels, electricity consumption, procurement (e.g. office supplies, catering, cleaning supplies, etc.), waste, etc.
- **Indirect environmental impacts:** refer to impacts associated with the programs/projects, for instance support to capacity development, infrastructure development, natural resource management, advocacy, or other types of development cooperation.

¹¹ OECD DAC (2014)

Introduction

Sida's Helpdesk for Environment and Climate Change was commissioned by the Embassy of Sweden in Bangkok, on February 25th, 2021, to conduct a mapping of biodiversity issues in Asia and the Pacific.

The Helpdesk's mapping should cover:

- Key characteristics of biodiversity in Asia and the Pacific
- Key drivers of biodiversity loss in the region
- An analysis of risks related to biodiversity loss, with focus on risks to human rights and poverty reduction.
- A mapping (of national and) regional legal/political frameworks/commitments related to biodiversity restoration and preservation.
- A mapping of regional organisations/actors active in the region that could be of relevance for Swedish support to biodiversity restoration, preservation and its sustainable management.

The responsible officer at the Helpdesk was Göran Ek. The officer wishes to express his deep gratitude to the authors of the 2018 report of The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) *A regional assessment report on biodiversity and ecosystem services for Asia and the Pacific*¹². The report has been both a great inspiration for the structure of this study and the main part of the facts and analyses provided here originates from the findings of the IPBES contributors.

1. Key characteristics of biodiversity in Asia and the Pacific

Biodiversity is crucial to food security in the region

The 4.5 billion people¹³ living across the Asia-Pacific region are highly dependent on the diverse marine, aquatic and terrestrial biodiversity and ecosystem services in the region for their food, water, energy and health security.

In particular, most rural populations in the region are reliant on wild harvests from nature for their subsistence, income and energy needs, through forest enterprises, woodcutting, inland fisheries, honey collection and gathering fuelwood.

It is estimated that nearly 200 million people¹⁴ across the region directly depend on the forest for their non-timber forest products¹⁵, medicine, food and fuel, as well as other subsistence needs.

¹² IPBES 2018

¹³ IPBES 2018

¹⁴ Ibid.

¹⁵ Non-timber forest products (NTFPs) are useful foods, substances, materials and/or commodities obtained from forests other than timber. Harvest ranges from wild collection to farming. They typically include game animals, fur-bearers, nuts,

Agriculture provides much of the employment and nutrition of the region's communities. In addition, urban and suburban food production in farms, backyards, community gardens and rooftop farms can also make significant contributions to the urban food supply and biodiversity.



The Boon Rueang wetland forest in northern Thailand. Wetland forest provides food, medicine and valuable ecosystem services to the community, such as purifying water for drinking and agricultural use, limiting flooding, storing carbon, and replenishing groundwater.

Photo: RECOFTC

The Asia-Pacific region is particularly rich in marine and coastal biodiversity due to innumerable islands and an extensive coastline. The coastal ecosystems in the region are also a great provider of food security. Coral reefs, mangroves, seagrass¹⁶ beds and kelp forests are of critical ecological, cultural and economic importance in the Asia-Pacific region, providing a range of services, including food security, livelihoods and coastal protection.

They are key social-ecological systems supporting the livelihoods of hundreds of millions of people in the region and beyond, through vital and valuable ecosystem services, for example, coastal protection, fisheries and tourism.

All in all, the Asia-Pacific region's terrestrial, freshwater and marine ecosystems offer various goods directly — such as plants, fungi, and animals including fish — that individuals need in order to earn an income and secure a sustainable livelihood. Sustaining the viability of, and access to, various provisioning services, will contribute to the alleviation of poverty.

Many ecosystems important for livelihoods are under pressure but some promising signs are visible

The population of large wild mammals, especially some ungulates¹⁷ and carnivores¹⁸, and birds has *declined across the region mainly due to loss and degradation of forest ecosystems*. For example, in

seeds, berries, mushrooms, oils, sap, foliage, pollarding, medicinal plants, peat, mast, fuelwood, fish, insects, spices, and forage. Reads more in Corlett R 2017..

¹⁶ Seagrasses are so-named because most species have long green, grass-like leaves. They are often confused with seaweeds, but are actually more closely related to the flowering plants that you see on land. Kelp (Swedish "tång") a seaweed, on the other hand, is an algae.

¹⁷ Large mammals with hooves; threatened "flagship species" in the region include the Indian Rhinoceros and the forest-dwelling buffalo gaur. The equally vulnerable Asian Elephant are like their African cousins considered near-ungulates. They have toenails, not hooves.

¹⁸ "Meat eaters"= predators like the tiger and the Asian leopard subspecies

the lowland forests of Sundaland¹⁹ it is projected that 29 per cent of the bird species and 24 per cent of the mammals residing there are likely to become extinct in the coming decades if the current rate of forest loss continues²⁰. The reduction in faunal diversity could also lead to a decline in the population of large seeded animal-dispersed trees in tropical forests not only in Sundaland but also across the region that will have a measurable impact on many forest functions and services²¹.

However, owing to improved global efforts and enabling policies of the countries where they live, some of the charismatic larger species – like the tiger, Indian rhinoceros and Asian elephant - have performed better. In the near future, it might be possible to highlight the links between conservation of larger animals and benefits to society in the form of access to and provision of ecosystem services from protected areas for wildlife.

The tiger is a case in point; despite still being persecuted, it no longer faces extinction. The benefits from its improved status in India might be an inspiration for other countries in the region as the tiger is a flagship for conservation in India. Forty-seven tiger reserves cover 68 000 km², 2 per cent of the land area. In addition to their critical role in conservation, these areas provide important economic, social, cultural and spiritual benefits, and since 2006, tiger reserves have been required to have 'core' and 'buffer' areas, with the buffers intended to ensure the flow of ecosystem services to neighbouring communities.

A study of six of reserves chosen to represent the variety of environmental and economic situations found throughout the network used a selection of approaches to value the tangible and intangible ecosystem services.

The main services valued were gene-pool protection, provisioning of water and water purification services, employment for local communities, provision of habitat and refugia for wildlife, sequestration of carbon, provisioning of fodder in buffer areas, recreation value, biological control, cycling of nutrients, and, in the Sundarbans, fish nursery and provisioning, waste assimilation and moderation of cyclonic storms.

The study valued the flow of benefits from the individual tiger reserves from EUR 114 million to EUR 243 million per year, or between EUR 690 to EUR 2 620 per hectare per year. The study also valued stock – land, timber and carbon – and concluded that the reserves protect, and conserve stock valued from EUR 0.3 billion to EUR 9 billion. These values can be expected to increase because of increasing demand, greater scarcity and technological advances, which allow the exploitation of a wider range of biological materials and services²².

¹⁹ The biogeographical region consisting of Malaysia, Brunei and most of Indonesia.

²⁰ IPBES 2018.

²¹ Seed dispersal by large vertebrates like deer and elephants are important in both near-intact and degraded ecosystems. Seed dispersal services for many plant species are currently threatened by hunting, but, if this can be controlled, vertebrate eating plants and small trees (and then disposing of them further away with their manure) help maintain links in fragmented landscapes, facilitate movements in response to climate change, and aid the recovery of forests on abandoned agricultural land.

²² European Commission 2018

Overall, the case for seeing the large predators of Asia – tiger, leopard and the Asiatic lion²³ - as not mere charismatic tourist attractions but also vital in preserving and enhancing ecosystem services should be recognized.



An adult male chital. The Tiger's favorite prey.

Photo: R. Shankar Raman - Own work, CC BY-SA 4.0,

Additional pressures are also on the rise

Other pressures than habit degradation are also on the rise. There is a steady increase in the number and abundance of *invasive alien species*, impacting negatively native biodiversity, ecosystem functioning and productivity.

Of course, *climate change*, associated sea level rise, ocean warming, ocean acidification and extreme weather events are contributing to affect species, habitats and ecosystem structure and functions.

Finally, the increasing impact of *waste and pollution on terrestrial, freshwater and marine ecosystems*, is threatening the current and future health of nature and people in the Asia-Pacific region.

Overall, the rich biodiversity of the Asia-Pacific region contributes directly and indirectly to good quality of life through the provision of numerous ecosystem services. The sustainable management of these resources can help the world's most populous region improve its food, water, energy and environmental security.

1.1. A brief description of sub-regional contexts

1.1.1. The Pacific²⁴

For thousands of years, the people of the Pacific region have relied on Oceania's natural resources for their survival. The marine environment sustains them, and they depend on it for food, transport, traditional practices, and economic opportunity. Lands and forests of the Pacific islands have

²³ The Asiatic lion - *Panthera leo persicus* - once roamed much of Western Asia and the Middle East to northern India. The only population surviving today - since the turn of the 20th century - is restricted to Gir National Park and the surrounding areas in the Indian state of Gujarat.

²⁴ Adapted from <https://portals.iucn.org/library/sites/library/files/documents/RL-2017-001.pdf>

nurtured their inhabitants by providing food, fuel, and shelter. Indigenous cultures and their traditions over many generations have developed a rich heritage of stewardship over natural capital, of traditional management practices, and of knowledge. Due to the limited land areas, there has also been a long history of ecosystem modification and species extinction across the Pacific islands; this trend has accelerated with modern development pressures which are increasingly impacting on island ecosystems.



To better understand the status of marine turtles in the Pacific islands region, an assessment of their extinction risk in the region was commissioned by the Secretariat of the Regional Environment Programme (SPREP). The assessment is considered an essential step toward strengthening support for marine turtle conservation and management in Pacific Island nations. Photo: SPREP

The vital resources and ecosystems upon which Pacific islands depend for their sustenance and livelihoods are under increasing pressure. Foremost among the threats is climate change, a deeply troubling issue for the environmental, economic, and social viability of Pacific Island countries and territories. In the wake of climate change follow of higher temperatures, sea level rise, and increased risk of storm damage.

This is already having very real impacts on coastal and forest ecosystems, oceans, fresh water supplies, biodiversity, and indeed all aspects of life – particularly on communities in small, low-lying countries where sea level rise and changing weather patterns are creating social and economic disruption.

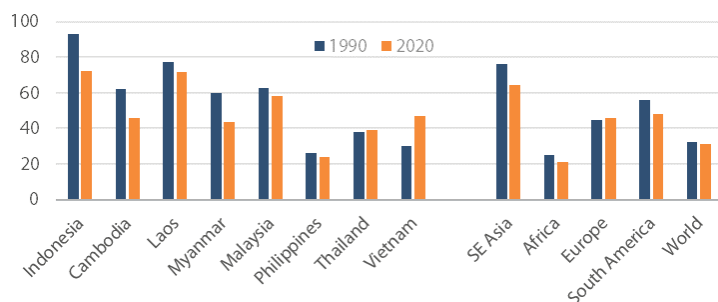
Increasing harvesting pressures on natural resources, destruction and modification of habitats and ecosystems in the quest for development, and severe reductions in species populations continue to threaten the integrity and health of the vulnerable natural systems on which all island life depends. Waste and pollution generated from an increasingly consumer-based way of life put ecosystems and human wellbeing at risk, the spread of chemicals is one example the spread of plastic pollution in the oceans is another.

The increasing pressures on Pacific habitats and species are expressed, *inter alia*, as proposed deep-sea mining, coastal development, nutrient loading, sedimentation, disease, invasive species, predator outbreaks, overfishing, destructive fishing, ocean acidification, marine noise and light pollution. ,

1.1.2. South East Asia²⁵

Southeast Asia is a known global hotspot of biodiversity and endemism, yet the region is also one of the most threatened by degradation of natural resources. Ecosystems across the region are endangered by an array of drivers, each of which increases the probability of extinction of species in a variety of ecosystems. These issues are symptomatic of the issues that face the global tropics; however, with around 4 billion people in the wider region and the associated pressures on biodiversity, this region may be under some of the greatest levels of threat for ecosystem services.

Deforestation rates in SE Asia are some of the highest globally²⁶; between 1990 and 2020, an area larger than Germany²⁷ was deforested.



Changes in forest cover 1990-2020 in SE Asia (percentage of land area covered by forest).

Source: European Parliament 2020.

The two worst affected countries were Indonesia and Cambodia, which lost one-fifth and one-quarter respectively additionally it has the highest rate of *mining* in the tropics, around the greatest number of *hydropower dams* under construction, and a consumption of species for *traditional medicines* that is a threat to biodiversity globally.

²⁵ Adapted from Hughes 2017

²⁶European Parliament 2020.

²⁷376 000 km²



Board members of community fishery organization in Kompong Chhnang province, Cambodia. The value of fishery products in the country is approximately US\$ 1.5 billion per year and it contributes 8-12 per cent to the national GDP.

Photo: Göran Ek

Tree-plantations and deforestation represent one of the most imminent threats, and some countries have already lost over half their original forest cover (i.e., the Philippines, parts of Indonesia), with projections of as much as 98 per cent loss for some regions in the coming decade. Hunting and wildlife trade represent a significant threat as demand stems not only for food, but also for medicine, for ornamentation, and as a status symbol.

Mining represents a frequently overlooked threat, as the Asian region is one of the greatest exporters of limestone and various minerals globally. The cost of this to biodiversity is not only through the direct loss of areas for mines, but also through the development of roads that further fragment the landscape, the leakage of heavy metals, and the destruction of limestone karsts²⁸ which represent global endemism hotspots²⁹.

1.1.3. South Asia³⁰

The main ecosystems of South Asia – the mountain ranges of the Himalayas and Hindukush, Deccan plateaus, the fertile Indo-Gangetic plain and coastal/marine areas - provide each immense ecosystem benefits and values to the world at large.

The *Himalaya and Hindu Kush Mountain ranges* separate the South Asian subcontinent from the rest of Asia covering India, Nepal and Bhutan. To the south of the mountain ranges of Himalayas is the 200-mile-wide fertile and *Indo-Gangetic plain* that harbors one of the richest and oldest agriculture

²⁸ Karst is a topography formed from the dissolution of soluble rocks such as limestone, dolomite, and gypsum. It is characterized by underground drainage systems with sinkholes and caves.

²⁹ Sites with a high number of endemic species

³⁰ Adapted from <https://www.iucn.org/commissions/commission-ecosystem-management/regions/south-asia>

practicing areas of the world. Indigenous crops and cropping patterns that can withstand climate variability and vulnerabilities are characteristic to this plain.

To the south of the Indo-Gangetic plain in India is *the Deccan plateau*, a relatively flat highland area that lies between the Western Ghat Mountains (another mega biodiversity hot spot) that separates the plateau from the coastline. Four countries in South Asia - India, Sri Lanka, Bangladesh, and Maldives - harbor extensive mangroves, coral reefs, and marine areas of the Indian Ocean that has world's most significant coastal and marine biodiversity. Andaman and Nicobar Islands are major island groups of the region.



India's wild tiger population has increased by more than 30% in four years (2015-19), raising hopes for the survival of the endangered species. Photo: WWF

South Asia is home to many traditional and indigenous communities dwelling in remote as well as sensitive and fragile ecosystems. These communities have helped in shaping conservation and management of natural resources of these sensitive and fragile ecosystems. Many of these sustainable practices are still relevant in a changing world.

The region has been facing increasing occurrence of natural hazards such as floods, droughts, cyclones, and tidal surges; deforestation and degradation; rapid changes in land-use; and increasing climate led variability and vulnerabilities. These natural events accelerated with man-made activities are going to have severe impacts on ecosystems in coming decades. Integrated management of mountains, river basins and coastal and marine environment is crucial to ensure the long-term sustainability of this sub-region.

2. The main drivers for biodiversity loss in the region³¹

Direct and indirect drivers³² acting synergistically are accelerating the loss of biodiversity and posing an increasing risk to the sustaining the ecosystem services to people in the Asia-Pacific region, but there are opportunities to counter them. *Direct drivers*, such as unsustainable use, illegal trade in wildlife, conversion of habitats, invasive alien species, pollution and climate change, are combining with *indirect drivers* such as socioeconomic and demographic changes to create stress.

The numerous drivers of threats to biodiversity in the region highlighted in this chapter are components in the complex interaction; between growing human populations, increasing wealth leading to greater demands for resources, and the pursuit of capital-intensive economic growth. Governments are unable to respond adequately to the pressures on natural resources because mechanisms for governance are weak, while the role of both communities and the private sector in driving sustainability is undermined by conflicts over rights and access.

IPBES' *Global Assessment Report on Biodiversity and Ecosystem Services*, published in 2019, made an effort to rank the *direct drivers* for biodiversity degradation *globally*³³. A summary of their analysis is presented in the figure below. In terrestrial and freshwater environments overall, *land use change* is the largest direct driving force, while it is *direct exploitation*³⁴ in marine environments. Both are strongly linked to food production. However, this should not *automatically* be interpreted as a ranking of to prioritize work on addressing drivers affecting ecosystems health. Focus must also be on what the most cost-effective action to implement is, and the probability of achieving a beneficial and permanent change. I.e. many other factors must be considered when addressing drivers and governments in the region have set out priority actions relevant to their context in the NBSAPs.³⁵

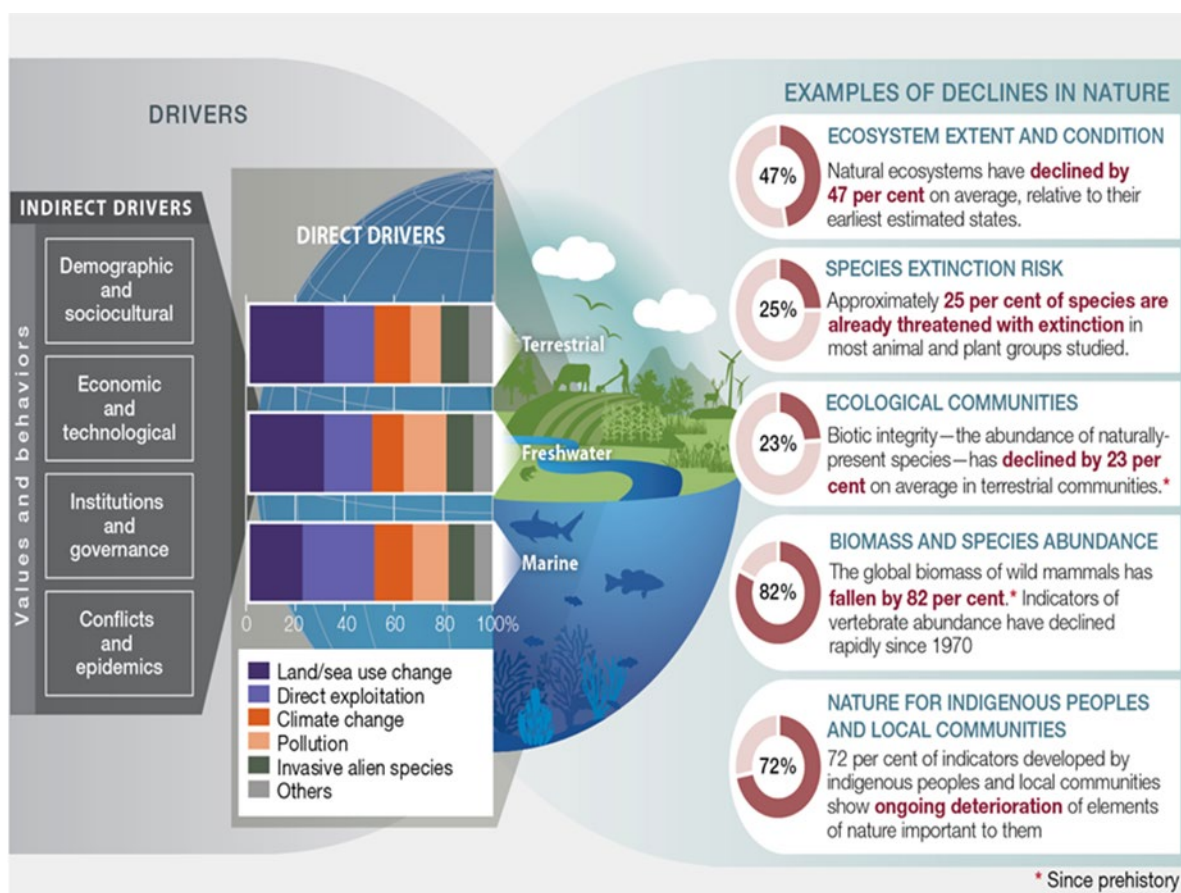
³¹ Text in section 2.1 and 2.2 is adapted from IPBES 2018 chapter 4.

³² A driver is any natural or human-induced factor that directly or indirectly causes a change in an ecosystem. A direct driver unequivocally influences ecosystem processes. An indirect driver operates more diffusely, by altering one or more direct drivers.

³³ There is no such ranking in the regional assessment for Asia-Pacific which was published one year earlier

³⁴ Overfishing, destruction of coral reefs and the like

³⁵ Pers comm from Torbjörn Ebenhard, director of the SLU Swedish Biodiversity Centre, CBM



Source: IBES 2019

2.1. Main direct drivers

Land-use and land-cover changes

Land-use and land-cover change brought about by rapid industrialization, urbanization and agricultural activities accelerate the degradation of land resources. The Asia-Pacific region is one of the most populated places on earth, resulting in fragmented land cover and degraded ecosystems in many eco-regions. The scale of deforestation, for example, has dramatically expanded in the last few decades, especially in South-East Asia. Land-use and land-cover change due to developing large-scale intensive agriculture (e.g. oil palm, rubber and sugarcane), and logging activities have become key drivers of habitat fragmentation or loss.



In Koh Kong Province, Cambodia, 456 families from three villages lost approximately 5,000 hectares of land in clearing operations and forced evictions to make way for a sugar plantation. A sad example of land use that do not respect human rights and the value of biodiversity for local livelihoods. Photo: EarthRights International

Land-use and land-cover change due to urbanization has also led to the massive loss of natural ecosystems and agricultural lands in developing Asia-Pacific countries. Overall, the Asia-Pacific region is experiencing some of the fastest urbanization rates with urban areas expanding faster than urban populations. By 2030, the total urban area is expected to triple whereas the urban populations are expected to nearly double³⁶. Such urban expansion is threatening several key biodiversity hotspots and contributing to carbon emissions associated with deforestation and changes in land-use and land cover.

Natural resource overexploitation

According to UN Environment, the Asia-Pacific region can be regarded as the single largest user of natural resources in the world³⁷. The UN partly explains this state of affairs by delving on how rising consumption among the new middle class can have major environmental impacts that need to be mitigated by various policy initiatives, such as a thorough implementation wain of the SDGs across the region. The global middle class is expanding rapidly, particularly in Asia's emerging economies (China and India). The global middle-class population is expected to grow from less than 2 billion today to nearly 5 billion within two decades, largely from Asian emerging economies.

The middle class is an important driver of economic growth due to its high-income elasticity for durable goods and services, and the OECD predicts³⁸ that its global spending may grow to USD 56

³⁶ Elmqvist et al., 2013

³⁷ UNEP 2016. However, this UN analysis does not cover the issue of separating Asian-Pacific nations ecological/carbon footprint between production for domestic consumption and production for exportation to the rest of the world. For example, consumption-based carbon emissions of China are 14 per cent lower than their production-based emissions and most of the countries in the region - whose economies are very « export-oriented. » - have similar discrepancies as regards carbon emissions and consumption of natural resources. See *How do CO₂ emissions compare when we adjust for trade?* <https://ourworldindata.org/consumption-based-co2> for a deeper analysis of this interesting topic.

³⁸ OECD 2010

trillion³⁹ by 2030 from USD 21 trillion in 2010 when OECD conducted this study. More than 80 per cent of this growth in demand is expected to come from Asia and the Pacific, putting heavier pressure on natural resources.

During the rapid urbanization and industrialization in the Asia-Pacific economies, the use of primary materials (metal ores and industrial minerals, fossil fuels and construction minerals) continues to grow. In addition to the well-known overexploitation of forest products, overgrazing, overfishing, energy utilization/generation – such as hydropower dams harming freshwater ecosystems and wetlands - and mining are also examples of direct drivers in this category.

Climate change

Due to the meagre cuts in global emissions of greenhouse gases, the Asia-Pacific region is likely to experience substantial near and long-term effects associated with climate change. Projected changes are considered significant stressors on biodiversity (from the individual organism to ecosystem level), both today and in the future rivalling human land use⁴⁰.

Ecosystems most at risk are freshwater, coastal and urban due to increasing risk of sea level rise, heat stress, flooding, and high population density exposure along the coastline.

Determining the impact of future climate on biodiversity, including ecosystem services and socio-economic systems, however, remains extremely challenging given the uncertainty around the magnitude and rate of projected changes for the large range of climate parameters⁴¹ and the diversity of species in the region. However, we could certainly project that climate change will amplify the impact of other drivers, e.g. we can already see how water levels in the lower Mekong are decreasing due massive dam building on the upstream and climate change-induced droughts (with less rainfall) provide an “add-on” to this grave situation.

Pollution

It is well known how the abundant *air pollution* in Asia in affects human health. Air pollution cause more than 6.5 million deaths annually, the bulk of which – 70 per cent – occurs in the Asia-Pacific region⁴². In addition to health hazards, air pollution is a threat to the region’s economy, food and water security, and climate systems.

Air pollutants may damage forests directly via damage to foliage and indirectly via the soil; increased nitrate leaching also enhances the risk of eutrophication of coastal marine areas and groundwater⁴³. Ozone has strong ecological effects, including species- and individual-specific effects on resource acquisition and root/crown architecture.⁴⁴

³⁹ I.e. 56 000 000 000 000 USD

⁴⁰ Scholes, 2016

⁴¹ Runtig et al., 2017

⁴² <https://www.unep.org/regions/asia-and-pacific/regional-initiatives/restoring-clean-air>

⁴³ UNEP 2016

⁴⁴ Matyssek & Sandermann, 2003



Air pollution in the region comes with many faces. Harvest time in Thailand's northern city of Udon Thani, a sugarcane heartland, and a farmer is collecting his crop the old-fashioned way, by setting fire to his fields. The flames strip away dry leaves and expose the stalks, where the sugar is. It is much more efficient than hacking at the plants with a knife, and for poor farmers it is the only method that is financially viable.

However, it comes with a massive environmental price tag. As the fields burn, plumes of black smoke head skyward. The

Thai government says this practice is one of the main reasons the country suffers air pollution that is double the World Health Organization's safe threshold and the UN environment programme says is to blame for around 50,000 deaths a year.

Photo: Mekong Eye News Digest #301

Water pollution caused mainly by domestic sewage, industrial effluents, and runoff from agricultural and mining activities, affects both water security and aquatic biodiversity. For instance, IPBES⁴⁵ reports that mussels from Cambodia, China, India, Indonesia, Japan, Korea, Malaysia, Philippines, and Vietnam are regularly contaminated with PCB, DDT and PBDE^{46s}, all of them very harmful biocides. In addition, excessive use of agricultural fertilizers means that most are lost through runoff or wastewater and is leading to eutrophication and acidification of water bodies and biodiversity loss in Asia. Water pollution associated with agriculture causes environmental damage and ecosystem degradation lost aquaculture and fisheries income, and increased treatment costs for drinking water and consequently causes severe human health impacts.

Lastly, rapid population growth, economic development, urbanization, industrialization, and intensive agriculture are leading to *soil pollution*.

Soil in many areas of the Asia-Pacific region is contaminated by municipal, hospital, radionuclides and industrial wastes; solid waste landfills and sewage sludge; agrochemicals, insecticides, herbicides, fungicides and other pesticides, mine tailings, organic pollutants and heavy metals.

⁴⁵ IPBES 2018

⁴⁶ Polybrominated Diphenyl Ethers a.k.a. brominated flame retardants or "Bromerade flamskyddsmedel" in Swedish. In some consumer products like textiles and computers, flame retardants are added to protect against rapid fires. When humans and animals are exposed to them in high doses reproduction systems can be negatively affected.

Increasing *plastic pollution* threatens the health of the regions' oceans. Nearly half of the world's plastic is produced in Asia and the Pacific⁴⁷. Plastic waste in the ocean could triple by 2050 unless transformative action is taken. Plastic represents a double burden for the ocean: the production process generates CO₂, which ends up being absorbed by the ocean, and the final plastic products affect the ocean in the form of pollution.

Invasive alien species

Invasive alien species affect native species through predation, competition and displacement through both direct and indirect disruption of ecosystem services such as soil stabilization, pollination and seed dispersal.

On the Pacific islands, they have been particularly impactful. For example, the brown tree snake has caused the extinction of the endemic birds, fruit bats and geckos and the reduction of bird-dispersal and reproduction of new trees by as much as 60—90 per cent in Guam.



The brown tree snake (*Boiga irregularis*), native to eastern and northern coastal Australia. An infamous invasive species on the Pacific islands.

Photo: Wikicommons CC BY-SA 2.0

French Polynesia, Rotuma, Hawaii and many other islands have experienced widespread extinction, and drastic population declines of native birds, land snails and land crabs due to invasive avian malaria, rats, mongooses, cats, pigs, goats, ants, predatory land snails, flatworms and habitat degradation.⁴⁸

As an example of the impact in raw economic terms, it is estimated that South-East Asia alone incurs losses of about \$33.5 billion annually due to invasive alien species in terms of damage to environment, human health, and agricultural production⁴⁹.

⁴⁷ <https://www.sustainability-times.com/environmental-protection/asia-pacific-nations-must-work-together-to-save-their-ocean/>

⁴⁸ IPBES 2018

⁴⁹ Nghiem et al., 2013

As to the root causes for the expansion of invasive alien species in the region the IPBES refers to studies⁵⁰ that highlight how the rapid urban and infrastructure expansion in Asia-Pacific provides the opportunities for invasive alien species due to the increasing rate of so-called “introduction events”⁵¹ and the disturbed areas for alien species established. Although not all introduced species become invasive to semi- and natural habitats within and surrounding urban ecosystems, many plant invaders originate from ornamental and greening materials introduced intentionally for aesthetic purposes. In addition, such introduced species can lead to intra- and inter-specific hybridization, which often proceeds to the evolution of invasiveness. Accidental introduction of non-native species in urban ecosystems also occurs frequently because cities are centres of trade, traffic and horticulture.

2.2. Main indirect drivers

The indirect drivers of change in ecosystems and their services described here influence the production and consumption of ecosystem services through the complicated interaction with direct drivers discussed above.

Demographic Drivers

The impact of *population growth* on biodiversity and ecosystem services is complex to analyze. For example, rapid population growth and poverty are often blamed as the main cause of deforestation whereas recent large-scale deforestation in South-East Asia is primarily driven by agricultural enterprises, accompanying road construction and migration enhancement. In addition, rising consumption and dietary changes are contributing to increased pressures on many ecosystems that could lead to changes in resilience and adaptation capacity of the ecosystems.⁵²

Economic Drivers

In last two decades rapid *economic growth* in the Asia-Pacific region has brought about many regional or global benefits but has also resulted in negative environmental effects including threats to regional biodiversity and ecosystem services⁵³.

Agricultural expansion and road construction, for example, have led to deforestation and habitat fragmentation in some previously remote areas; demands for vegetable oils for food, cosmetics and biofuels are expanding cash crops plantation in tropic Asia (e.g. oil palm in Indonesia and Malaysia).

Increasing consumption of marine proteins has brought about overexploitation of marine resources as have large-scale construction of hydroelectric development impacts on biodiversity in river basins such as South and South-East Asia.

⁵⁰ Like CBD 2012

⁵¹ When an alien specimen is introduced in a new environment e.g. a cargo ship emptying its ballast tank in a foreign port or an insect is brought to a new country hidden in a fruit in a traveller’s luggage

⁵² Romanelli et al., 2015

⁵³ Squires, 2014



Ho Chi Minh City by night. Rapid economic growth in the Asia-Pacific region has brought about many regional or global benefits but has also resulted in some negative environmental effects including threats to regional biodiversity and ecosystem services. Photo: Wikicommons

However, the continued economic growth and increasing international trade in the Asia-Pacific region also create conservation opportunities since the growing economic surplus is available for investment. With wealth and R&D investment increase in some emerging economics, the implementation of new technologies, and the fast popularization of internet social medias in the Asia-Pacific region, awareness on harnessing this growth towards conservation and sustainable development has been raised⁵⁴.

Socio-cultural Drivers

Societies across the Asia-Pacific region differ markedly from each other in terms of their structure and functioning, creating abundant cultural diversity. It has been estimated that about *70-80 per cent of the 370 million people in the world categorized as “indigenous” live in the Asia-Pacific region*⁵⁵. The amazing range of traditional and local cultures in the Asia-Pacific region has sprung from the contrasting landforms and climates of the region. The conservation of traditional and local knowledge and practice is important to not only the long-term survival of humankind but also the conservation of biodiversity in general.

Many of the “indigenous” communities in the Asia-Pacific region have traditionally coexisted in a sustainable way with their natural environments. Sacred natural sites often preserved important biological resources due to their spiritual significance to communities.

These sacred sites with rich biodiversity and strong interlinkage with cultural services have been well protected by local communities over long periods and have experienced low disturbance. However, increased demands on biological resources and changing social norms are undermining many sacred sites.

⁵⁴ IUCN 2017

⁵⁵ Dhir 2015

Overall, the region's economic growth and social development has markedly *changed the lifestyle and culture of most people*. Westernization of foods has reduced rice consumption, once essential in many Asian traditional diets, leading to significant decreases in paddy fields.

Globalization and the consequent global interconnectedness of the urban middle class is a driving force behind the convergence of diets. International and intra-national migration, with remittances sent to home countries, can have an obvious impact on land-use and the environment through *increased meat, dairy and material consumption*. Since the traditional food supply chain cannot meet the growing demand for diet diversity, Asian agriculture is changing from a traditional dominance of cereal crop production towards an increasingly commercialized and diversified production system. The consumption of meat and dairy products has increased rapidly in most of Asia-Pacific countries, which is changing the traditional rural industries and even socio-cultural values.

Science and Technology

The globalization of trade and commerce, rapid technological changes, emergence of new technologies, and the resulting emergence of a knowledge economy are bringing new challenges around the world, including in the Asia-Pacific region. Today's integrated and interlinked technological areas, namely information and communication technology (ICT), biotechnology, renewable energy, technology, nanotechnology and space technology.

The application of new technologies has contributed significantly to encouraging *borderless movement of products, services and labour*, expanding economic activities in environmentally friendly ways, and increasing the supply of food, energy, clean water, as well as connectivity of human society. On the other hand, while new technology can be a powerful force to improve the standard of living across the region, it comes at a cost, as new technological appliances can be burdensome to the environment. This damage may come from acquiring the resources to produce new technology⁵⁶, or from toxic byproducts of technological production⁵⁷. It can consist of environmentally harmful waste produced by the technology itself, or the castoff remains of obsolete technology from the widespread use of mobile phones across Asia.⁵⁸

Policies, Governance systems and Institutions

In the Asia-Pacific region, many positive trends have occurred in governance systems with the *Progressively strengthened environmental laws*. One reason for this positive development could be a "virtuous circle" of a growing prosperity in most countries leading to additional capacity and resources available to governments to address other needs than mere basic provisions like food security and expanding health systems. As a "spin-off" from the economic growth the emergence of a new middle class is often that is more environmentally conscious and can readily promote and accept greener lifestyles is also a factor as well as the rise of an eloquent and perceptive civil society.

⁵⁶ Like the rare earth minerals mined in China to provide batteries for electric vehicles and solar energy systems

⁵⁷ Emanating from the expanded use of washing machines in the region that create microplastic-laden wastewater that winds up in the ocean,

⁵⁸ Gellert A., 2017

Last but not least the major achievement of the Rio Summit in 1992 with the addition has been the adoption of the three globally important multilateral environment agreements (MEAs) collectively known as the Rio conventions⁵⁹ that the majority – if not all – of the region’s countries have ratified and strive to implement their policy recommendations

However, in most of the region’s low and middle-income countries, environmental policy formation and policy implementation are still following a top-down approach, but participatory approach with the involvement of local governments and civil society has gradually been adopted by more and more countries.

Nevertheless, a common problem faced by these countries is *the ineffectiveness of implementing environmental policy*. The reasons behind include financial shortages, overlap of administrative authorities, poor communication and lack of economic incentives to control pollution and restore degradation. A lack of enforcement by government agencies also exacerbates illegal logging, mining and overexploitation of natural resources.

In addition, *transboundary issues* such as air pollution – particularly in recent years - of a shared river basin – like the Mekong basin - or loss of habitat across the migration range of a species are challenging the conventional governance and institutional systems. A regional system of environmental management with landscape approach is thus essential to securing cooperative implementation of specific action programs within an effective institutional framework.

3. What are the risks related to biodiversity loss?

In the Asia-Pacific region, ecological degradation has affected mainly the poor people especially in rural areas where poverty is intrinsically linked to the loss of biological resources⁶⁰. Poor people depend more on ecosystem services such as fuel woods, non-timber forest products, bush meats, and fish for their subsistence as they are less able to access or pay for alternative sources for their livelihoods.

In some middle-income Asia- Pacific countries (e.g. Vietnam, Indonesia and India), poor households depend on non-timber forest products (NTFPs) for more than 20 per cent of their income.⁶¹

Vast inland fisheries are under pressure which impacts gender equality

Another example is the vast inland fisheries of South East Asia. Today 60 million people (12 million households) live in the Lower Mekong Basin, and 80 per cent rely directly on the river system for

⁵⁹ The Convention on Biological Diversity (CBD), The United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification (UNCCD)

⁶⁰ Squires 2014

⁶¹ IPBES 2018

their food and livelihoods. Local people for their own consumption produce most of the current capture fisheries. This serves as a diversified livelihood strategy that helps ensure food security, generate income, and acts as insurance against crop failure, providing an important safety net against hunger and deprivation.⁶²

Water infrastructure development in the great river basins of Asia – mostly by dams – for hydropower, irrigation and flood control has in many places affected the freshwater ecosystems negatively with often-severe consequences for food security and livelihoods in local communities. For example, to replace all freshwater fish annually harvested in the Lower Mekong Basin beef would require an additional 395,048 km² of land (equivalent to 65 per cent of the total area of the Mekong River basin) and a 63 per cent increase in water withdrawal. Replacing the fish with chicken would require the least additional land and water but still would require more than 36,000 km² of land and an 8 per cent increase in total water withdrawal from the Mekong River.⁶³



Fisherwomen harvest edible seaweed, an important ecosystem service from the Mekong River. Photo: Living Rivers Siam

In general, the contribution of women to fisheries is overlooked and although starting to be realized (e.g. women's contribution to fisheries value chain and fish marketing), the role of women as fishers has yet to be recognized and accepted. In inland fisheries women could be the main utilizers of certain wetland types (floodplains, ponds, swamps and nearshore fisheries in lakes).

The exclusion of gender considerations in the planning and implementation of management of freshwater biodiversity is still an issue of concern. Largely, technical issues have been given more importance than socio-cultural and socio-economic considerations.⁶⁴ When a water infrastructure is constructed on a freshwater ecosystem – such as a dam for electricity generation or to store water for irrigation - there are bound to be massive shifts in the ways in which men and women access and control resources across the river basin.

In some cases, women might gain access to markets and urban facilities that were not available to them prior to resettlement, thus enhancing their set of economic choices and activities. Positive gender impacts can result from the increased and improved supply of water and electricity in both urban and rural areas. However, having access to resources might not mean that women might have

⁶² Orr et al 2012.

⁶³ Lymer et al. 2016

⁶⁴ This issue is extensively discussed in Mehta L. & Srinivasan B 2000

control over them. For example, enhanced irrigation possibilities might not lead to women having more control over water if men control water pumps and irrigation channels.

A case in point are the inland fisheries of Southeast Asia where women work alongside men, notably in preserving and marketing fish which provide both an income and thus economic independence. When dam construction reduces the fish catch the men move to urban areas to find work and the women are left behind in their villages in order to care for the family and elderly, *thus losing both their income and independence*.⁶⁵ Without careful gender considerations on the social impacts of exploiting freshwater ecosystems, these investments can strengthen existing inequalities between men and women in the access to, and control over, resources and sometimes even create new ones.

Women's livelihoods are thus disproportionately impacted by unsustainable practices when it comes to developing water infrastructure.

Coastal and marine ecosystems in decline

Finally, the decline of the coastal and marine ecosystems might be perhaps the biggest threat to successful poverty alleviation in the region. The CBD reports that over three billion people globally depend on marine and coastal biodiversity for their livelihoods, and marine fisheries directly or indirectly employ over 200 million people⁶⁶. Fish continues to be one of the most-traded food commodities worldwide. It is especially important for developing countries, sometimes worth half the total value of their traded commodities.

In the Asia-Pacific region, fisheries provide food and income to more than 200 million people and 34 million people are engaged in commercial fishing.⁶⁷ 84 per cent of the global population engaged in the fisheries and aquaculture sector are from Asia. Thus, it is troubling that, according to the UN⁶⁸, a wide variety of indicators show that, despite the abovementioned vital importance of oceans, their health is very fragile in most countries in the Asia-Pacific region. Coastal and offshore fisheries play a critical role in the economic and social development of many countries in the Asia-Pacific region, but they are encountering severe threats from overfishing, climate change and environmental degradation.

Several factors contribute to the fragile situation of oceans here. One of the most prominent factors is *climate change*. For the countries in Asia and the Pacific, there has been an ongoing decrease in the pH-level of the water, rising water temperatures and increased loss of oxygen, which has further detrimental impacts on ecosystems – particularly the coral reefs - and humans.⁶⁹

A second factor is *marine pollution*; agricultural practices, coastal tourism, port and harbour developments, damming of rivers, urban development and construction. The third factor contributing to the deterioration of oceans is *overfishing*. This is happening mostly in areas close to large population centres, and for fishery products in demand from rapidly growing Asia-Pacific

⁶⁵ Barlow C. et al 2008

⁶⁶ CBD 2018

⁶⁷ FAO 2016

⁶⁸ Ibid.

⁶⁹ UNESCAP 2020

economies, such as sharks' fins. Overfishing is threatening ecological integrity and food security; it has adverse impacts on national economies, peoples' livelihoods – especially those of individual small-scale fishers in poor coastal communities in developing countries – food security, and the marine environment. It typically degrades the environment, inhibits stock rebuilding efforts and exacerbates the decline of many fisheries.

Human rights – a prerequisite for healthy ecosystems in the region

The decline of ecosystem health in many areas of the region is often a consequence of a lack of respect for human rights by governments that eludes local communities and CSO to participate freely and safely in decision-making processes regarding management of natural resources. Environmental human rights defenders are all too often harassed, threatened, and jailed by the region's governments.

Thus, major development projects like dams, logging and fishing concessions and construction of major infrastructure projects such as roads and ports are often implemented in ways that do not recognize the services local communities obtain from healthy ecosystems and would enable a more holistic and sustainable approach in development interventions.

The UN Human Rights Offices for South-East Asia and the Pacific has also highlighted how they during 2020 have witnessed a number of governments in the Asia-Pacific region adjusting or relaxing environmental laws and regulations during the global pandemic. In particular, this regards required consultations with local and indigenous communities, risking harmful environmental practices, reduced respect for human rights and above all, contravening the principles set out in the UN Guiding Principles on Business and Human Rights.⁷⁰

“The amendment of national environmental laws and regulations as governments respond to the economic impact of COVID-19 can have an adverse impact on affected communities, including on their ability to engage in meaningful participation in large scale development or extractive projects.”⁷¹ (Cynthia Veliko, South-East Asia Representative for the UN Human Rights Office in Bangkok.)

However, in 2015, the region adopted the *ASEAN Community Blueprint 2025*⁷², a set of policy frameworks that seek to advance the elements comprising a healthy environment: clean air, water and sanitation, a safe climate, sustainable food systems, non-toxic environments, and healthy ecosystems and biodiversity. At the same time, ASEAN will “strengthen democracy, good governance, the rule of law, promotion and protection of human rights and fundamental freedoms as well as combat corruption”.

The ASEAN initiative could pave the way for a more rights-based approach in decision-making processes on natural resource management for the benefit of sustained biodiversity and ecosystem services in member countries and, hopefully, would inspire other states in the region to follow suit.

⁷⁰ https://www.ohchr.org/documents/publications/guidingprinciplesbusinesshr_en.pdf

⁷¹ <https://bangkok.ohchr.org/governments-across-asia-pacific-must-step-up-efforts-to-protect-human-rights-in-the-environment-un-human-rights-offices-say/>

⁷²A.k.a *ASEAN 2025: Forging Ahead Together* <https://www.asean.org/storage/2015/12/ASEAN-2025-Forging-Ahead-Together-final.pdf>

Indigenous people at risk

The region is home to almost 75 per cent of the global population of 370 million indigenous people. Most of them have distinct but increasingly threatened traditions and culture and have been maintaining their livelihoods in harmony with nature and managing landscapes and seascapes for generations. Several countries have set up community-conserved areas that are managed and guided by indigenous and local knowledge and culture-based practices that have been shown to have a positive impact on the conservation of native biodiversity. In some countries, a number of community-based conservation initiatives supported through indigenous and local knowledge have helped in scaling up community-conserved areas.



Participants in a 2019 regional workshop in Community Based Monitoring and Information System (CBMIS) organized with the Asia Indigenous Peoples Pact (AIPP) and Forest Peoples Programme. Photo: Forest Peoples Programme

Indigenous and local communities have nurtured the bio-cultural diversity of their ancestral lands and waters, and commonly consider themselves as stewards and custodians of Nature. They apply their indigenous and local knowledge (ILK) to manage agricultural, forestry, fisheries and freshwater systems, among others, as a basis of their livelihoods and culture.

There is a growing recognition of the need to preserve these diverse ILK systems and cultural practices and build synergies with modern scientific knowledge for conserving nature and ensuring the sustainable provision of its contributions to people. This is because single knowledge systems are inadequate for addressing the emerging challenges due to the loss of biodiversity in the region. However, a substantial number of indigenous and local communities still live in extreme poverty, have poor access to natural resources and social services, and are losing their ILK and distinct cultures. Their communities' interests are seldom represented in national decision-making processes.

Better management of natural resources can mitigate pandemics

In the wake of the global Covid-19 pandemic the American think tank Brookings⁷³ have elaborated on how better management of biodiversity can reduce the likelihood of another viral “spillover” sweeping the world. Their thoughts are also relevant in an Asia-Pacific context. Brookings says that this requires a fundamental change in how we interact with nature, namely:

⁷³ <https://www.brookings.edu/research/preventing-pandemics-through-biodiversity-conservation-and-smart-wildlife-trade-regulation/>

- Minimizing human interface with wild animals and wild spaces; eliminating transmission points where the likelihood of viral spillover to humans is high, such as unhygienic commercial markets in wild animal meat and live animals.
- Better monitoring of the legal trade in wildlife; diligently suppressing illegal and unsustainable trade in wildlife; and conserving natural habitats.
- Conserving natural habitats and human encroachment on remaining natural habitats.
- Decision-making about pandemic prevention and nature conservation must be elevated to the highest levels of governments on a permanent basis.

They conclude their paper by emphasizing that what is needed is deep prevention based on a fundamental restructuring of how we treat nature, even after Covid-19 vaccines become widely available.

4. A sample of legal/political frameworks/commitments related to biodiversity restoration and preservation.

The IPBES report highlights how the Asia-Pacific countries region have accelerated and strengthened their environmental cooperation ever since the 1992 Rio Earth Summit. There are a great number of regional, subregional and trans-boundary initiatives alliances, and agreements that aim to achieve the many targets related to biodiversity conservation in the region.

The inception of so many initiatives has largely been influenced by the collective realization that the environmental impacts of socio-economic development (dam building, deforestation, overfishing and the like) in the region have far exceeded the capability of any individual country to handle.

The IPBES recognizes several initiatives as important on-going regional collaborative arrangements that promote cross-border co-operation for biodiversity conservation in the Asia-Pacific region. The next section provides a sample of these some additional initiatives collated from other sources.

4.1. Major regional biodiversity initiatives in the Asia-Pacific region.

The Heart of Borneo Initiative (HoB) ⁷⁴

The Heart of Borneo Initiative is a government-led and NGO-supported programme that was initiated by the governments of Brunei, Indonesia and Malaysia in 2007 and covers parts of the three countries. It aims to conserve and use sustainably the largest remaining rainforest in Asia, which contains highly biodiverse ecosystems with large carbon stocks. The initiative has developed multi-level plans and programs to enhance the sustainable use of timber, non-timber forest products, water, minerals and other natural resources.

⁷⁴ <http://www.heartofborneo.org/>

Critical Ecosystem Partnership Fund, CEPF⁷⁵

CEPF was founded in 2000 to address the degradation of biodiversity globally by empowering civil society in the South and in transitional economies to protect the world's biodiversity hotspots, some of the Earth's most biologically rich yet threatened terrestrial ecosystems. CEPF provides grants and technical assistance support conservation of species in the IUCN Red List of Threatened Species and strengthening the management and of Key Biodiversity Areas. Their website highlights that 3 500 communities in the biodiversity hotspots have benefited directly from CEPF-funded projects through improved access to clean water, improved land tenure and increased representation in decision-making processes. AFD, Conservation International, the EU, GEF, the Government of Japan and the World Bank fund CEPF.

One of their current programs concern support to what they call the "Indo-Burma Hotspot"⁷⁶ where they address emerging conservation issues; wildlife trade, hydropower development and expansion of agro-industry among them. These strategies are focused on the geographies where these conservation issues are most urgent, including the Mekong River and its major tributaries; Tonle Sap Lake; the limestone highlands along the Vietnam-China border and the mountains of Hainan Island; and Myanmar⁷⁷.

The Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF)⁷⁸

CTI-CFF is a regional initiative that covers extensive seascapes in Indonesia, Malaysia, the Philippines, Papua New Guinea, Solomon Islands and Timor-Leste. It aims to protect one of the richest areas in the world in terms of marine biodiversity, also known as the "Amazon of the Seas".

In 2016 CTI-CFF launched a 10-year plan (i.e. "CTI-CFF Regional Plan of Action"), whose key foci include the protection of critical seascapes, marine protected areas, and fisheries by applying ecosystem-based approaches.

The Biodiversity Conservation Corridors Initiative in the Greater Mekong Subregion (BCI)⁷⁹

BCI brings together the six Greater Mekong basin nations to work jointly for the conservation and sustainable management of the basins' resources. It is a major program of the Core Environment Program of the ADB. The intended outcome is to implement effective community-based natural resources management and climate resilience across the region.

⁷⁵ <https://www.cepf.net/about>

⁷⁶ Encompassing mainland South East Asia

⁷⁷ <https://www.cepf.net/our-work/biodiversity-hotspots/indo-burma>

⁷⁸ <http://www.coraltriangleinitiative.org>

⁷⁹ <http://www.gms-eoc.org/biodiversity-conservation-corridors-initiative>



Asian elephants refreshing themselves in a Lao PDR river. This highly vulnerable animal is a beneficiary of ADB's Biodiversity Conservation Corridors Initiative.

Photo: ADB

The Kailash Sacred Landscape Initiative (KSLCDI)⁸⁰

KSLCDI is a transboundary, multilateral programme established in 2010 between China, India and Nepal. The program aims to achieve the sustainable conservation of critical ecosystems, wildlife habitats and key biodiversity areas in the central Himalayan region. At the same time, it aims to promote sustainable development, increase the resilience of communities against climate change, and protect cultural bonds among the three countries. Swedish partner ICIMOD facilitates KSLCDI, with the support of designated national bodies.

Asia Protected Areas Partnership (APAP)⁸¹

APAP brings together national institutions from 12 Asian countries (i.e. Bangladesh, Bhutan, Cambodia, India, Japan, Mongolia, Myanmar, Nepal, Pakistan, South Korea, Sri Lanka, and Vietnam). The Partnership aims to promote collaboration, co-operation, and sharing of best practices and innovative solutions for Asia's protected areas. APAP is co-chaired by Japan and IUCN Asia Regional Office and offers Country Membership and Associate Membership to other relevant institutions such as NGOs. It supports capacity building, training and knowledge exchange among its members.

Pacific Oceanscape⁸²

23 Pacific Island nations and territories endorsed Pacific Oceanscape in 2010. It is a framework that aims to promote the conservation and sustainable management of a vast marine protected area shared between the participating nations and territories. The overall goal is to foster regional cooperation for increasing the health and well-being of ocean and island populations.

South Asia Co-operative Environment Programme (SACEP)⁸³

SACEP's mission is to promote regional co-operation in South Asia. In the field of environment, and on issues of economic and social development which also impinge on the environment and vice

⁸⁰ <http://www.icimod.org/?q=9456>

⁸¹ <http://www.asiaprotectedareaspartnership.org>

⁸² <http://www.conservation.org/where/Pages/pacific-oceanscape.aspx>

⁸³ <http://www.sacep.org/about-us>

versa; to support conservation and management of natural resources of the region and to work closely with all national, regional, and international institutions.

The ASEAN Centre for Biodiversity (ACB)

ACB was established in 2005. An intergovernmental organization facilitates cooperation and coordination among the ten ASEAN Member States and with regional and international organizations on the conservation and sustainable use of biological diversity, and the fair and equitable sharing of benefits arising from the use of such natural treasures⁸⁴. ACB has an ongoing collaboration with the Sida-funded Swedish Biodiversity Centre (SwedBio)⁸⁵.

Mekong River Commission (MRC)⁸⁶

The MRC is an intergovernmental organisation for regional dialogue and cooperation on water resources management between the countries⁸⁷ in the Lower Mekong River Basin (LMB). The organisation serves as a regional platform for water diplomacy and a knowledge hub of water resources management for the sustainable development of the region. Although not primarily focused on biodiversity the MRC plays an important role in sharing knowledge, data and understanding among member countries on the importance of fostering sustainable management and development of fisheries and aquatic resources in the basin. MRC has been a long –term partner to Sweden in the region.



Sweden has supported the Mekong River Commission since it was founded. The MRC is trying to strike a balance between the development and protection of the Mekong River Photo: MRC

Secretariat of the Pacific Regional Environment Programme (SPREP)⁸⁸

SPREP is the regional organisation established by the governments and administrations of the Pacific charged with protecting and managing the environment and natural resources of the Pacific. The core priorities and focus of SPREP are in the areas of climate change resilience, island and ocean ecosystems, effective waste management and pollution control, environmental governance.

⁸⁴ GIZ is a major donor to the Centre <https://www.giz.de/en/worldwide/75795.html>

⁸⁵ <https://swed.bio/collaborative-programme/long-term-partners/asean-center-for-biodiversity/>

⁸⁶ <https://www.mrcmekong.org/>

⁸⁷ Lao PDR, Thailand, Cambodia and Vietnam

⁸⁸ <https://www.sprep.org/about-us>

Mangroves for the Future, MFF⁸⁹

A previously Sweden-funded initiative spanning eleven countries in South and Southeast Asia.

4.2. Some legal regional agreements and conventions**4.2.1. South Asia****SAARC⁹⁰ Convention on Cooperation on Environment⁹¹**

The “SAARC Convention on Cooperation on Environment” was signed during the sixteenth summit of the Association. The Convention has been ratified by all member states and entered into force with effect from 23 October 2013. The Convention identifies 19 areas for cooperation in the field of environment and sustainable development through exchange of best practices and knowledge, capacity building and transfer of eco-friendly technology in a wide range of areas related to the environment. The implementation of the Convention has been entrusted to a Governing Council, comprising of the Environment Ministers of member states.

4.2.2. Southeast Asia**Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin**

Often referred to as “the Mekong agreement” it was signed in 1995 by the countries of the Lower Mekong Basin. Its purpose is to enable an equitable sharing and management of the resources of the river as related freshwater ecosystem services are natural assets of immense value to all the riparian countries for the economic and social well-being and living standards of their peoples.

Partnerships in Environmental Management for the Seas of East Asia (PEMSEA)⁹²

PEMSEA was established in 2006 as the regional coordinating mechanism for the implementation the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA)⁹³. Its purpose is to promote integrated coastal management for countries in East and Southeast Asia.⁹⁴The strategy includes measures to address issues related to biodiversity protection, conservation and rehabilitation, enhancement of freshwater and marine water quality as well as equitable and sustainable fisheries. UNDP and GEF are the main donors.

4.2.3. The Pacific

A number of regional initiatives have been developed in the Pacific area in the field of transboundary and migratory fisheries resource management, so-called Regional Fisheries Management Organizations (RFMOs). One example relevant for Sweden’s engagement is the Western & Central Pacific Fisheries Commission⁹⁵ (WCPFC) for tunas⁹⁶. Other marine biodiversity-related policies such as marine habitat protection, marine pollution or marine debris, climate change and acidification,

⁸⁹ <http://www.mangrovesforthefuture.org/>

⁹⁰ The South Asian Association for Regional Cooperation

⁹¹ <https://www.saarc-sec.org/index.php/areas-of-cooperation/environment-natural-disasters-biotechnology>

⁹² <http://www.pemsea.org/about-pemsea>

⁹³ <http://pemsea.org/our-work/regional-marine-strategy>

⁹⁴ PEMSEA’s name is somewhat misleading as several South East Asian countries are members including Cambodia, Vietnam and Malaysia

⁹⁵ <https://www.wcpfc.int/home>

⁹⁶ There are also a number of initiatives dealing with fisheries conservation in the North Pacific i.e. mostly concerning Russia, Japan, the USA and Republic of Korea.

invasive species, etc., are also regionally addressed in the Asia- Pacific region such as the Pacific Island Regional Ocean Policy ⁹⁷(PIROP).

Incidentally, the Pacific Islands Forum⁹⁸, founded in 1971 and comprising 18 member states across the Pacific describes itself as the “region’s premier political and economic policy organisation⁹⁹. Thus, it would be expected that it also pursues policies for sustaining biodiversity and ecosystem services of importance for its members that mostly are dependent on natural resources for their prosperity. The organization has issued a “Pacific Roadmap for Sustainable Development”¹⁰⁰ stating the importance of sustainably using and protecting Pacific natural resources for current and future generations but do not elaborate further on this endeavor.

4.3. NBSAPs – the foremost national instruments for management of biodiversity

The major national instruments for management of biodiversity in the region are each country’s National Biodiversity Strategies and Action Plan (NBSAP). They are the principal instruments for implementing the Convention of Biological Diversity (CBD) at the national level. 35 countries out of the 62 nation states in the Asia-Pacific region had developed NBSAPs by 2010.

After the CBD’s Strategic Plan for biodiversity 2011-2020 was adopted at the tenth meeting of CBD - COP 10 - in Nagoya, Japan in 2010, thirteen Asian countries have submitted a NBSAP, with three under development, which is considered a considerable progress towards according to the IPBES assessment.¹⁰¹ All CBD parties in the Asia-Pacific region were projected to complete the formulation of NBSAPs by 2020¹⁰².

NBSAPs can be an important means to ensure that biodiversity considerations are in the mainstream of decision-making at national level.

⁹⁷ <http://macbio-pacific.info/wp-content/uploads/2017/08/Pacific-Ocean-Policy.pdf>

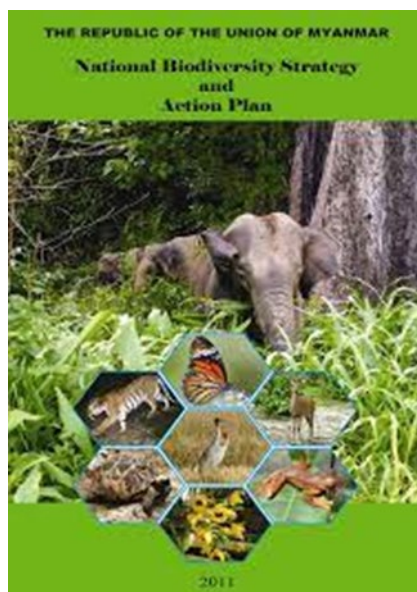
⁹⁸ <https://www.forumsec.org/who-we-arepacific-islands-forum/>

⁹⁹ Ibid.

¹⁰⁰ In 2017. <https://www.forumsec.org/wp-content/uploads/2018/10/The-Pacific-Roadmap-for-Sustainable-Development.pdf>

¹⁰¹ IPBES 2018

¹⁰² For information on which countries in the region have developed a NBSAP go to <https://www.cbd.int/nbsap/search/>



Cover of Myanmar's NBSAP.

At the policy level, many countries in the Asia-Pacific region have made progress in revising and updating their NBSAPs and developing legal instruments to incorporate the new challenges and meet the obligations under the CBD and other biodiversity-related conventions.

However, effective implementation of NBSAPs remains a challenge. The main reason is the limited capacity and knowledge to initiate and implement actions to address these challenges. At the same time, lack of willingness among the policymakers, planners, and field managers to utilize the traditional knowledge available among the indigenous and local communities for managing the biodiversity resources sustainably remains a significant issue. Capacity development needs will have to be addressed at three levels - national, provincial and local.

There is also limited knowledge on how ecosystem services contribute to national economic growth, employment, and prosperity of the nations, and the risks associated with loss of these services. Therefore, it is important to assess and understand how countries and regions can benefit from the region's abundant biodiversity with the help of the NBSAPs, and to guide policymaking efforts. However, there is no regional body that supports NBSAP development and implementation as a core part of its mandate.

ASEAN Centre for Biodiversity offers some related training and support. IUCN has provided technical support with NBSAP development in a number of countries, including Lao PDR, Myanmar and Sri Lanka; IUCN is also assisting Vietnam with its current NBSAP revision¹⁰³. The UNEP-World Conservation Monitoring Centre¹⁰⁴ provides capacity building on the development and use of NBSAP indicators.

¹⁰³ Scott Perkin, IUCN Asia Regional Office pers comm.

¹⁰⁴ <https://www.unep-wcmc.org/>

One example of a Swedish partner country that has developed an NBSAP¹⁰⁵ is Myanmar. In the introduction to the plan, the government states that they trust that the NBSAP provides a comprehensive framework for planning biodiversity conservation, management and utilization in a sustainable manner, as well as “to ensure the long term survival of Myanmar’s rich biodiversity”.



Myanmar leopard with cub. The country’s rich biodiversity is managed with the help of an ambitious NBSAP. Photo: CBD

4.3.1. A vast variety of national initiatives complementing the NBSAPs

Most environmental policies and legislation in the Asia-Pacific countries cover protection and conservation of biodiversity and ecosystem services such as protection of wildlife. While laws and policies for environment cover many terrestrial (i.e. urban and semi-urban, agro-ecosystems, grassland and savannah, forest and woodland, alpine, deserts and semi-deserts) as well as inland freshwater and wetland ecosystems, many countries also have those related to specific sectors due their importance in the Asia- Pacific economies from their ecosystem services such as:

- Urban environment/“Green cities”
- Forestry
- Agro-forestry
- Agriculture
- Bioenergy
- Coastal/Marine
- Inland wetlands

Due to constraints of space, it is not possible to cover even a sample of the vast variety of national laws and regulations, however comprehensive overviews can be found in other recent (and peer-reviewed) publications.¹⁰⁶

¹⁰⁵ Myanmar’s NBSAP can be downloaded at <https://www.cbd.int/doc/world/mm/mm-nbsap-01-en.pdf>

¹⁰⁶ E.g IPBES 2018 chapter 6.2.2

5. Regional organisations and actors active in the region that could be of relevance for Swedish support to biodiversity management.

The list of organisations and actors in chapter 5 can be accessed by contacting the Helpdesk at: sidaenvironmenthelpdesk@slu.se

List of References

- ADB (2017). *Greater Mekong Subregion core environment program strategic framework and action plan 2018–2022*
- Barlow, Chris & Baran, Eric & Halls, Ashley & Kshatriya, Mrigesh. (2008). *How much of the Mekong fish catch is at risk from mainstream dam development?*. Catch and Culture. 14. Mekong River Commission
- CBD (2011). *Strategic Plan for Biodiversity 2011–2020 and the Aichi Targets*
<https://www.cbd.int/doc/strategic-plan/2011-2020/Aichi-Targets-EN.pdf>
- CBD (2012). *Cities and Biodiversity Outlook*.
- CBD (2020). *Update of The Zero Draft Of The Post-2020 Global Biodiversity Framework*
<https://www.cbd.int/doc/c/3064/749a/0f65ac7f9def86707f4eaefa/post2020-prep-02-01-en.pdf>
- Corlett, R.. (2017). *Frugivory and seed dispersal by vertebrates in tropical and subtropical Asia: An update*. Global Ecology and Conservation. 11. 1-22
- Elmqvist, T., Fragkias, M., Goodness, J., Güneralp, B., Marcotullio, P.J., McDonald, R. I., Parnell, S., Schewenius, M., Sendstad, M., Seto, K. C., & Wilkinson, C. (Eds.). (2013). *Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities: A Global Assessment*. Dordrecht: Springer Netherlands.
<https://doi.org/10.1007/978-94-007-7088-1>
- European Commission (2018). *Larger than tigers - Inputs for a strategic approach to biodiversity conservation in Asia - Synthesis report*
https://ec.europa.eu/international-partnerships/system/files/study-larger-than-tigers-synthesis-asia-2018_en.pdf
- European Parliament (2020). *Forests in south-east Asia - Can they be saved?*. FAO (2016). *The State of World Fisheries and Aquaculture 2016. Contributing to Food Security and Nutrition for all*. Rome:
- Gellert A. (2017). *Technological Advancement and the Effect on the Ecosystem*. Nature.
<http://sciencing.com/technological-advancementeffect-ecosystem-23107.html>
- Hughes A. C. (2017). *Understanding the drivers of Southeast Asian biodiversity loss*
 Ecoshpere, Volume 8, Issue 1 January 2017.
- The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (2018): *The IPBES regional assessment report on biodiversity and ecosystem services for Asia and the Pacific*. Karki, M., Senaratna Sellamuttu, S., Okayasu, S., and Suzuki, W. (eds). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany.
- IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pages.
<https://doi.org/10.5281/zenodo.3553579>

Lymer, David & Teillard, Félix & Opio, Carolyn & Bartley, Devin. (2016). *Freshwater fisheries harvest replacement estimates (land and water) for protein and the micronutrients contribution in the lower Mekong River basin and related countries*. In book: *Freshwater, fish, and the future: proceedings of the global cross-sectoral conference* (pp.169-182) Publisher: American Fisheries Society, Bethesda, Maryland

Matyssek, R., & Sandermann, H.(2003). *Impact of ozone on trees: an ecophysiological perspective*. *Progress in Botany*, 64

Mehta L., Srinivasan B (2000). *Balancing Pains and Gains. A Perspective Paper on Gender and Large Dams*. WCD Thematic Review 1.1 (b). World Commission on Dams Secretariat

OECD (2010). *The emerging middle class in developing countries*. OECD Development Centre. Working Paper No. 285 <https://www.oecd.org/dev/44457738.pdf>

Runting, R. K., Bryan, B. A., Dee, L. E., Maseyk, F. J. F., Mandle, L., Hamel, P., Wilson, K. A., Yetka, K., Possingham, H. P., & Rhodes, J. R. (2017). *Incorporating climate change into ecosystem service assessments and decisions: a review*. *Global Change Biology*, 23(1), <https://doi.org/10.1111/gcb.13457>

Scholes, R. J. (2016). *Climate change and ecosystem services*. *Wiley Interdisciplinary Reviews: Climate Change*, 7(4), <https://doi.org/10.1002/wcc.404>

Squires, D. (2014). Biodiversity Conservation in Asia. *Asia & the Pacific Policy Studies*, 1(1), 144–159. <https://doi.org/10.1002/app5.13>

UNEP. (2016). *GEO-6 Regional Assessment for Asia and the Pacific*. Nairobi, Kenya.

Retrieved from <http://web.unep.org/geo-6-global-environment-outlook-regionalassessment- asia-and-pacific>

UNESCAP (2020). *Changing Sails: Accelerating Regional Actions for Sustainable Oceans in Asia and the Pacific*