POLICY & INSTITUTIONAL REVIEW INTEGRATED REPORT

BIOFIN
THE BIODIVERSITY FINANCE INITIATIVE

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ABBREVIATIONS

ASEAN

ASSOCIATION OF SOUTHEAST ASIAN NATIONS

BAAC

BANK FOR AGRICULTURE AND AGRICULTURAL COOPERATIVES

BEDO

BIODIVERSITY-BASED ECONOMY DEVELOPMENT OFFICE (PUBLIC ORGANIZATION)

BIOFIN

THE BIODIVERSITY FINANCE INITIATIVE

BMR

BANGKOK METROPOLITAN REGION

CBD

CONVENTION ON BIOLOGICAL DIVERSITY

CBI

CITY BIODIVERSITY INDEX

CITES

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES OF WILD FAUNA AND FLORA

CSR

CORPORATE SOCIAL RESPONSIBILITY

DMCR

DEPARTMENT OF MARINE AND COASTAL RESOURCES

DNP

DEPARTMENT OF NATIONAL PARKS, WILDLIFE AND PLANT CONSERVATION

DOF

DEPARTMENT OF FISHERIES

ABBREVIATIONS

EIA

ENVIRONMENTAL IMPACT ASSESSMENT

IUU

ILLEGAL, UNREPORTED AND UNREGULATED FISHING

MEA

MILLENNIUM ECOSYSTEM ASSESSMENT

MNP

MARINE NATIONAL PARK

MOAC

MINISTRY OF AGRICULTURE AND COOPERATIVES

MONRE

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT

NBSAP

NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

NESDB

NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT BOARD

ONEP

OFFICE OF NATURAL RESOURCES AND ENVIRONMENTAL POLICY AND PLANNING

PES

PAYMENTS FOR ECOSYSTEM SERVICES

PCD

POLLUTION CONTROL DEPARTMENT

RAMSAR

RAMSAR CONVENTION ON WETLAND OF INTERNATIONAL IMPORTANCE ESPECIALLY AS WATERFOWL HABITAT

ABBREVIATIONS

RFD

ROYAL FOREST DEPARTMENT

THB

THAI BAHT (THE CURRENCY OF THAILAND)

TISTR

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH

UNDP

UNITED NATIONS DEVELOPMENT PROGRAMME

UNFCCC

UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

WSSD

WORLD SUMMIT ON SUSTAINABLE DEVELOPMENT

BIODIVERSITY

Biodiversity is the variety of life on earth including plants, animals, and microorganisms, which refers to diversity within species, between species, and of ecosystems.

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EXECUTIVE SUMMARY

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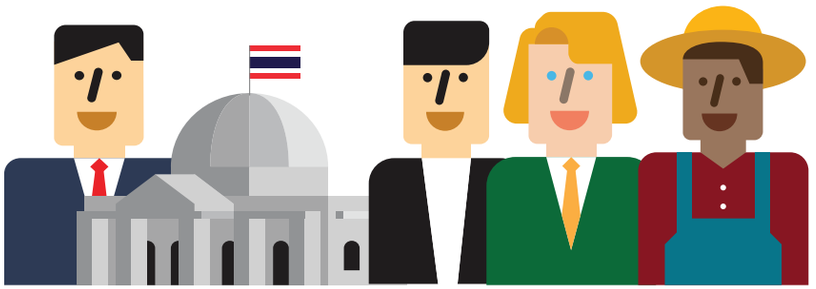


EXECUTIVE SUMMARY

This Policy and Institutional Review (PIR)–Thailand, is prepared as part of the Biodiversity Finance Initiative (BIOFIN). BIOFIN was launched in 2012 by the United Nations Development Programme (UNDP) as a new global partnership seeking to address the biodiversity finance challenge in a comprehensive and systematic manner. It aims to enable countries to construct a sound business case for increased investment in the sustainable and equitable management, protection and restoration of biodiversity and ecosystems. For Thailand, the BIOFIN has been launched in June 2014 to support the Royal Thai Government in successfully achieving its national biodiversity targets. The Initiative includes a variety of finance solutions, including resource mobilization from the public and private sector, better delivery of financing, reducing future costs and realigning expenditures.

With its many varied landscapes and climates, Thailand enjoys an exceptionally high level of biodiversity. The numerous benefits of this natural wealth remain undervalued, however, the contributions of biodiversity to the country's socio-economic well-being are not widely recognised. Thus, biodiversity and ecosystem services are being degraded like never before. In Thailand, ecosystem changes have resulted in a significant decline in biodiversity. However, Thai policymakers are beginning to understand the crucial role of biodiversity in socioeconomic development. Yet without a paradigm shift in how Thailand approaches development –which incorporates the economic value, scientific data and financial benefits of biodiversity– the degradation stands to get worse.

By conserving biodiversity and ecosystems, we are retaining the capacity of the planet to sustain our prosperity. Investing in the well-being of our planet is undoubtedly a worthwhile investment. However, there is inadequate investment in biodiversity worldwide. Insufficient finance spent on biodiversity is a problem in both developed and developing countries and is holding back our achievement of both the Convention on Biological Diversity's (CBD) Strategic Plan and the Sustainable Development Goals.

In this regard, this PIR assesses the policy and institutional context for biodiversity management in Thailand. It provides analysis to support the development of biodiversity policies and institutional roles that are both economically efficient and environmentally effective for Thailand. Looking forward, in light of the biodiversity finance challenge, it also recommends a set of possible finance solutions, which serve to reinforce the role of biodiversity in Thailand's socioeconomic development, and in the process creates incentives for both private and public actors to sustainably manage biodiversity.

Thailand's vision for biodiversity

First and foremost, policies and institutional arrangements in Thailand are built around the country's National Economic and Social Development Plans. In terms of biodiversity governance, Thailand's National Biodiversity Strategy and Action Plan (NBSAP) is the principle instrument for implementing the country's vision for biodiversity. To this end, this report examines the relevance of the NBSAP– notably: its articulation in specific plans such as the National Economic and Social Development Board (NESDP) strategy that contains a vision for Thailand's terrestrial ecosystem, and the Department of Marine and Coastal Resources (DMCR) roadmap that provides guidance for the marine and coastal ecosystem.

This report identifies more than 60 agencies in Thailand, which have mandates and functions related to biodiversity resources utilization and conservation. These agencies are mainly government agencies, although several non-government agencies, academic institutions and private companies also carry out work, which relates to biodiversity. With such a large number of agencies involved, some agencies tend to have much more direct linkages with biodiversity resources while others have indirect or minimal linkages.

Historically, although efforts to conserve natural resources have been discussed in Thailand since the 1980s, such attempts did not materialize until the turn of this century. In recent years, a major overhaul in the Thai ministerial structure has seen several government agencies restructured and new ones established to specifically address conservation. Given this context, three issues pertaining to institutional arrangements are examined in this report:

1. the role of public vs. private agencies,
2. the role of central government vs. local government,
3. resource conservation agencies vs. resource utilization agencies.

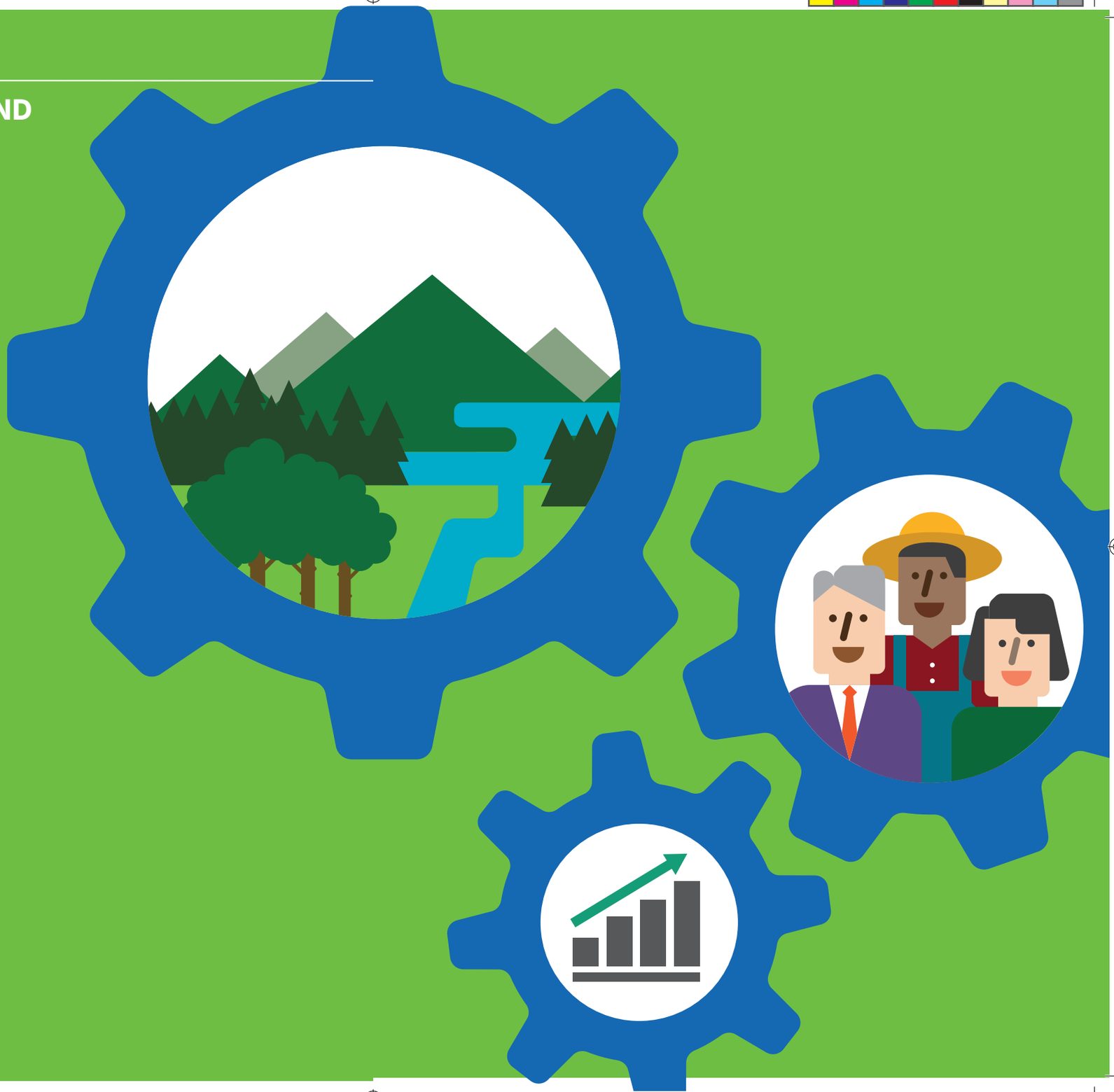
Key sector findings and recommendations for policymakers

The PIR is structured around four main ecosystems in Thailand: (i) terrestrial ecosystem, (ii) wetland ecosystem, (iii) coastal and marine ecosystem, and finally, (iv) urban ecosystem. In each of the four main ecosystems, the report reviews the key sectoral practices, policies and economic drivers that are contributing both positively and negatively to biodiversity trends. Some of the highlighted policy drivers are cross sectoral while others are sector specific. Based on the sector findings, the final section of the PIR highlights the fundamental problems related to each of them. Solutions that might contribute to alleviating and eliminating the problems are identified together with a specific focus on financial solutions that could be instrumental in bringing about change. As many of these financial solutions are new to Thailand, there may be substantial preparatory work that would need to be undertaken in respect to implementation.

Towards a Biodiversity Finance Plan

The findings and recommendations from the PIR are designed to serve as entry points for initiating, improving and scaling up effective biodiversity finance solutions. Following the approach of BIOFIN (The BIOFIN Workbook, 2016), alongside the PIR, the national process also consists of a Biodiversity Expenditure Review (BER) and Financial Needs Assessment (FNA). Together these three country-level assessments culminate in the development of a Biodiversity Finance Plan for Thailand.

INTRODUCTION AND METHODOLOGY



INTRODUCTION AND METHODOLOGY

The purpose of the integrated Policy and Institutional Review (PIR) report is to provide an overview of the policy and institutional context that concerns the management and utilization of Thailand's biodiversity resources. Following the overall methodology of UNDP's Biodiversity Finance Initiative, the report is structured around four main ecosystems in Thailand, namely, terrestrial ecosystem, wetland ecosystem, coastal and marine ecosystem, and urban biodiversity. The BIOFIN Workbook 2014 was used as the main guideline in structuring the frameworks and approaches to prepare the Policy and Institutional Review methodology. Furthermore, the PIR methodology was revisited with the concept of institutionalization from the BIOFIN Workbook 2016. With four main ecosystems as entry points, Thailand's PIR process has built links between the ministries responsible for environment and finance, supported by stakeholder consultations and outreach that attracts board ownership of its output. The successful completion of the integrated PIR requires cooperation of the stakeholders, at least from the onset, the cooperation of the public stakeholders. The specific policies and legal contexts with economic implications that drive both positive and negative trends in biodiversity and ecosystems in the country have been identified by a group of national PIR Experts. It is essential to conduct the initial NBSAP review as the rapidly reviewed process in turn has helped identifying key information, such as the biodiversity targets, legal aspects, key stakeholders, etc., which are necessary for the Policy and Institutional Review, Biodiversity Expenditure Review, the Finance Need Assessment and the Biodiversity Finance Plan. Having said that, the coordination arrangement during the inception period benefited BIOFIN Thailand from the full support of the Project Steering Committee (PSC).

The PSC members in Thailand represented by members of various public agencies whose roles are the formal decision-making and approval body for the national BIOFIN process and outputs. To take the national BIOFIN process forward, UNDP Thailand together with the PSC members have identified entry points for conducting the analysis of biodiversity finance in the country. Therefore, the four biodiversity and ecosystems, namely: Terrestrial, Coastal and marine, Wetland and Urban biodiversity were officially identified during the inception workshop. On hindsight, greater practical cooperation has been designed that the BIOFIN process should begin with the 'buy-in' from high level decision makers in the ministries and departments. Thus, it is crucial for obtaining agreement to appoint a BIOFIN 'Working Group' to work with the BIOFIN Technical Advisory team.

Since this Working Group is formally appointed, this process has facilitated the formality of getting approval to providing information. Not only would this mean that there will be greater depth of information and insights from those within the organizations, but a working partnership between the Working Group and the BIOFIN Thailand team throughout the process has also ensured that the PIR output is a product of joint efforts and not a report prepared by the BIOFIN technical advisory team to be approved and reviewed by the line agencies. Thus, a series of focus group discussion was conducted in the government agencies. During the PIR initiation, BIOFIN Thailand entered the scene where the fourth NBSAP has officially been endorsed by the Cabinet on 10th March 2015. Upon reviewing of the current NBSAP, particularly for the 'costable' actions and plans, it appeared as though there were measures relevant to protection and conservation of biodiversity resources, which have not been fully covered by the NBSAP. So, the main task of BIOFIN Thailand team was an attempt to understand other related policies and activities, which are included in the roadmap of agencies and have not yet been incorporated into the current NBSAP. This is not in any way a criticism of the NBSAP but merely to indicate that the BIOFIN Thailand has attempted to make the policy and institutional reviews as comprehensive as possible.

The integrated Policy and Institutional Review report of Thailand is divided into seven Sections. The Introduction elaborates the purpose, the initiation of PIR in Thailand and the methodological framework. Section 2 outlines the status of biodiversity in Thailand alongside the key trends exhibited in each of the four ecosystems under review. Section 3 goes on to discuss Thailand's vision for biodiversity by looking into the country's National Plans, in which particular focus is given to Thailand's National Biodiversity Strategy and Action Plan (NBSAP). This section also reviews sector plans of the key agencies whose mandates are closely linked to the management of biodiversity resources, as well as plans that are specific to each of the four ecosystems. The sectoral practices, policies and policy factors, and economic drivers that result in negative and positive biodiversity trends are discussed in Sections 4 and 5. This is followed by an analysis of institutions that are relevant to the management, utilization and conservation of biodiversity resources in Section 6. The final Section 7 summarizes preliminary policy recommendations and possible biodiversity finance solutions that will guide Thailand to further its Biodiversity Finance Plan.

BIODIVERSITY STATUS AND TRENDS IN THAILAND

BIODIVERSITY STATUS AND TRENDS IN THAILAND

Thailand is well endowed with rich natural resources and ecosystems (refer to the figure 1 below). These natural resources and ecosystems have served as an engine of growth for Thailand for decades. Thailand's fertile soil and abundant water supply has long been the rural population's bread and butter and forms the backbone of Thai society. From an economic standpoint, these rich natural resources and ecosystem services enable Thai agricultural products to capture substantial income from export markets, including products such as staple foods, fishery products, poultry, spices, fruits and vegetables. As Thailand slowly transforms away from agriculture and moves more towards manufacturing and services, natural resources and ecosystems will continue to perform important functions. For example, Thai forest ecosystems serve as a source of water supply and flood control for the urban population and economic activities. Meanwhile, Thai marine ecosystems and coastal resources generate substantial income for the fishery industry and attract international tourists worldwide. Thus, acknowledging the importance of natural resources and ecosystems to Thailand, clearly also means recognizing the benefits and critical role of biodiversity. For example, the knowledge inherited in plant and animal genetics will play an important role in enhancing the value of Thai agriculture, cosmetics, pharmaceutical, medical or herbal products. Overall, then, biodiversity is a central factor in the future economic and social development of Thailand.

Yet, while figures showing the total number of animal and plant species in Thailand's Fifth National Report (2015)[1] indicate biodiversity resources in Thailand account for eight to ten percent of the world stock, the report also states that six animal species have become extinct, and seven animal species became extinct from their habitat. As many as 316 animal species are threatened with extinction, with a further 149 animal species deemed to be 'close' to extinction, and 84 animal species currently judged to be 'severely close' to extinction. As for plant species, Thailand's Fifth National Report indicates that 367 plant species are threatened with extinction, a further 131 plant species are 'close' to extinction, and 19 plant species are currently judged to be 'severely close' to extinction. Thus, in light of the precarious status of biodiversity in Thailand, the remainder of section 2 addresses how this threat is related to ecosystem change or trends exhibited in each of our four main ecosystems.

[1] The 5th National Report of Thailand https://www.cbd.int/doc/world/th/th-nr-05-en.pdf

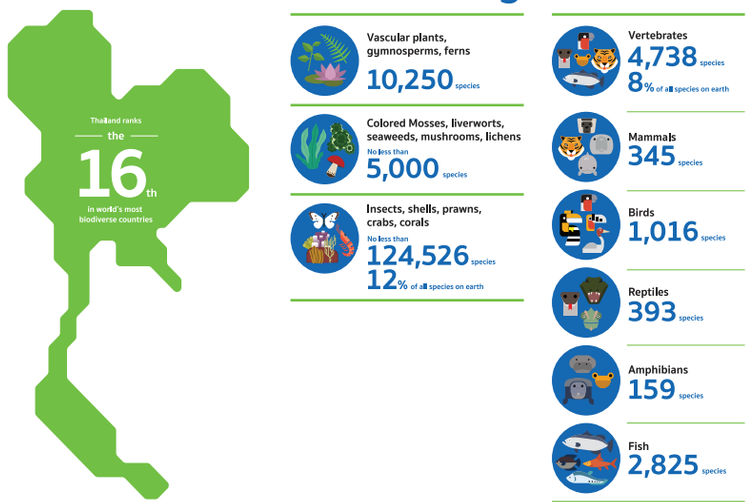


Figure 1: Status of Biodiversity in Thailand

Overview of trends in the terrestrial ecosystem

Thailand's Fifth National Report on Biodiversity (2015) indicates that, in 1961, the forest coverage in Thailand was as high as 53.33 percent of the total land area in Thailand (513,120 sq.km). However, in 1989, due to the expansion of farmland and urbanization, forest coverage declined drastically to 27.95 percent. In 2013, the statistics of forest coverage may show a slight increase from 27.95 to 31.57 percent but this increase has been a result of a change in satellite image interpretation. Therefore, despite Thai society placing a much greater emphasis on forest protection and conservation, there has not yet been effective mechanism that can successfully reverse the deforestation trend in Thailand.

In terms of terrestrial biodiversity, according to Baimai (2010), Thailand's tropical forests are home to 12,000 species of vascular plants, around 15,000 known species of animals and roughly 10,000 known species of microorganisms[2]. Moreover, it is thought that around 100,000 species of living organisms in Thailand's forests have not yet been discovered. Therefore, the potential loss of biodiversity in terrestrial areas is one of the most

[2] Baimai (2010) http://www.royin.go.th/royin2014/upload/246/FileUpload/2560_7631.pdf

important issues that Thailand is facing. That is to say, due to the deforestation trend outlined above, the shrinking habitats for local plants and animals truly threatens Thailand's status as a biodiversity hotspot.

Linked to this trend are the key sectoral drivers affecting terrestrial biodiversity resources in Thailand. These drivers relate to commercial agriculture such as corn and rubber plantation on the highland, illegal logging and hunting, human settlement and urbanization. In Thailand, the sectoral drivers that affect biodiversity resources tend to shift over time. Therefore, it should be noted that what were once the major sectoral drivers in the past, such as timber concession, opium plantation or shifting cultivation, are no longer relevant today.

Overview of trends in the wetland ecosystem

Thailand's wetland and rivers are continuously under pressure. The increase in the demand for agriculture land as well as the expansion of urbanization has threatened wetland areas in Thailand. As for the quality of rivers and canals that were once rich in freshwater biodiversity resources, it was found that unregulated discharge of wastewater from agriculture, households and factories have degraded water quality in many rivers and canals. To this end, many animal species are not able to tolerate the high level of water contamination in rivers and canals.

According to Thailand's Cabinet Resolution on 3rd November 2009, total wetland in the country is 22,555,100 rai[3]. It is equivalent to 7.5 percent of the total area of the country. Around 45 percent of this area pertains to wetland and is classified into the following:

[3] In Thailand, land measurements are expressed in 'rai'. 1 rai is equivalent to 0.16 hectare.

Classification of wetland in Thailand	Number of sites
Wetland of international importance	69
Wetland of national importance	47
Wetland of local level importance	19,295
Wetland areas registered as RAMSAR sites	14

According to the Millennium Ecosystem Assessment (MEA), wetland generate both direct and indirect benefits. In reviewing the situation regarding wetland in Thailand, the vulnerability of wetland ecosystems represents the widely known common-pool resource problem, in the sense that multiple agencies are responsible for wetland, yet no one is truly responsible.

CHANGES OF WETLANDS IN THAILAND

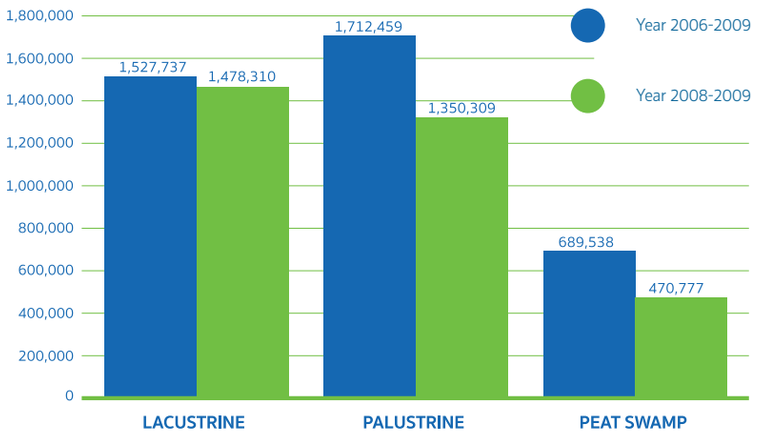


Figure 2: Changes of wetland over two time periods in Thailand

From Figure 2, the area defined as wetlands in general is observed to have followed a state of decline both in terms of area coverage and in condition. Based on aerial photographs taken by the Department of Land Development for the year 2006-2009, the surface area of swamps and lakes stood at around 1.5 million rai. River plains in the same period were estimated to be 1.7 million rai, while peat lands covered about 0.7 million rai. These estimates, along with those from Thailand Institute of Scientific and Technological Research (TISTR) which estimated for the period 2008 and 2012, have showed a decline in all categories of wetlands.

Overview of trends in the marine and coastal ecosystems

Thailand has a coastline of 3,148 kilometers. There are 23 provinces with coastlines, 17 on the Gulf side and six on the Andaman side.[4] The coastal and marine ecosystems cover three main ecosystems, i.e., mangroves, seagrass and coral reefs. In addition to these, there are also beach forest and islands ecosystems, which are also important habitats and considered as biodiversity hotspots..

[4] In Thailand, land measurements are expressed in 'rai'. 1 rai is equivalent to 0.16 hectare.

Figure 3: Political Map of Thailand, based on a UN map (UN Cartographic Section)

Mangroves[5]

Dating back to 1961, Thailand had 368,000 hectares[6] of mangroves. Over the years, the decline in mangrove area has been a result of conversion for agriculture, aquaculture, shrimp farming and salt farms. Mangrove forests, which have also declined in the past due to mining activities, changed dramatically as a result of urbanization, tourism, industrialization, expansion and development of physical infrastructures such as roads, electricity networks, seaports and dredging. By 2009, according to the Department of Marine and Coastal Resources (DMCR), Thailand's mangroves have reduced to 252,751 hectares. Classification of land that used to be mangroves revealed that 223,200 hectares has been converted. Around 45 percent of what used to be mangroves in 2009 has become agricultural land and another 25 percent has been converted to shrimp farms. There are also around 1,000 villages, which are located near or close to mangrove forests. Members of these communities continue to benefit from supplies of wood and from fish.

Similar to other forest areas, land conflicts have been mainly due to overlapping claims between the occupiers and the State. On 17th October 2000, a Cabinet Resolution was passed stating that anyone who occupied a so-called mangrove forest prior to 1991 would be allowed to stay. However, they were not allowed to expand the area they occupy, nor would any land document be issued. But it was not until 2011 that the DMCR earmarked a budget of THB 16.19 million[7] (THB 55,000 per area) to clearly define the boundary of mangrove areas that has been occupied by 280 communities in 24 provinces to clearly demarcate the mangrove forests that are left[8].

Dating back to the period covered by the fourth National Report of Thailand on the Implementation of the Convention on Biological Diversity (CBD)[9], it was reported that at that time, there were 74 perennial plants from 53 families found in the area. In particular, the main trees include Red Mangrove (Rhizophora mucronata Poir, Rhizophora apiculata Blume, Avicennia alba), Cork Tree (Sonneratia caseolaris Engler, Sonneratia alba Smith) and Portia Tree (Thespesia populnea (L.) Sol. ex Correa). Mangrove animals incorporate around 15 species of prawns, 7 species of fish, 32 species of crabs and 32 species of shells. Furthermore, the forest is also a residence of birds, monkeys, otters, wild cats, bats, snakes, turtles and copious numbers of insects.

The state of mangroves along the Mae Nam Ngao estuary in Ranong Province was at that time the most abundant. Conversion of mangroves for shrimp farms were already on-going along the coastal provinces in the Gulf of Thailand, namely Rayong, Chantaburi and Trad as well as Satun in the lower south of Thailand. The vulnerability of mangroves in Bang Khun Tien district of Bangkok and Nakhon Sri Thammarat province were linked to coastal erosion. The provisioning services of mangrove forests in terms sources of food, firewood and medicinal herbs were also the sources of pressure and the causes of both decline in area coverage and deteriorating quality.

In the present day, on the western part of the Peninsular, or the Andaman side, mangroves from Ranong province to Satun stretch over a length of 1,014 kilometers. Mangroves on the Andaman side, i.e., in Ranong, Phang Nga, Krabi, Trang, Satun and Phuket, are still in good condition despite the fact that some parts of the mangroves have been encroached for settlement and villagers going in to fish, collecting wood and other products. On the coastlines along the Gulf of Thailand, particularly in Rayong and Chantaburi there has been widespread problem of encroachment and conversion for shrimp farming. Conversion for shrimp farming has also been the major reason for the decline in mangroves provinces on the east coast further down south in Surat Thani and Nakhon Sri Thammarat. There are also areas where there are problems of coastal erosion, these are mainly mangrove areas on the upper part of the Gulf in Chachoengsao, Samut Prakarn, Samut Songkram and Phetchaburi, land rights have been granted but have been resold.

Information about mangroves is considerably extensive. The DMCR has prepared detailed reports on the status of mangroves for each province. Area calculation is based on satellite images taken in 2000 and 2009, which is overlain with the military topographical map (L7018). Information has been prepared for each province and downscaled to district level and also to the sub-district level. The information shows existing mangroves, shrimp farms, agricultural land and built-up areas, including a large area that is unclassified. These are neither lands left fallow nor types of land use fitting into any of this classification. These provincial level reports contain information about the types of flora and fauna species that can be found.[10]

[5] Information on mangroves is mainly based on Nabangchang O., Valuation of ecosystem functions and services provided by mangrove ecosystem in Thailand: Literature Review and Assessment' A Review Paper submitted to the Economy and Environment Program for Southeast Asia. 2015
[6] The total area was 2.3 million rai; 1 rai = 0.16 hectares
[7] Conversion rate: USD 1 = THB 31
[8] Office of Mangrove Conservation, DMCR. Stories about mangroves and the sea (in Thai) 2010.
[9] The 4th National Report of Thailand: https://www.cbd.int/doc/world/th/th-nr-04-en.pdf

[10] The information is analysed as several indices, namely Shannon–Wiener diversity index for biodiversity and Margalef's index for concentration, Pielou index for evenness.

Mangrove forests can be said to be the ecosystem that links the land and the sea. The biological processes are said to be effective in screening and filtering pollutants that would otherwise end up in the sea. These pollutants, including heavy metal is absorbed by the roots of trees, gradually transmitted to the leaves and the fruits. More visible is some of the solid waste such as plastic, cans, glass, and bulbs. In one of the provinces in the Eastern Region of Thailand, the amount of waste collected from mangroves is as much as 4 tons per hectare. If other indirect benefits such as producing oxygen and filtering as well as other direct benefits were included, the monetary benefit per 1 rai of land has been estimated to be as high as THB 667,886.[11] One of the ecosystem services is carbon storage. There have been studies to measure carbon content in 13 types of trees in mangrove forests, which showed that the carbon content is almost the same at around 46 percent of the dried weight. It has been estimated that 100 grams of biomass in mangroves translate into 46 grams of carbon. Carbon storage function alone has been converted into monetary value $3,629 per hectare or THB 18,000 per rai. Based on this information, the amount of carbon stored in the 1.5 million rai of Thailand's mangrove was estimated to be between 4.5 - 6 million tons/year.

Finally, technical experts within DMCR observed that reduced mangroves would result in higher water temperatures, reduced nutrients, increasing salinity and turbidity, coastal (soil) erosion and changes in quantity and diversity of plant and fish species. Indeed, the remaining sections on marine and coastal ecosystems in this report will review whether there is any credible data in Thailand that can verify these observations.

[11] Thanuwong Saengtien in Stories about mangroves and the sea (in Thai). Office of Mangrove Conservation, DMCR. 2010

Seagrass

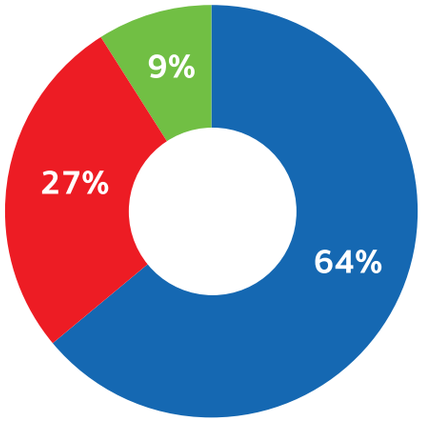
Worldwide, there are 12 genera and 48 species of sea grass (Philip and Menez, 1988). In Thailand, there are seven genera and 12 species of sea grass on both the east coastline on the Gulf of Thailand side and on the west along the Andaman coasts (Kanchanapart et. al). The study area of Trang Province is one of the areas on the west coast where a diversity of sea grass species can be found – an area that is known for the concentration of sea grasses. Sea grasses normally grow well where the sand is level and gently slopes down and these are usually areas where the waves and the current are not very strong (Chorthip.et.al. 1999). Part of the coastlines of Trang has been declared as a Marine National Park (MNP). This MNP is where sea grasses are dispersed from the shore up to distances between 100-750 meters where the sands are either 'fine' or 'very fine', salinity between 28-31 part per thousand, and sea temperature between 25-31 degree Celsius.

According to the DMCR survey, the total seagrass area of Thailand is 159,829 rai, with 62 percent of this total being on the Andaman, and the remaining can be found along the coastline of the Gulf side.[12] The DMCR has undertaken a survey of the conditions of seagrass in each province in Thailand and classified into five groups, as follows:

1. 'Very good' referring to areas with more than 75 percent with sea grass coverage,
2. 'Good' are areas with sea grass coverage between 51-75 percent coverage,
3. Areas classified as 'fairly good condition' have between 26-50 percent coverage,
4. 'Fair' has 25 percent of sea grass coverage,
5. 'Degraded' refers to areas with less than 25 percent of sea grass coverage

[12] Bible: Thailand's Coastal and Marine Resources. Department of Coastal and Marine Resources. 2015 (in Thai)

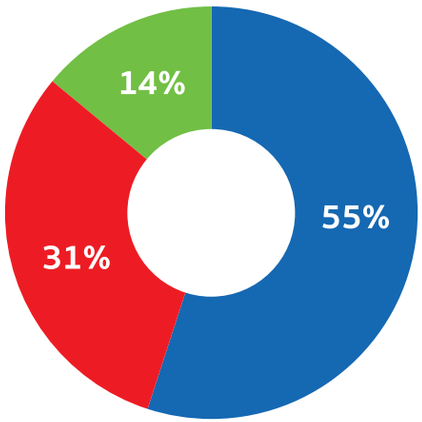
Around 9 percent of seagrass beds along the Andaman are in poor condition compared to 14 percent on the Gulf side. Where the deterioration of seagrass beds is human induced, these have been due to fishing practices— short-necked clam dredges with push nets, pollution from shrimp farms and infrastructure development— construction of seaports, increase in sediment load, dredging for navigation purposes, etc.



Seagrass Condition in Andman Coast of Thailand

Chart 1: The State of Thailand's Seagrass beds along the Andaman Coast

- low
- good
- average



Seagrass Condition in The Gulf of Thailand

Chart 2: The State of Thailand's Seagrass beds along the Gulf of Thailand

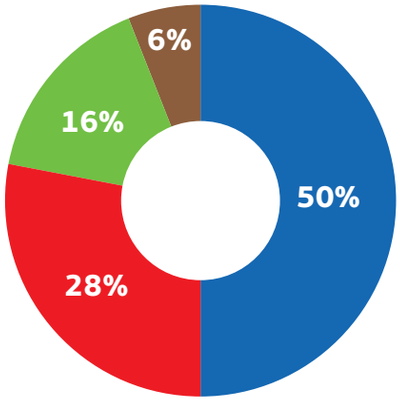
- low
- good
- average

Coral Reefs

Thailand's coral reefs cover an area of 148,954 rai. Of the 600 types of corals worldwide, 280 can be found in Thailand although the most commonly found is Acropolaa spp and Porites lutea. A survey of the state of coral reefs has been conducted in 2009 by Department of Marine and Coastal Resources of Thailand. Alarmingly, 50 percent of Thailand's coral reefs are classified as 'much-damaged' and another 28.3 percent as 'damaged'. Around 16 percent is of average quality. Less than 6 percent of Thailand's coral reefs are in 'good' and 'very good' condition.

There have been incidents of coral bleaching over the years but the worst incident occurred in 2010 when the sea temperature rose from an average of 29 - 30 degrees Celsius. The ensuing bleaching of the coral reefs started in March 2010 and went on for around three months, during which time the average sea temperatures rose further from 30 - 33.5 degree Celsius. Thus, there are around 30-40 percent of coral reefs in the Gulf side which were affected. Worst still, between 50-60 percent of corals in the Andaman Coast were bleached.[13] Apart from these incidents of bleaching, the conditions of the coral reefs have been affected by human induced factors. Among these has been the increase in the sediment load (from mining and from construction along the coastlines) and from the degraded condition of the mangroves. More apparent has been the increasing number of tourists in major island destinations and the snorkeling and scuba diving activities in major destinations such as Phi Phi Islands in Krabi province and Koh Tao Island in Surat Thani province.

[13] DMCR (2015). Bible: Thailand's Coastal and Marine Resources. Page 58



State of Coral Reefs in Thailand

Chart 3: The State of Thailand's Coral reefs, surveyed by DMCR (2009)

- average
- good
- much-damaged
- damaged

Endangered marine species

Among the highlights of coastal and marine resources, the iconic species include (i) Sea turtles (the green turtle, Hawskbill, Olive Ridley, Leatherbacks and Loggerheads); (ii) Dugongs; (iii) Dolphins (Indo- Pacific bottlenose, Finless porpoise, Indo-Pacific humpback dolphin and Irrawaddy dolphin); (iv) Bryde's whale; and (v) Omura whale. There is a considerable amount of data about their numbers and distribution along the coastlines. These endangered marine species have been among the major attractions for eco-tourism activities. Increasing sightings of Bryde's whales off the coast in Samut Sakhon province on the Gulf side has also generated interest and promises to be a significant source of revenue for some of the local communities. On the downside, however, these iconic marine species face increasing risks from both direct and indirect human induced threats. The causes of death of many of the turtles and dugongs washed ashore has been due to injuries caused by fishing equipment. Many deaths are also caused by getting entangled in drift nets.

Protective measures

Given the importance of coastal marine ecosystems and the prevalent risk factors, initiatives to declare many of these areas as Protected Areas have started. Table 1 shows the various types of protected areas that offer different kinds and levels of protection. Due to their different physical locations, the Protected Areas fall under the responsibility of a number of public agencies. These Protected Areas are spatially distributed in all of the provinces with coastlines and each province may have two or more types of Protected Areas.

Table 1: Coastal and Marine Protected Areas in Thailand

Types of Protection	Total	Land area unit: sq. km	Sea surface area
Marine National Parks (MNPs)	6,927.75	2,137.75	4,790.00
No Hunting Zone	1,054.17	864.29	189.88
Environmental Protection Zone	9,499.27	4,943.62	4555.65
Area under regulated fishing	50,105.57	-	50,105.57
Wetland of International Importance	1,213.85	1,194.45	19.40
ASEAN Heritage Site	2,154.73	375.17	1,779.56
Biosphere	304.13	188.24	115.89

Overview of trends in the urban biodiversity

Biodiversity and ecosystems in urban areas are found mostly in green spaces, which are interspersed with the built environment that occupy the majority of the urban landscape. Green space come in many forms in metropolitan areas and can vary depending on the geographic location of the city. The most common forms of urban greenery are parks, gardens, trees that line streets and walkways, and pockets of wilderness areas that grow on abandoned or unused land. Depending on the location of the city and the landscape, urban green space can also come in the form of wetland, grasslands, and agricultural lands. As such, urban biodiversity and ecosystems can be divided into natural areas such as urban wetland, and man-made areas such as gardens and parks.

Green areas found in Bangkok come from a combination of its location, history, and current government policies. Bangkok is located in the lower basin of the Chao Phraya River where the land is naturally flat and low-lying. The city is also interspersed with many canals, which were historically built for commuting purposes and are now mainly used to help drain excess water into the ocean. Given this background, green area in Bangkok includes agricultural land (24.25 percent), aquaculture

area (7.19 percent), meadows and groves (5.19 percent), and mangroves (0.16 percent). Surface water area covers approximately 3 percent of the city's land area. (Land Development Department, 2017). Green area can also be found in recreational parks, of which there are 7,219 at the end of 2016. (Bangkok Metropolitan Administration, 2017).

In terms of biodiversity, studies show that green areas in Bangkok contain many species of flora and fauna. Recreational parks in Bangkok are home to insects, birds, and butterflies. Chaipakdi and Chanittawong (2005) identified 64 species of birds in the Bang Khun Tien wetland alone. This number includes 32 local species, 20 migratory species, and 12, which are both local and migratory bird species. The survey also found monkeys (Macaca fascicularis), dolphins (Tursios aduncus, Neophocoena phocoenoides, and Orcaella brevirostris), bats (Pteropus lylei), pythons (Pytohon molurus, Pytohon reticulatus), snakes (Enhydris bocourti, Homalopsis buccata), and water monitor (Varanus salvator).

Urban biodiversity and ecosystems are important environmental assets. Biodiversity and ecosystems found in cities provide all four types of ecosystem services. In terms of provisioning services, agricultural areas in cities serve as a source of food for local residents. Trees provide regulating services in the form of positively contributing to local climates and air quality. Wetland and mangroves in cities help moderate the effects of extreme weather events. Mangroves also provide the added benefit in terms of wastewater treatment. Urban green space provides habitats for a diverse array of species and offers recreational benefits to city dwellers.

Population increases, land use changes, and pollution problems pose threats to urban biodiversity and ecosystems in Thailand. Nonetheless, important stakeholders such as local city governments have realized the importance of urban biodiversity and ecosystems. As a result, initiatives related to urban biodiversity and ecosystems have been and are being implemented at the city-level in many cities throughout Thailand. These initiatives represent positive forces leading to conservation and enhancement of urban biodiversity and ecosystems in Thailand.

THAILAND'S VISION FOR BIODIVERSITY

THAILAND'S VISION FOR BIODIVERSITY

This section seeks to establish the national policy and institutional context for biodiversity measures in Thailand, in which emphasis is given to the central role played by the country's National Plans. Here, Thailand's National Biodiversity Strategy and Action Plan (NBSAP) is the core document representing the country's vision for biodiversity. It is articulated in specific plans such as the National Economic and Social Development Plan (NESDP), which contains a vision for terrestrial ecosystem, and the DMCR roadmap which provides guidance for the marine and coastal ecosystem.

National plans and their relevance to biodiversity

The importance of biodiversity resources has only been recently recognized in Thailand. During the first National Economic and Social Development Plan (beginning in the 1960s), much emphasis was placed on infrastructure, economic and social development. Natural resource conservation did not find its place in the Thai National Plan until the recurrence of the sixth NESDP in the 1980s. Thus, Thai public policies in relation to biodiversity resources are currently still natural resource oriented. However, two policy highlights deserve special mention. First, forest conservation policy is always placed high on the agenda where the aim of the Thai forest policy is to increase its forest coverage from the current 31 percent to 40 percent of the total land area in Thailand. Second, the national target for attaining a mangrove area of 1.5 million rai (or 2,400 square kilometers) has already been achieved, yet the quality of marine and coastal ecosystem in Thailand is still deteriorating.

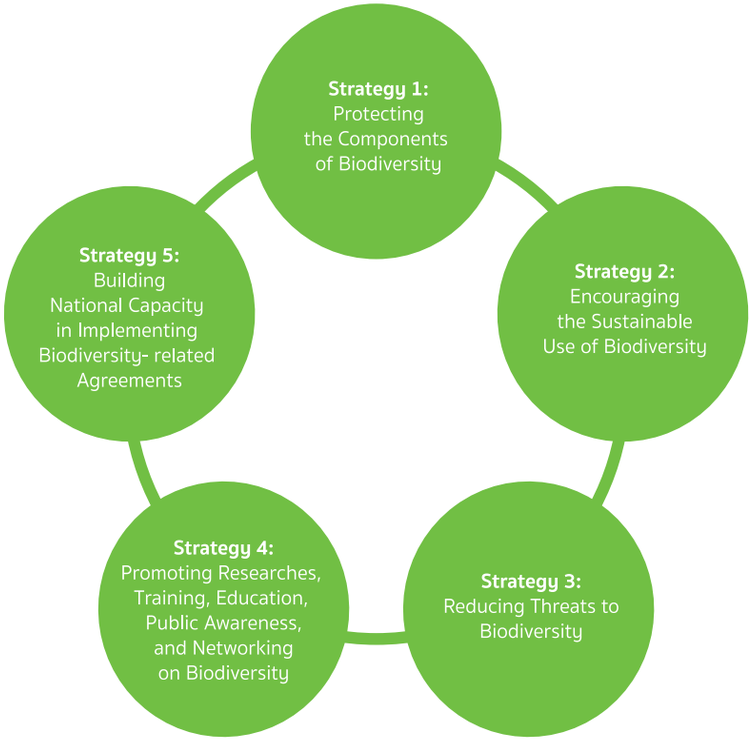
National Biodiversity Strategy and Action Plan (NBSAP)

Achievements of previous NBSAPs

Thailand has formulated three consecutive NBSAPs, which are entitled "National policies, measures and plans on the conservation and sustainable utilization of biodiversity". The first Plan covered the period of the year 1998-2002; the second Plan covered the period of the year 2003-2007; and the third covered the period 2008-2012. The third NBSAP was formulated based on the 2010 biodiversity target, which was adopted by the World Summit on Sustainable Development (WSSD) in 2002.

As shown in Figure 4, the third NBSAP developed policies, strategies and guidelines on implementation regarding the conservation and sustainable use of biodiversity. Thus, in accordance with the concept of sustainable development, the intention of the third NBSAP was to achieve the target to significantly reduce the rate of biodiversity loss by the year 2010. As detailed in the CBD Strategic Plan, the target was adopted by the Conference of the Parties (COP) at its seventh meeting in 2004. Most importantly, on 15th January 2008, the Thai Cabinet agreed to the draft national policies, measures and plans on biodiversity as a framework for the country's implementation during the five-year period (2008-2012). Such framework consisted of 5 strategies and 17 action plans and a total budget of THB 9,555.93 million (US$ 280.627 million). The overall target of the third NBSAP (see diagram below) was to significantly reduce biodiversity loss while maintaining various types of ecosystems, species and gene pool and, amongst other things, to sustainably protect all components of biodiversity

Figure 4: The 3rd NBSAP of Thailand (2008 – 2012)



Based on the assessment of the outcome of the third NBSAP, the targets that were not achieved are as follows:

1. Under Strategy 1: Protecting the Components of Biodiversity

- At least one site of seagrass beds and dugongs have been designated as protected area;
- At least five sites of wetland of international importance have been designated as RAMSAR sites;
- At least 20 percent of marine and coastal areas in Thai waters have been designated as protected areas.

2. Under Strategy 3: Reducing threats to biodiversity

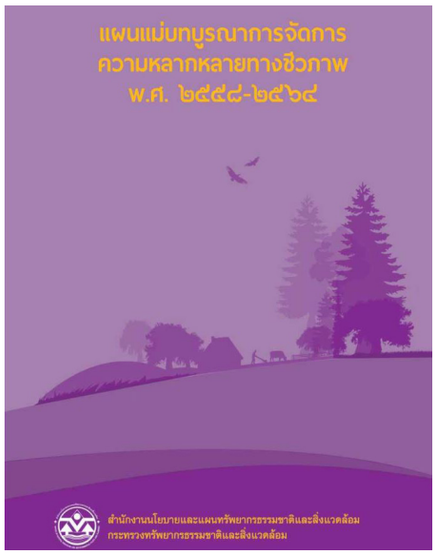
- The formulation of a long-term policy at the national level regarding climate change adaptation and mitigation to biological diversity

3. Under Strategy 5: Strengthening National Capacity for Implementing Biodiversity-
Related International Agreements

- The establishment of a Committee on biological diversity-related institutions/organizations

The current NBSAP (2015 – 2021)

The current NBSAP is the fourth national biodiversity action plan and strategies, which covers the period of 2015-2021. It has four strategies as shown below.



The 4th National Biodiversity Strategy and Action Plan of Thailand (B.E. 2558)

Strategy 1

- Integrating the value and management of biodiversity resources involving stakeholders at all levels through participatory processes

Strategy 2

- Conserving and restoring biodiversity resources

Strategy 3

- Protecting the national rights in term of access and benefit sharing that is consistent with the concept of green economy

Strategy 4

- Developing the knowledge and standardized database on biodiversity resources so that they are consistent with international standards

From the current NBSAP, there are specific national targets and measures under Strategy 2: Conservation, Restoration and Protection of Biodiversity, which determined the core biodiversity issues of terrestrial ecosystem, wetland ecosystem, coastal & marine ecosystem and urban biodiversity in Thailand. The targets and measures are as follows:

- The targets are to reduce rate of natural habitat loss, including forests and coastal ecosystems by 50 percent by 2020;
- Relating to wetland management, the target is to increase the efficiency of wetland management at all levels by 2016 and significantly reduce wetland ecosystem loss so as to maintain the use of ecosystem service and support climate change adaptation by 2021;
- Increasing of capacity in Protected Areas management to ensure sustainable flow of ecosystems services by 2021;
- Improving the management of native and vulnerable species through conservation and protection of habitats;
- Reducing human induced pressure on species and habitat especially in coral reefs and fragile ecosystems that are already facing impacts from climate change;
- Mechanism, policies and laws for protection genetic diversity;
- Measures to reduce and control pollution to a level that no longer places threats on ecosystems and biodiversity resources; and
- Improvement at all levels of management of wetland.

At the time of the submission of the Conceptual Report for Cost of implementing national biodiversity strategies and actions (BIOFIN Workbook 2014), an NBSAP Action Plan covering the period 2015-2016 was already completed. Such plan had estimated a total budget of THB 11,048.59 million.

Recently, the additional version of NBSAP covering the remaining period 2017-2021 was completed. The total budget requirement for the period 2017-2021 was estimated at THB 10,945 million as shown in Table 2.

Table 2: Thailand's 4th NBSAP Strategy and estimated budget (Unit: THB million)

Strategy & Action plans	2015 – 2016 Estimated budget	2017 – 2021 Estimated budget
Strategy 1: Integrating the value and management of biodiversity resources involving stakeholders at all levels through participatory processes. (i) Action Plan 1.1 – Increasing awareness and providing knowledge about biodiversity resources (ii) Action Plan 1.2 – Integrating and promoting participation in the management of biodiversity resources	890.23	745.24
Strategy 2: Conservation and restoration of biodiversity resources (i) Action Plan 2.1 – Conservation, restoration and protection of biodiversity resources (ii) Action Plan 2.2 – Reducing the pressure and ensuring sustainable use of biodiversity resources (iii) Action Plan 2.3 – Management of Wetland (iv) Action Plan 2.4 – Management of alien invasive species (v) Action Plan 2.5 – Biosafety	7,538.46	8,353.28

Strategy 3: Protecting the national rights in terms of access and benefit sharing that is consistent with the concept of Green Economy (i) Action Plan 3.1 – Protecting genetic resources (THB 51 million for 2017 - 2021) (ii) Action Plan 3.2 – Research and Development for the purpose of creating market values for biodiversity resources (THB 265.7 million for 2014 - 2021)	2,078.14	131.08
Strategy 4: Developing the knowledge and standardized database on biodiversity resources so that it is consistent with international standards. (i) Action Plan 4.1 – Knowledge Management and Database (THB 541.76 million for 2017 -2021) (ii) Action Plan 4.2 – Protecting local/traditional knowledge about biodiversity resources	541.76	1,715.83
Total	11,048.59	10,945.43

Given that Thailand has adopted a CBD's Strategic Plan for Biodiversity and the Aichi Biodiversity Targets, the current Thailand's NBSAP has been designed following the adoption of the Strategic Plan for Biodiversity 2011-2020. Table 3 will show the coherence between the specific strategy of coastal and marine resources in Thailand and the CBD Strategic Goals.

Table 3: Linkages between CBD's Strategic Plan for Biodiversity and Thailand's NBSAP

Convention on Biological Diversity Strategic Goals	Thailand's NBSAP strategies for coastal & marine resources (2015 – 2021)	Relevant ecosystems
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society Aichi Targets: 1 - 4	Eliminating perverse incentives and harmful subsidies • Strategy 1, Measure 2.5 • Strategy 4, Measure 1.7 Promoting sustainable production and consumption • Strategy 1, Measures 2.1, 2.2, 3.1–3.4 • Strategy 3, Measures 2.1, 2.2, 3.2	• Terrestrial • Wetland • Coastal & marine
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use Aichi Targets: 5 - 10	Reducing habitat loss and habitat fragmentation • Strategy 2, Measure 1.1, 1.2, 3.2 Reducing overfishing and destructive fishing • Strategy 2, Measures 3.1, 3.2 • Strategy 3, Measure 2.1 Reducing human pressure on coral reefs and fragile ecosystems which have been impacted from climate change and ocean acidification • Strategy 2, Measure 3.2	• Terrestrial • Wetland • Coastal & marine • Wetland • Coastal & marine • Coastal & marine
Strategic Goal C: To improve the status of Biodiversity by safeguarding ecosystems, species and genetic diversity Aichi Targets: 11 – 13	Protect at least 10% of ecologically fragile marine ecosystem • Strategy 2, Measures 1.1, 1.6, 2.3, 3.2, 3.5	• Coastal & marine
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services Aichi Targets: 14 – 16	–	–
Strategic Goal E: Enhance implementation Through participatory planning, knowledge management and capacity building Aichi Targets: 17 – 20	–	–

Source: Integrated Master Plan for Biodiversity Resources 2015 - 2020

In accordance with the NBSAP's implementing timeframes, key government agencies have formulated their own strategic plans with prioritized activities. The example of prioritized activities of marine and coastal ecosystem that drives the measures in Thailand's NBSAP can be highlighted under different timeframe, namely;

(i) Immediate, to be implemented by the end of 2016,
(ii) Long term, to be completed by 2020; and
(iii) Long term, to be completed by 2021, which is the NBSAP timeframe.

In Table 4 below, it shows the specific strategies and measures in coastal and marine sectors are presented according to the NBSAP timeframes.

Table 4: Prioritization of activities in the NBSAP with different timeframe

NBSAP Timeframe	Prioritized activity	NBSAP Strategy	Related ecosystems
Immediate: to be implemented by the end of 2016	Activity # 1: Reducing rate of loss of natural resources	Strategy 2 Conservation and restoration of biodiversity resources	• Terrestrial • Wetland • Coastal & marine • Urban
Measures 1.1 – Improve capacity for PA management 1.2 – Reduce rate of loss of natural habitat and restore degraded ecosystems 2.1 – Localize BD targets and support for formulation of local BD plans 2.3 – Support actions for wetland management in urban & urban fringe area 3.2 – Control and prevent activities that may impose risks on coastal & marine resources and wetland			
NBSAP Timeframe	**Prioritized activity**	**NBSAP Strategy**	**Related ecosystems**
Immediate: to be implemented by the end of 2016	Activity # 2: Increasing management capacity of PAs and ecosystems to ensure sustainability of ecosystems services	Strategy 2 Conservation and restoration of biodiversity resources	• Terrestrial • Wetland • Coastal & marine • Urban
Measures 1.8 – Promote application of technology in conservation, restoration and sustainable utilization of BD resources 3.2 – Control & prevent activities that may impose risks on coastal & marine and wetland 3.5 – Ensure that process is made regarding the registration of wetland of Int'l and national levels of importance as well as wetland conservation measures in accordance with the Cabinet decision in 2009			
NBSAP Timeframe	**Prioritized activity**	**NBSAP Strategy**	**Related ecosystems**
Immediate: to be implemented by the end of 2016	Activity # 3: Reducing human induced pressures particularly on coral reefs	Strategy 2 Conservation and restoration of biodiversity resources	• Terrestrial • Wetland • Coastal & marine • Urban
Measures 3.1 – Zone of aquaculture activities 3.2 – Control & prevent activities that may impose risks on coastal & marine and wetland 3.6 – Set guidelines for controlling the spread of GMOs in accordance with the new Biosafety and Biotechnology Bill 3.7 – Ensure that there is adequate measure to prevent, control and eliminate alien invasive species in accordance with the Cabinet Decision of 2009			
NBSAP Timeframe	**Prioritized activity**	**NBSAP Strategy**	**Related ecosystems**
Immediate: to be implemented by the end of 2016	Activity # 4: Increasing capacity at all levels to manage wetland	Strategy 2 Conservation and restoration of biodiversity resources	• Terrestrial • Wetland • Coastal & marine • Urban

Measures:
2.2 – Involve stakeholders in formulating management plans for wetland of international and national importance and promote the incorporation of these plans into the provincial, local and community development plans
2.3 – Support actions for wetland management in urban & urban fringe area
3.2 – Control & prevent activities that may impose risks on coastal & marine and wetland
3.5 – Ensure that process is made regarding the registration of wetland of Int'l and national levels of importance as well as wetland conservation measures in accordance with the Cabinet decision in 2009

NBSAP Timeframe	Prioritized activity	NBSAP Strategy	Related ecosystems
Long-Term: To be implemented by the end of 2020	Activity # 5: Reducing the rate of loss of terrestrial and marine habitat by 50%	Strategy 1 Integrating the value and management of biodiversity resources involving stakeholders at all levels through participatory processes Strategy 2 Conservation and restoration of biodiversity resources	• Terrestrial • Wetland • Coastal & marine • Urban

Measures:
1.1 – Improve capacity for PA management
1.2 – Reduce rate of loss of natural habitat and restore degraded ecosystems
2.3 – Support actions for wetland management in urban & urban fringe area
2.4 – Create awareness of the value and importance of conserving
3.2 – Control & prevent activities that may impose risks on coastal & marine and wetland

NBSAP Timeframe	Prioritized activity	NBSAP Strategy	Related ecosystems
Long-Term: To be implemented by the end of 2021, which is the NBSAP period	Activity #6: Significantly reducing the loss of wetland ecosystems to ensure	Strategy 2 Conservation and restoration of biodiversity resources	• Wetland

Measures:
2.2 – Involve stakeholders in formulating management plans for wetland of international and national importance and promote incorporation of these plans into the provincial and local development plans
2.3 – Support actions for wetland management in urban and urban fringe areas
3.2 – Control and prevent activities that may impose risks on coastal and marine resources and wetland such as expansion of built up areas, pollution and overfishing
3.5 – Ensure that progress is made regarding the registration of wetland of international and national level of importance as well as wetland conservation measures in accordance with the Cabinet decision in 2009

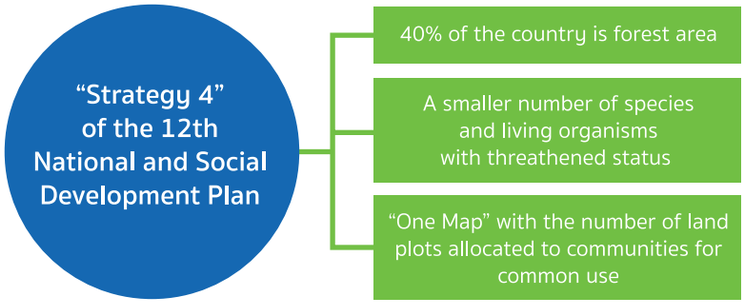
Biodiversity strategic plans specific to ecosystems

Having reviewed Thailand's vision for biodiversity and the central role of the NBSAP, greater attention will now be paid to the strategic plans for each of the four main ecosystems. As such, we engage here first with the terrestrial ecosystem, both in terms of the number of projects and activities of interest.

Terrestrial ecosystem

The targets and indicators related to terrestrial ecosystems were specifically contained in the 12th National Economic and Social Development Plan (NESDP) of Thailand. It should be noted that whilst the 12th NESDP contains ten Development Strategies, for the purpose of the terrestrial ecosystem, the most relevant information is specifically included in the fourth Strategy of NBSAP entitled 'Environmentally-Friendly Growth for Sustainable Development' as shown in Figure 5 below.

Figure 5: Strategy 4: Environmentally-Friendly Growth for Sustainable Development



A further example of plans specific to the terrestrial ecosystem in Thailand is a flagship project entitled 'Project for Promoting the Cultivation of Long-Term Economic Value Trees', promoted in the 12th NESDP. This project encourages the growing of long-term 'economic value trees', which aims to develop afforestation procedures and the sustainable management of forest plantations, while also creating a high-value timber industry in the entire supply chain. The general idea is to restore the use of wood in conservation, construction of houses, temples and other buildings, as well as wood carving as a national art. In a supportive role, the government should set incentive measures, designate the suitable areas with potential in the ecological landscape and establish a central timber market.

The logistics system for transporting timber should also be developed while supporting the study of and research into the genetic improvement of tree varieties. Meanwhile the introduction of new financial mechanisms such as forest bonds, tree banks, and forestation funds can help enable innovations that add new value to wood and timber. The project aims to increase the economic forest to 15 percent of the country's total area, while forest for conservation will grow to around 25 percent. The economic forest plantations, with a long-term harvesting period, will therefore create several co-benefits including revenue generation, ecosystem restoration, and greenhouse gas sequestration. As a result, this project can contribute to green growth not only at the national but also the global level. In terms of the key implementing agencies, this project assumes an integrated implementation approach by several parties. The Office of the National Economic and Social Development Board (NESDB) needs to work with other related key agencies as a group. The working group should comprise the Royal Forest Department, the Forest Industry Organization, the Plant Genetic Conservation Project under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn, the Agricultural Land Reform Office, the Bank for Agriculture and Agricultural Co- Operatives, academia, and the private sector. The main mandate of this working group is to formulate the strategies of economic forest cultivation in the entire system and implement these strategies to achieve the stated goals. Finally, a number of significant long-term strategies exist and seek to address issues related to terrestrial ecosystems in Thailand. These plans and frameworks are listed in Table 5 below.

Table 5: Thailand's long-term strategic plans related to terrestrial ecosystems

Agency: Royal Thai Government	Plan: The 20-Year National Strategic Plan of Thailand (2017 – 2036)	Targets: conserve and restore the stock of natural resources; increase the area of forest for conservation and commercial use, and reverse mangrove forest depletion; curb biodiversity loss; solve the problem of public land encroachment; and provide the poor with common rights to use land.
Indicators: - Proportion of the country's forest, forest plantation and restoration area - A complete demarcation map of public land (One Map Project)		
Agency: NESDB, Office of the Prime Minister of Thailand	Plan: The 12th National Economic and Social Development Plan (2017 – 2021)	Strategy 4: Environmental-Friendly Growth for Sustainable Development.

Indicators: - 40 percent of the country is forest area, classified into forest for conservation (25 percent), and commercial forest (15 percent). The mangrove forest area is enlarged from 1.53 to 1.58 million rai. Watershed restoration areas also grow substantially. - A smaller number of species and populations of living organisms with threatened status or nearly extinct. - A complete demarcation map of public land (One Map Project), which is formally announced to the public. The number of land plots being allocated to communities for common use.		
Agency: Ministry of Natural Resources and Environment	Plan: The 20-Year National Strategic Plan of MoNRE (2017 – 2036)	Strategic Issue 1: conserver, protect, restore, promote and develop the natural resources and BD in sustainable manner. Target 1: protect and maintain the forest area without encroachment and deforestation, and prevent the occurrence of wild fire.
Indicators: Protect the protected forest of 80.88 million rai (25 percent of the total area of the forest in the country); Protect the reserved forest of 39.87 million rai, reclamation 918,000 rai, and support the local administrative organizations in preventing and controlling wild fire 100 percent of the target local administrative organization. Develop the area of 500 forests (300,000 rai) to be learning centers.		
Agency: Ministry of Natural Resources and Environment	Plan: The 20-Year National Strategic Plan of MoNRE (2017 – 2036)	Target 2: Increase the forest area by restoring the degraded forest area and create economic forest.
Indicators: - The protected forest of 3.17 million rai will be restored. - The national reserved forest of 16.25 million rai will be restored (the degraded forest of 8.42 million rai/ economic forest of 3.83 million rai) - The mangrove forest area will be increased to not less than 10 percent (increase to 1.69 million rai and land reclamation of 100,000 rai)		

Agency: Ministry of Natural Resources and Environment	Plan: The 20-Year National Strategic Plan of MoNRE (2017 – 2036)	Target 4: solve the problems of local people in the forest areas in a systematic and fair manner
Indicators: - Solve the problem that communities live in protected forest by using the protected forest area of 169,254 people/235,283 land plots (1,599,777-1-94.76 rai) - Arrange the national reserved forest area that is already degraded for local people to sustainably live in such areas (3.4 million rai) - Arrange the degraded mangrove area for local people to sustainably live in such areas (not less than 50,000 rai)		
Agency: Ministry of Natural Resources and Environment	Plan: The 20-Year National Strategic Plan of MoNRE (2017 – 2036)	Target 5: significantly reduce the loss of natural resources and biodiversity
Indicator: There will be robust research, which can be used for application.		
Agency: Ministry of Natural Resources and Environment	Plan: The Royal Forest Department's 20-Year Strategic Plan (2017 – 2036)	Strategic Issues: there are two strategies that are directly associated with the forest, namely, Strategy 1: protect and maintain the forest area in a sustainable way; Strategy 2: efficiently restore the degraded forest.
Indicator: Natural resources will be managed in a balanced and sustainable manner at least 40 percent of the country's forest area in 20 years) by conserving the forest area 53.80 million rai; managing the area that is without forest condition; reforestation 14.02 million rai and promoting economic forest 8.68 million rai.		

Within the current NBSAP, Thailand has identified a number of activities with estimated budget related to the terrestrial forests as shown in Table 6.

Table 6: Plans, activities, budget related to territorial ecosystem in the NBSAP (2017-2021)

Plans and Activities	Budget (THB million)
Strategy 1: Integrate biodiversity values and management with participation at all levels	
Plan 1.2 Integrated action plan and promote participation in biodiversity management	
Develop tools and conduct a study on economic valuation of forestry biodiversity	8
Plans and Activities	**Budget (THB million)**
Research and development of forestry bond or marine and coastal resources bond system in accordance with payment for ecosystem service scheme	2
Establish cooperation networks for forest fire control	5
Establish biodiversity conservation and utilization networks (family forest)	12
Project on the Promotion of Reforestation under the Sufficiency Economy Philosophy of His Majesty the King	0.5
Strategy 2: Conserve and restore biodiversity	
Plan 2.1 Action plan on conservation, restoration and protection of biodiversity	
2.1.1.2 Strengthen and increase the efficiency in the management of protected areas, conservation areas and important biodiversity areas	
Acquire and increase the capacity of information technology for conducting the assessment survey on the forestry status and track changes in forestry	20
Create the collaborative network, check the ownership rights to forest areas and mangrove, and develop the database system	5
Assess the efficiency of the management of protected areas and conservation areas as specified by law	10
2.1.1.3 Encourage establishing protected network of conservation areas and habitats management at local levels.	
Develop the guideline framework and implement in order to link the ecosystem corridor and to increase the efficiency on the management of protected areas and ecosystem	9
Conduct trainings for authorities and community members to increase their knowledge and understanding of relevant laws, regulations and principles on political science and social science for the prevention and suppression of the violations of forestry laws, as well as enable them to apply those knowledge and understanding	6
2.1.2.3 Restore ecosystem, especially on degraded ecosystem country	
Plantation of watershed forest, mangrove and community forest	500
Follow the King Rama IX's foosteps on forest protection	0.25
Sustainable conservation, protection and restoration of flora and fauna resources	3
Project on the garden on wild fora species	5
Plan 2.2 Action plan on threat mitigation and promotion of sustainable utilization of biodiversity	
2.2.1.2 Utilization of plant biodiversity in a sustainable manner, and control of the products collected from forest for sustainability	
Organize the economic forest in a sustainable way in accordance with standards on economic forest	50
Increase the standards on economic forest for entering into the ASEAN Community	140
Plans and Activities	**Budget (THB million)**
Strategy 4: Develop biodiversity knowledge and database systems to be consistent with internationally recognized standards	
Plan 4.1 Action plan on knowledge management and database	

4.1.1.1 Study, survey biodiversity status, collect and improve database systems of biodiversity, protected areas and Thailand's Red Data so as to be fundamental information for stipulating policies and directions for biodiversity management.	
Conduct biodiversity database in national reserved forest	3
4.1.3.4 Promote knowledge development and research on biodiversity and taxonomy	
Research on utilization of plants from flood plains forest ecosystem in North-eastern Thailand	0.9
Research on important plant species in the Don-Pu-Taa conserved forest in Northeastern Thailand	0.9
Knowledge development in forest and wildlife animal resources management	3.5
4.1.3.5 Promote research and develop knowledge for adaption and mitigation impacts from climate change	
Study on forest structural change and dynamics of forest ecosystem from climate change	5

Wetland Ecosystem

To a great extent, Thailand's NBSAP can be said to have reiterated the importance of wetland ecosystems both in terms of the number of projects and activities related to wetland, as well as budget estimates. The total budget estimated to finance activities in NBSAP related to management, conservation and restoration of wetland amounted to THB 1,275.1 million.

Table 7: Plans, activities, budget related to wetland in the NBSAP 2015-2016 Action Plan

Plans and Activities	Budget (THB million)
Plan 2.1 Conservation and restoration action plan	
2.1.2.2 Preparedness for Climate change	
Compile information on the impacts of climate change on biodiversity resources and wetland	2.00
2.1.2.3 Survey wetland, forests, agricultural land and unutilized land to prepare measures for restoration	20.00
Plan 2.3 Improve wetland management	
2.3.1.2 Develop management guidelines	0.5
Compile information about various types of utilization	2.00
Land use planning for sustainable uses of resources in the wetland	5.00
2.3.1.3 Advocate inclusion of impacts on wetland in Environmental Impact Assessment	
Study and analyse environmental impacts on 5 target wetland of national and international importance	125.00
Analyse the impacts of dredging	20.00
2.3.1.4 Ensure that measures are undertaken in accordance to the Cabinet Resolutions	
Define the boundaries of wetland and buffer zones with involvement of local communities	2.00
Monitor the progress of measures undertaken in compliance to the Cabinet decisions	0.50

Survey and register all wetland in all provinces	150.00
Some restoration and conservation measures for the purpose of defining the appropriate boundaries of wetland	50.00
2.3.1.5 Coordinate actions undertaken by Non-Government Organizations and local communities in order to reduce the rate of loss of wetland areas	
Promote increasing involvement of local communities	195.00
Promote better understanding of the value of ecosystem services of wetland	5.00
Promote greater involvement of women in conservation of wetland	5.00
2.3.1.6 Promote formulation of management plan that involve participation of local communities	
Develop an approach, appropriate rules and regulations for local communities so they can protect their wetland: formulate provincial wetland management plans	20.00
Monitor the progress of the protective measures introduced	9.00
2.3.1.7 Conduct studies on the impact of changes in land use on wetland	20.00
2.3.2 Protection measures for wetland	
2.3.2.1 Measures agreements undertaken in compliance with international	
Monitor the status of RAMSAR sites	2.50
Restore wetland ecosystems so that it can be used for educational purposes	12.00
Create national network of wetland: promote sustainable tourism in RAMSAR sites and develop (and enforce?) tourism standards	2.50
2.3.2.2 Propose additional RAMSAR sites	
Propose at least 3 new wetland as RAMSAR sites	2.50
Formulate conservation and utilization plan for at least 2 sites	100.00
Formulate Town Plans that recognizes that natural wetland should be kept as Green Space	100.00
Formulate land use plans for wetland that are of international importance	60.00
Survey, classify and develop a database of wetland that are of local importance	6.00
2.3.2.3 Conducting surveys of the physical, ecological conditions as well as the socio-economic context of the wetland	
Revise rules and regulations concerning protection of wetland for greater effectiveness	2.00
Analyse the outcome of efforts to manage natural resources as well as the impacts on land use in Bung Boraped area on the local ecosystem and biodiversity resources	12.00
Revise and update the database on wetland	37.50
Conduct studies on migratory birds and in wetland that are located in Protected Areas.	18.00
Conduct studies on migratory birds and water fowls in wetland that should be given priorities; Pasak dam, islands in the Southern Region, Mun river basin, Lower Mekong river basin, Lower part of the plains in the Central Region, Yom river basin, Weru estuary and Kung Kraben Bay	20.00
Survey the status of peatlands and fresh water swamps	5.00
Review the status of wetland nationwide	30.00
Study the impact of climate change on wetland ecosystem, particularly on bird population and nesting behavior	25.00
Conduct a study on the population and the distribution of large water fowls to generate information for design appropriate protection measures	3.00
Survey and develop a database of swamps, peatlands that are of local importance	50.00
monitor the conditions of wetland of local importance for purpose of defining clear boundaries of wetland that are of local importance	100.00
2.3.2.4 Coordinate the efforts of NGOs and local communities to reduce rate of loss of wetland areas	
Organize workshops	2.50
Undertake conservation and restoration measures	50.00

In Table 8, the estimated budget for wetland ecosystems for the period 2017-2020 is planned at the amount of THB 49.5 million.

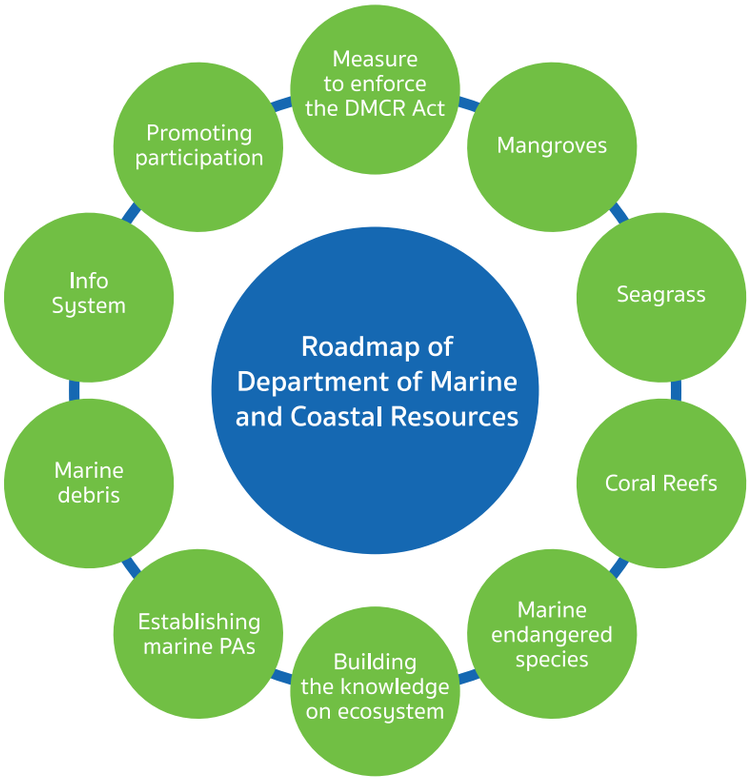
Table 8: Plans, Activities, budget related to wetland in the NBSAP 2017-2021 Action Plan

Plans and Activities	Budget (THB million)
Sustainable management of wetland to support the tourism sector	2.00
Formulation of management plans for wetland of international importance	4.00
Formulation Community Master Plan for the restoration of Nong Han wetland	1.00
Review the Cabinet Decision of 2009 on the registry of wetland of international and national importance as well conservation measures	1.50
Analyse the effectiveness in management of RAMSAR sites as required by COP 12	5.00
Develop a Guideline for protection, conservation and wise use of wetland	2.00
Develop a Guideline for protection and restoration of wetland	1.00
Develop a Guideline of standard practices for the management of RAMSAR sites	0.50
Organize a workshop for purpose of exchanging experiences and insights of concerned agencies	0.50
Improve capacity for protection and control of harmful activities.	20.00
Propose additional RAMSAR sites	2.00
Monitor the status of RAMSAR sites	5.00
Reduce the use of chemicals from agricultural production in areas near and around Nong Han	4.00
Conduct surveys to identify invasive species in inland water resources	1.00
Conduct research on the potential to use invasive plant species as materials for developing renewable energy or as material for soil improvement	3.00
Conduct research to develop and promote technology that use invasive plant species as materials for developing renewable energy or as material for soil improvement	15.00
Conduct research on producing renewable energy from invasive plant species found in wetland as materials for developing renewable energy or as material for soil improvement	20.00
Conduct researches on diversity and benefits of insects in Kung Krachao wetland, Samut Prakarn province	12.50

Marine and Coastal Ecosystem

In addition to the NBSAP, the policy direction for coastal and marine resources is laid out in the Roadmap of Department of Marine and Coastal Resources.

Figure 6: Category of measures for protection, restoration and conservation of coastal and marine resources identified in the DMCR road map



The comprehensive plan, as illustrated in Figure 6 above, comprises ten areas of intervention, namely:

i) Measures to enforce the DMCR Act, ii) Mangroves, iii) Seagrass, iv) Coral reefs, v) Marine endangered species, vi) Building the knowledge on ecosystem and promoting participation, vii) Establishing MPAs, viii) Marine debris, ix) Information system, and x) Promotion of participation.

Compared to the NBSAP, the roadmap lays out the activities in greater detail that will be undertaken by the DMCR. Some of the listed activities are presented below in Table 9 and they have been classified into five broader categories, namely support, damage assessment, protection, pollution control, protection and habitat loss prevention. Also indicated in Table 9 are the relevant sections in the DMCR Act. Note that some of these activities can be said to have already been included in the NBSAP, but most have not. For the purpose of Thailand BIOFIN, they will be considered as NBSAP plus activities. Since these activities have not been costed as such, additional work will need to be done to estimate the costs of implementation and included in the analysis of financing gaps. Moreover, collaboration with other agencies will be instrumental in successfully undertaking the proposal although DMCR will be playing an important role in these activities.

Table 9: Activities, categories and legal aspects in the DMCR Road Map of Thailand

Activities	Category	Legal aspects
Clear definition of mangrove, beach forest, beach swamp, island, canals	Mangrove – Supporting	DMCR Act Section 3
Land use map indicating each type of land	Mangrove – Supporting	-
Verification of two by area-based authorities	Mangrove – Supporting	-
Criteria for determining the extent of the damages to mangroves	Mangrove – Damage assessment	DMCR Act Section 17
Notify relevant authorities so that criteria set can be used as guidelines for damage assessment	Mangrove – Damage assessment	-
Declare protection area	Mangrove – Protection	DMCR Act Section 18

Mangrove forest management	Mangrove – Protection	DMCR Act Section 19
Declare selected areas as Coastal and Marine Protected Areas	Mangrove – Protection	DMCR Act Section 20
Define the critical level of damage coastal resources and mangrove	Mangrove – Damage assessment	DMCR Act Section 22
Reduce pressures on seagrass	Seagrass – Pollution	-
Monitor measures to reduce impact from coastal development projects as required by the EIA	Seagrass - Protection/habitat loss	-
Monitor measures to reduce impacts from projects that do not have to submit an IEE or and EIA report	Seagrass - Protection/habitat loss	-
Reduce threats from fishery activities	Seagrass - Protection/habitat loss	-
Review approval for all types of stationary fishing equipment such as piers	Seagrass - Protection/habitat loss	-
Organize a meeting of coastal fishers to discuss the impacts on sea grass from various us type of fishing equipment's	Seagrass - Protection/habitat loss	-
Increase capacity for restoration	Seagrass – Supporting	-
Promote Measures for Sustainable use	Seagrass – Supporting	-
Identify measures for protection of sea grass beds	Seagrass – Protection	DMCR Act Section 23
Monitor the status of sea grass beds for reporting purposes according to the DMCR Act (Section 9)	Seagrass	-

Increase capacity for restoration of coral reefs	Coral – Supporting	-
Reduce threats to coral reefs	Coral – Protection/Habitat loss	DMCR Act Section 17
Develop the standard for sustainable utilization of benefits from coral reefs	Coral – Protection/Habitat loss	-
Introduce measures to protect coral reefs in accordance with the stipulations of the DMCR Act section 20 and 22	Coral – Protection/Habitat loss	DMCR Act section 20 and 22
Monitor the status of coral reefs for reporting purposes according to the DMCR Act Section 9 (7)	Coral – Protection/Habitat loss	DMCR Act Section 9 (7)
Ensure that there is adequate enforcement of the DMCR Act	Coral – Protection/Habitat loss	-
Increase the capacity to provide assistance to animals washed ashore	Endangered species – Protection/Habitat loss	-
Reduce harm from human beings (getting caught in fish traps, boat accidents, marine litter and other pollutants)	Endangered species – Protection/Habitat loss	-
Research and improve conservation of marine endangered species	Endangered species – Protection/Habitat loss	-
Identification sanctuaries and measures to protect marine endangered species according to Section 22 and 23 of the DMCR Act	Endangered species – Protection/Habitat loss	DMCR Act Sections 22 & 23

Monitor the status of marine endangered species for reporting purposes according to the DMCR Act, Section 9 (7)	Endangered species – Protection/Habitat loss	DMCR Act, Section 9 (7)
Declare areas as Marine Protected Areas	Establishing new Marine Protected Areas	-

Urban Biodiversity and Ecosystem

Urbanization of cities without proper planning has led to the unintended consequence of the loss of urban biodiversity and ecosystems. The losses, in turn, have led to a number of negative outcomes for city dwellers. The more prominent impacts felt include air pollution, water pollution, floods, and coastal erosion for cities by the sea. With increasing realization of the impacts of biodiversity and ecosystem loss on urban environmental problems, policymakers in Thailand are paying more attention to their conservation.

Efforts to conserve, develop, and enhance the quality of urban biodiversity and ecosystems in Thailand are guided by two main policy frameworks:

1. the National Biodiversity Strategies and Action Plans (2015-2021),

2. the Ministry of Natural Resources and Environment's Strategic Plan (2016-2021)

The two plans set visions to be achieved, and identify strategies and measures to achieve the visions. Nonetheless, it can be seen from the estimated budget for different measures under both plans that urban biodiversity and ecosystems are not accorded its own category. As such, activities pertaining to urban biodiversity and ecosystems must compete for funds with other activities that fall under the mandate of both plans.

However, one key measure aimed at conserving urban biodiversity and ecosystem is the preservation, development, and expansion of urban green space. This measure is most prominent in the Bangkok Metropolitan Region (BMR). As mentioned earlier, the Bangkok Metropolitan Administration, which is responsible for the Capital city of Thailand-- Bangkok, has goals to increase urban green space in the city. This is primarily achieved through increasing parklands in Bangkok.

A fine example of green space conservation, development, and expansion can be seen in Samut Prakarn province to the South of Bangkok. As part of the BMR, Samut Prakarn is within proximity of Bangkok proper. The Chao Phraya River passes through the province, and Samut Prakarn is where the river empties into the vast Gulf of Thailand. Within the province lies Bang Krachao, a green urban oasis formed by natural bends in the Chao Phraya River. This area is a designated green space conservation area, and is a green urban oasis within an hour's drive from Bangkok city.

While the green area of Bang Krachao, shown in Figure 7, is mostly seen as serving the residents of Bangkok, the space also provides recreational and ecosystem services to the people of Samut Prakarn. As a province that lies on the Chao Phraya River and adjoining the Gulf of Thailand, Samut Prakarn is an important urban city in its own right. In addition to agricultural areas such as orchards and salt fields, Samut Prakarn is home to major industrial estates such as Bangpu, Bangplee, and Asia Industrial Estates. Within this setting, the benefits to urban residents of ecosystem services offered by Bang Krachao is also applicable to the residents of Samut Prakarn.

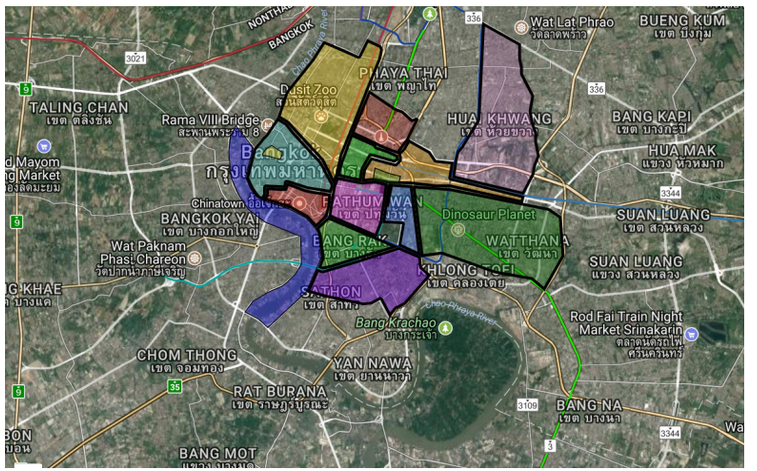


Figure 7: Map of Bangkok and Bang Krachao area in Thailand

As the Bang Krachao case demonstrates, many agencies are responsible for the conservation of urban biodiversity and ecosystem in Thailand. However, two agencies stand out in particular. The most prominent agency is the Office of Natural Resources and Environmental Policy and Planning (ONEP), which is within the Ministry of Natural Resources and Environment (MONRE). In addition to ONEP, the Pollution Control Department (PCD), another agency within MONRE, also has a crucial role to play in monitoring and mitigating the threats to biodiversity and ecosystems.

ONEP serves as the National Focal Point for the Convention on Biological Diversity (CBD). The mandate for ONEP in this position is to develop national policies and plans on biodiversity. As such, ONEP's overall role extends far beyond the scope of urban biodiversity and ecosystems. Within ONEP, the directly responsible agency for the matter is the Urban Environment Section of Urban Environment and Area Planning Bureau (UEAPB). UEAPB is responsible for proposing policies, plans and measures regarding community and rural environment, green space, and protected areas. The agency is also in charge of coordination and research and analysis on the matter. UEAPB also has the power to screen, express opinions, and offer suggestions to public and private projects that could impact community environment, green space, protected areas, and areas with potential for industrial development.

As the agency responsible for pollution control, PCD has an important role of alleviating some of the threats to urban biodiversity and ecosystems. The PCD's main role in this matter is to formulate policies and plans aimed at enhancing and conserving environmental quality (i.e. achieve low pollution levels). The PCD also regularly monitors environmental quality in many places throughout the country. As an agency in charge of controlling pollution, PCD plays an important role in reducing the threats to urban biodiversity and ecosystems. High levels of all types of pollution pose a danger to flora and fauna, and impose risks to their livelihoods and survival. Thus, if PCD is successful in reducing all types of pollution, the dangers faced by urban biodiversity and ecosystems will be reduced.

In addition to conserving and expanding green areas, implementing favorable policies, and reducing threats to urban biodiversity and ecosystem, one area of action that is especially important is the conservation of genetic biodiversity. In this regard, the Plant Genetic Conservation Project under the Patronage of Her Royal Highness Princess Maha Chakri Sirindhorn plays a key role. Officially beginning operation in the 1990s, the project aims to conserve plant genetic resources and to develop them in order to enable effective utilization of those resources. To achieve these goals, a variety of activities and initiatives are undertaken. Among other things, the project maintains a plant germplasm database center, supports the collection of plant genetic materials, promotes scientific research related to the conservation and development of plants, and encourages a variety of activities to instill conservation mindset in children and adults. The project works closely with educational institutions and local governments in implementing its activities. The project has also supported the establishment of RSPG botanical and biological clubs throughout Thailand.

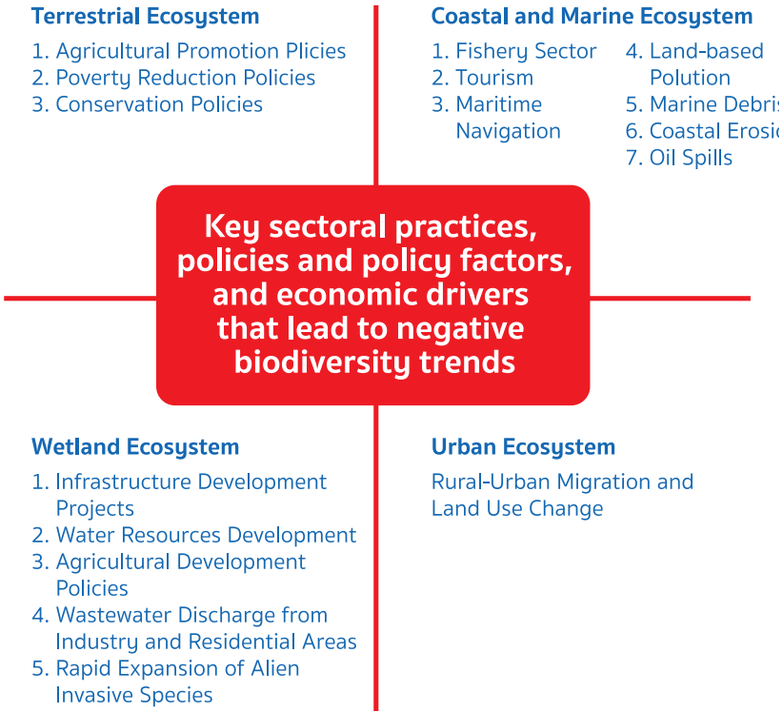
One other agency that plays a supporting role to the conservation and promotion of urban biodiversity and ecosystems is Biodiversity-Based Economy Development Office (BEDO). BEDO is a public organization, which studies data on biodiversity and uses it for economic development. In many instances, BEDO works closely with local communities to help conserve biodiversity and ecosystems. Conservation effort goes hand-in-hand with development, as communities are encouraged to benefit from the conservation of the local biodiversity and ecosystems.

In addition to BEDO, several other agencies play more indirect roles in sustaining biodiversity and ecosystem services. These include the Royal Forest Department for urban forests, and the Department of Marine and Coastal Resources for cities with coastlines. The Ministry of Agriculture and Cooperatives (MOAC) also has a role to play in terms of conducting research and development on fisheries, agriculture, rice conservation, and so forth. The Department of Environmental Quality Promotion is relevant in that it seeks to promote the dissemination of environmental information to the public.

KEY SECTORAL PRACTICES, POLICIES AND POLICY FACTORS, AND ECONOMIC DRIVERS THAT LEAD TO NEGATIVE BIODIVERSITY TRENDS

This section reviews the key sectoral practices, policies and economic drivers that are contributing negatively to biodiversity trends in Thailand (Figure 8 below). Some of the policy drivers highlighted are cross sectoral (e.g. poverty reduction, agricultural promotion), while others are sector specific. Once again, the section is structured according to the four main ecosystems under focus.

Figure 8: Key practices, policies and economic drivers that lead to negative biodiversity trends in Thailand



Terrestrial ecosystem

Agricultural promotion policy

Agriculture is important for Thailand as 40 percent of the Thai population still lives in the rural areas and practice some form of agriculture. For this reason, the Thai government tends to place agricultural policies highly on the agenda. However, agricultural policies often overlap with poverty reduction policies as many of the farmers in the rural areas are still poor. Many of these agricultural and poverty reduction policies tend to fail to both increase economic efficiency in the agricultural sector as well as solve poverty in the rural areas. Such policies include, for instance, support to conversion of commercial cash crops such as cassava, sugarcane and rubber (Trisurat et al 2010), an agricultural price support program (Duangbootseea and Myers 2015), and expediting the land titling process starting from B.E. 2527 (1984) for the farmers. In addition, these policies sometimes become detrimental to biodiversity conservation impacting on hydrology and water quality (Wosten et al 2008).

Commercial plantation of corn is pervasive in the Northern provinces in Thailand, particularly in the forest reserve areas. Corn plantation in the highland is illegal as it is practiced in the forest reserve. But owing mainly to the attractive high financial returns and the well-established production and marketing network by the animal feed monopoly, illegal corn plantation has managed to expand in many provinces in the northern region. Each year, more forest cover is cleared to provide room for corn production to serve the growing animal feed industry and the expanding export of food

products. In addition to ineffective law enforcement that fails to keep the farmers out of the forest reserve, agricultural policy failure exacerbates the issue of allowing agribusiness to expand their contract farming networks into the area of illegal corn plantation in the forest reserve areas. Furthermore, the Ministry of Commerce also adopted a Non-Tariff Barrier (NTB) for corn where they ban corn imports from the neighboring countries during the corn harvesting seasons in Thailand. This NTB aims to raise the

domestic price of corn in Thailand and maintain the farmers' income. At the same time Thailand encourages its trading partners to eradicate their NTBs to allow Thai exports to enter other markets. The agricultural policy has made the Thai feed industry fragile as corn used as input in the feed industry is illegally cultivated. Meanwhile corn plantation continues to increase at a rapid rate (see Sarinee et al 2014 and ONEP)[14]. Indeed, Kanittha Tambunlertchai and Sittidaj Pongkijvorasin (2012) report that from 2005 to 2010 corn plantation in the Nan Province alone rose from 115,975 acres to 336,940 acres[15].

Rubber plantation, on the other hand, is more pervasive in the Southern region of Thailand. While most of rubber plantation is practiced in low land with secured land ownership, a substantial rubber plantation area is reported on highland forest reserve as well. Illegal rubber plantation on highland forest reserve is less noticeable compared to that of corn plantation as rubber can be easily disguised in forest reserves. However, evidence shows that much of the forest reserves in the Southern part of Thailand are occupied by commercial rubber plantation instead of indigenous forest. This trend of pervasive rubber plantation in the forest reserves is partly governed by market forces and partly by government policies to promote rubber plantation and rubber price support program. The operation of the Rubber Replanting Aid Fund scheme is also partly responsible for illegal rubber plantation.

[14] Sarinee Achavanuntakul, Phatthaphon Yaemlao, Koranis Tanangsnakool, Sasivimol Klongakara and Parata Senpan. "Maize supply chain to support sustainable watershed management in Nan Province", Sal Forest, Bangkok, 2014.(in Thai); Office of Natural Resource and Environmental Policy and Planning (ONEP), State of Environment BE 2559, Bangkok, 2016, page 322. (in Thai)

[15] Kanittha Tambunlertchai and Sittidaj Pongvorasin, Animal Feed Corn – inequality at the local level: case study of corn supply chain, Viengsa District, Nan Province, Faculty of Economics, Chulalongkorn University, Bangkok, 2012. (in Thai)

Today a consumer of the corn and rubber products is not able to distinguish between legally or illegally produced corns. However, as the standard of living of Thai people gradually increases over time, there tends to be an increase in demand for green consumption. These consumers tend to be concerned about sustainable production and consumption. This will eventually become a means to combat the illegal expansion of corn and rubber plantations through an agricultural trading system. Thus, the market is favourable to the sustainability standards and certifications such as Good Agriculture Practice, Organic Participatory Guarantee System, Fair Trade; traceability system, and documentation of proper land ownership title accompanying crop trading. Such initiatives could provide incentives for smallholder farmers to operate in proper agricultural areas and avoid farming in the forest reserves. Aside from relying on green consumption and the green production trend, government efforts away from mere price subsidies and more towards technological innovation in rubber plantation would be less distortionary and still able to raise farmers' income. Last but not least, a concerted effort in law enforcement on forest encroachment still remains a priority for Thailand. Thus, on 22nd May 2018, the Draft Community Forest Act was endorsed by the Cabinet with the expectation that the participatory system of local communities in biodiversity management will enhance the livelihood of local communities.

Poverty reduction policy

As mentioned at the outset, poverty reduction policies in Thailand often appear in the form of agricultural policies. Policies such as agricultural price support policy or free water for agriculture neither increase economic efficiency in the agricultural sector nor eradicate poverty. Two additional poverty reduction policies that have direct implication on biodiversity conservation are free land title issuance for the landless farmer and the cabinet resolution (30 June B.E.2541) to exempt civil action against forest encroachment.

Low productivity and producing low-value crops have been a root cause of poverty in the rural areas of Thailand. This lack of income potential has subsequently led many Thai farmers into other forms of difficulty, such as chronic debts or lack of farm improvement. With indebtedness problems that continue season after season, some farmers end up selling their farmland or parts of their farmland in order to restart their future. As a result, landlessness has become an important issue of the Thai rural farming.

Owing to the landless problem, the Thai Government was accustomed to issuing free land title to the landless farmers. The lands that the Government uses for issuing land titles are generally the degraded forest reserves. The Government land issuance policy is administered under the Self- Enhancing Estate program or Sor-Por-Kor program. However, after such practice, this free land title issuance policy has, in turn, provided perverse incentives for further forest encroachment as those who encroach the forest reserve will eventually be permitted to occupy the land they encroached either with or without some form of land utilization documents. Giving free land title to the landless farmers has also proven ineffective in improving the welfare of the farmers as many farmers ended up selling the title they receive whilst ending up landless still. In terms of biodiversity conservation, this free land title issuance policy has generated a negative pressure on forest encroachment and hence biodiversity loss.

Another government policy that deserves mentioning is the cabinet resolution (30 June B.E.2541), which was passed in 1998. Forest encroachment can be found in many areas and those who encroach forest reserves are subject to legal action such as fine. However, as human settlement in the forest reserves may have occupied the land for generations and even before the forest was declared forest reserve, these villagers claim that they are entitled to the land. As it is generally difficult to distinguish between human settlements occupy the land before the forest reserve declaration and those that occupy the land after the forest reserve declaration, the Thai cabinet decided to pass a resolution in 1998 to withhold civil action against forest encroachers until further court ruling. This cabinet resolution has become an obstacle for government officials to take civil legal action against forest encroachers and, again, became a moral hazard problem encouraging people to encroach forest reserve and exert further negative pressure on biodiversity conservation.

As a middle-income country that aims to get itself out of the middle-income trap issue, Thailand adheres to several policies geared towards promoting economic growth and raising the average income of the people. Equally important is the issue of poverty reduction in Thailand. Throughout the present decade, the number of people living under the poverty line in Thailand is roughly 5 million or just under 10 percent of the population. This makes the issue of poverty reduction very relevant for Thai economic policy. For these reasons, many policies in Thailand are oriented towards economic growth promotion. These policies may include, for instance, export promotion policy to increase agricultural exports, expansion of housing in urban areas in an attempt to raise the wellbeing of the people, industrialization policy to increase both national income and average income or tourism promotion policy to increase inflow of foreign exchange and income.

While these growth promotion policies may eventually move Thailand out of the middle-income trap and reduce poverty, if such growth policies are not well-designed to incorporate sustainability dimensions in the growth promotion measures they may exert a negative pressure on the environment as well as biodiversity conservation. The sustainability dimension of growth promotion measures may include mechanisms such as effective Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA), proper pricing of natural resource utilization or establishing and enforcing a regulatory framework governing resource extraction and waste disposal. As we have seen, when growth promotion policies fail to incorporate the sustainability dimension, they tend to affect biodiversity resources in many ways. Here, the way that the increased plantation of rubber and corn areas into forest reserves imposes a negative pressure on terrestrial resources is a case in point.

Conservation policy

Last but not least, it is worth noting that while there exist conservation policies and measures aimed to enhance biodiversity conservation, some conservation measures themselves can have indirect negative impact on biodiversity conservation. The listing of endangered plant species is a case in point. Owing to forest encroachment for timber, such as teak, Thailand decided many years ago to list teak as prohibited plant. To this end, the policy was designed to curtail the commercialization of illegal teak throughout the country. However, the prohibitive policy created around teak plantation,

teak processing and teak transportation offered an impractical solution and therefore seldom was enforced in Thailand. Instead, with limited supply of teak by the private sector and the continued demand for teak, people still continue to harvest teak illegally from the forest reserve. There is now a proposal to liberalize wood plantation in Thailand so as to stimulate the private supply of hardwood to meet the demand and hence reduce the pressure on illegal logging but such as an effort has not yet materialized so long as teak and several similar hardwoods are still listed as being prohibited plants. This prohibited timber policy teaches us an important lesson that successful conservation must also take into consideration the possible adverse effect it may have on biodiversity conservation.

Wetland ecosystem

Infrastructure development, expansion of built up areas and urban amenities

The pressures on Thailand's wetland is the continuing expansion of physical infrastructure, such as construction of roads and expansion of built-up areas. Conversion and degradation of vast areas of wetland often fails to take into account the costs of those projects in terms of the loss of natural capital. This is particularly the case where there are no well-defined boundaries of what constitutes 'wetland'. The impact is not only the reduction of the wetland, but also in the changes in the wetland ecosystem where this results in changes in natural drainage of the area or even changes in the water channels. Incredible though it may seem, wetland have also been destroyed to build government offices and educational establishments. Examples include the development of land in the lower central region around Ayutthaya province where wetland have been developed into industrial estates and residential areas, alongside the construction of school buildings in Uttaradit province. The fragmented nature of management of wetland and failure to communicate the importance of the various dimensions of benefits allowed this to happen. For example, lack of knowledge on wetland hydrology leads to the notion that seasonal flooding is a 'natural disaster' calling for construction of dykes and other engineering methods. To control and regulate quantity and water flow without realizing that these actions would alter the water flow and the natural drainage systems within the wetland. Indeed, some agencies are prone to viewing wetland not for their ecological functions, but as wasteland, hence seeing only the benefits of what they could be turned into and not as a loss of natural capital. With increasing construction comes the demand for soil and open access wetland often become the supplier of soil for landfill in construction sites.

Agricultural development policies

Agricultural production is another source of pressure on the wetland ecosystem in Thailand. Here, one of the main negative policy drivers has been a policy to promote the development of the production of biofuel crops and, in particular, the goal to expand area under oil palm production by 2 million rai. This expansion target could be beneficial if the target areas were to be restricted to farmland that is no longer used for rice production, with the measurement being 46,134 rai in land reform areas. On the other hand, the net benefit of targeting other types of land such as 146,991 rai of peat lands in the southern provinces of Thailand and 37,291 rai in the Pak Panang river basin needs to be looked at. Since the conversion of existing wetland itself would have adverse impact on the wetland ecosystems, the Ministry of Agriculture and Cooperatives (MOAC) would need to weigh the benefits of trying to meet Thailand's energy supply target against the costs of losing the wetland.

Impact does not only stop at the conversion of land for agriculture, but also concerns the use of chemical inputs and the risk of contamination of water sources from chemical residues. In this way, a common practice in Thailand is to pump in salt water for aquaculture (i.e. shrimp farming) which, in turn, can increase the overall level of salinity of the water. To this end, discharge of wastewater from shrimp farms contributes a serious problem in terms of the potential for water contamination in Thailand. Lastly, other causes of deterioration of the wetland ecosystem include the rapid expansion of alien invasive species such as water hyacinth and snails, alongside the discharge of water from industries and residential areas.

Marine and coastal ecosystem

In this section, several policy drivers and pressures that have a negative effect on Thailand's coastal and marine ecosystem are discussed. The risks highlighted have been categorized according to the relevant sector.

Fishery sector

One of the sectors that relies on the abundance of coastal and marine resources and also one of the sectors which poses higher risks to its sustainability is the fishery sector. Thailand, the world's third largest seafood exporter, exported over USD 700 million (10 percent of total fishery exports) worth of fishery products including fish, shrimp and cuttlefish, and agro-industrial seafood in 2014.

The rise in revenue from the fishery sector, seen from another angle, points towards the increasing risks to coastal and marine life. In the past, conversion of mangroves for fish farming as well as the discharge of wastewater from shrimp farms directly into the sea was the major issue; however, intervention to terminate all mangrove concessions accompanied by declining profits from shrimp farming has at least contained, and in many cases eliminated, the further conversion of mangroves for alternative uses. Yet, coastal and deep-sea fishing continue. In fact, over-fishing beyond both the Maximum Sustainable Yield (MSY) and the Socially Optimum Yield (SOY) has been well documented in Thailand. With uncontrolled expansion of the number of fishing trawlers, Thailand has been on the watch list of international community regarding the Illegal, Unreported and Unregulated (IUU) fishing and over-fishing practices. For the period 2008 to 2011, for the Gulf side, Catch per Unit Effort (CPUE) for trawlers ranged between 18-25 kg/hour and the average was 25 kg/hr. For the Andaman, CPUE ranged from 39-45 kg/hour and averaged at 41.263 kg/hour [16 17]. In addition to the quantity harvested, the threats to sustainability of coastal and marine life is the use of destructive fishing gears such as trawlers and dynamite fishing in Marine Protected Areas, sea grass beds and coral reefs. There is also widespread violation of the 3,000-metre coastline limit- a protection in place for small artisanal fishers- as large fishing vessels encroach on the shore. Lastly, the use of fishing equipment such as drift nets also poses risks to marine turtles, dugongs and dolphins further compounds the woes in the fishery sector.

Tourism

It is estimated that between the year 2012 and 2014, the number of tourists visiting the 23 provinces has reached more than 20 million per year[18]. Snorkeling and scuba diving are among the major attractions that bring both Thai tourists and visitors worldwide. The top 3 most important sites being Phi Phi islands (Krabi), Koh Tao Island (Surat Thani) and Pattaya beach (Chonburi). In 2014, revenue from tourism was around THB 600,000 million with 50 percent coming from coastal tourism[19].

[16] Research and Development Office. Department of Fisheries. 2011 Annual Report (in Thai).
[17] DMRC (2015). Bible: Thailand's Coastal and Marine Resources. Page 124.
[18] DMCR (2015). Bible: Thailand's Coastal and Marine Resources. Page 124 quoting data from the Bank of Thailand (BOT) 2557.
[19] DMCR (2015). Bible: Thailand's Coastal and Marine Resources. Page 125

Although tourism has generated sizable foreign exchange revenue for Thailand, it has also exerted pressure on natural resources and the environment. Thus, in relation to biodiversity resources, tourism activities have added pressure on coastal resource conservation. The increase in the volume of tourist activities as well as malpractices on the part of tourism operators, has led to an expansion of the number of hotels and accommodation along the coastal areas. Diving, snorkeling and anchoring have had negative impacts of corals and seabed. These negative drivers have been a result of the government's tourism policy that aims to increase earning from unregulated tourism activities.

The negative impacts of tourism in Thailand are not only observed in the environmental sector, but are also felt within society in other ways, such as in cultural conflicts. The government policies of the past that aimed to increase the number of international tourists need to be seriously reconsidered. A more sustainable tourism policy should emphasize more on sustainability and value creation instead of a mere increase in the number of tourists each year. As with the fishery sector, while sea- based tourism is contingent upon the quality of coastal and marine resource, uncontrolled growth of the sector is also a direct cause for destruction of the natural resources. The degradation of coral reefs and coastal water quality in many popular island destinations are clear demonstrations of the harm done and the trend that is likely to be accelerated if the "business as usual" path is followed. Moreover, a number of infrastructure developments have been approved despite obvious risks to the local environment in which these infrastructures are built. The planned expansion of Phuket International airports and the construction of tourist boat piers in Trang province are two examples in which environmental concerns have been bypassed in the name of economic growth.

Maritime navigation

The first attempt to estimate the monetary value of marine resources in Thailand was a study by Padermsak Jarayaphand (2007), which estimated a total value of THB 7.442 trillion in 2007 prices. Converting this figure into US Dollars amounts to 215,596,410,010. Around 82 percent of this value was revenue from the maritime sector consisting of shipping, port facilities, forwarding, and freight services. By 2015, the value of maritime sector was roughly estimated to have increased from THB 6.12 trillion to an estimated high of THB 20 trillion (USD 579,710,144,928). While the sector's economic importance is undeniable, both current and projected volume of maritime navigation as well as expansion of infrastructure investments to accommo-

date its growth poses direct threat to marine biodiversity resources. The other threats include land-based pollution from wastewater and sediment, habitat disturbance and conversion, and loss of aesthetics. Finally, owing to the huge knowledge gap in the economic values of coastal and marine biodiversity resources and the necessity of needing to make trade-offs, it is most probable that greater weight will be attached to the more tangible economic importance of the maritime sector.

Land-based pollution

One of the changes in the quality of the environment, which could directly affect coastal and marine biodiversity resources as well as revenue earning potential is water quality. There are altogether 294 stations distributed along both coastlines, which have been collecting water samples, analyzing, and classifying water quality into five levels from very good to very poor quality. Overall, as yet there are no major causes for concern as the only two areas where between 2-3 percent of water sample collected were classified as being 'very poor' and this was the upper part of the Gulf of Thailand and Andaman coastline.20 Wastewater discharge is a source of water pollution in rivers and canals in Thailand. Untreated wastewater discharge can be found in agriculture, household and factories. Owing largely to under-investment in public wastewater treatment facilities, farms, households as well as businesses end up discharging their untreated wastewater in public waterways. This wastewater discharge has thus affected lifeform and hence reduced biodiversity in rivers and canals.

Occurrences of red tide and harmful algal bloom, invasive species such as Litopenaeus vannamel initially brought in for commercial shrimp farming, Mytilopsis adamsi and Leucothoe spinicarpa initially thought to have come from ballast water with the former now widespread in Songkhla Lake and nearby lagoon, Tetilla japonica, Clavelina cyclus, Ecteinascidia thustoni and Ciclasoma urophthalmus originally brought into the country as ornamental fish and has now spread into natural habitat especially in areas with brackish water.[21]

[21] DMCR (2015). Bible: Thailand's Coastal and Marine Resources. Page 106.

Marine debris

Marine debris is among the causes of endangered species mortality. Between 20-30 percent of marine turtles' mortality is caused by having swallowed marine debris.[22] Based on a survey conducted by DMCR in 18 provinces for the period 2009-2015 using the International Coastal Clean Up survey form, a total of 363,228 pieces of marine debris were collected and 46 percent were types of debris that would have been discarded by beach and sea-based recreational activities.[23]

Coastal erosion

Other changes that might affect the health of coastal and marine ecosystem of Thailand is the intensified problem of coastal erosion. Coastal erosion is affecting some 830 kilometers or 26 percent of Thailand's coastline.[24] It is an issue that deserves further investigation, as currently there has not been conclusive evidence on the root causes of coastal erosion. Arguments on the causes of coastal erosion range from dam construction that obstructs natural sedimentation to infrastructure development along the seashore, such as, roads, recreational sites and jetty.

Oil spills

The incidents of oil spill are surprisingly frequent. From 2000, there have been 10 incidents. Some of these have occurred in ecologically fragile areas causing damages to mangroves and coral reefs such as around Koh He, Koh Racha (September 2010) and Koh Samet (August 2013). While the general public is more aware of the damages from oil spill incident because of the sudden and more visible damages, the problem of ballast water is on-going occurrences, which, except for experts in the field and directly concerned agencies, almost goes unnoticed.

[22] DMCR (2015). Bible: Thailand's Coastal and Marine Resources. Page 69.
[23] DMCR (2015). Bible: Thailand's Coastal and Marine Resources. Page 103
[24] DMCR (2015). Bible: Thailand's Coastal and Marine Resources. Page 95

Urban biodiversity

Negative trends affecting urban biodiversity and ecosystem service include rural-urban migration, and land use changes. In 2000, Thailand's urban population numbered 9.3 million. In 2010, the number grew to 11.8 million. Growth in urban land in the same period also expanded from 2,360 square kilometers to 2,710 square kilometers (World Bank, 2015). Such increases impose pressures on natural resources and the environment. Increases in population lead to higher demand for housing units and supporting infrastructure.

Thus, the main threats to biodiversity and ecosystem in urban areas are urbanization and pollution. Land use changes that come with the growing of cities lead to conversion of natural land into built environments. This, in turn, results in loss of habitats and natural environments. With the loss of habitats and destruction of natural ecosystems, the loss of biodiversity is the inevitable outcome. Statistics indicate that the built environment area in Thailand has grown over the past decade. As population in urban centers has grown, built area grew by 21 percent from 2006 (Land Development Department, 2017; World Bank, 2017). In addition to being one of the factors that lead to a decline in green space and natural habitats, urbanization is also one of the culprits behind the loss of rice varieties. This is due to conversion of farmland into urban areas. Urbanization and industrialization are also cited as the factors responsible for loss of native cultivated species from their habitat sites. (ONEP, 2015).

Pollution is a threat to biodiversity and ecosystems. Air pollution generated in urban areas in the form of ground-level ozone, nitrogen oxides, and sulfur dioxide has harmful impacts on species and ecosystems. Ground-level ozone damage cell membranes, impeding the ability of organisms to grow (Mills, Wagg, & Harmens, 2013; UNECE, 2017). Nitrogen oxides and sulfur dioxide result in acid rain, which, in turn, deposit in water, soils, and vegetation. The resulting acidic condition is harmful to both fauna and flora. Particulate matter can also deposit on plants. For certain plant species, this deposit can impair normal functioning of the plants (Rai, 2016). Damaged plants and animals ultimately lead to impediments of the ability to provide ecosystem services. (Rai, 2016; Sutton et al., 2014; UNECE, 2017).

In urban centers such as the Bangkok Metropolitan Region, all of the main air pollutants that can cause damage to plants and animals can be found. However, particulate matter and ground-level ozone are especially problematic. In 2015, three provinces in the BMR made the top 5 in terms of worst air quality. Samut Prakarn recorded 97 days with air pollution levels exceeding the standard. Bangkok recorded 85 days and Ayutthaya recorded 74 days respectively. The major contributors to the violation of air quality standards are particulate matter and ground-level ozone. Nonetheless, compared with the previous year, the number of days in violation of the standards was slightly lower in 2015. (Pollution Control Department, 2017).

With all cities in the Thailand Environment Institute (TEI) survey citing that biodiversity can be found in waterways, maintaining good water quality becomes essential to biodiversity protection (Dudgeon et al., 2006). However, water pollution tends to be more severe in urban areas. This is especially true for the major rivers that run through industrial areas and the Bangkok Metropolitan Region In 2015, an assessment of water quality using the Water Quality Index (WQI)[25] classified the central and the lower parts of the Chao Phraya river as degraded. The same is true for Tha Chin river, Pasuk river, Sakaekrung river, and Lopburi river, all of which are in the Central region. In the North, Kuang and Borapet pond are classified as degraded. In the Northeast, the degraded waterways are Pong, and Lamtakong (lower part). In the East, Rayong (upper and lower part), and Pungrad (upper part) are degraded. In the South, it is Talaynoi. In addition to these waterways, seawater quality is also low in the Upper Gulf of Thailand adjacent to the BMR. (Pollution Control Department, 2017).

[25] WQI is calculated based on 5 water quality parameters. These are Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD), Total Coliform Bacteria (TCB), Fecal Coliform Bacteria (FCB), and Ammonia and Nitrogen (NH3-N).

KEY SECTORAL PRACTICES, POLICIES AND POLICY FACTORS, AND ECONOMIC DRIVERS THAT LEAD TO POSITIVE BIODIVERSITY TRENDS

KEY SECTORAL PRACTICES, POLICIES AND POLICY FACTORS, AND ECONOMIC DRIVERS THAT LEAD TO POSITIVE BIODIVERSITY TRENDS

This section reviews the key sectoral practices, policies and economic drivers that are contributing positively to biodiversity trends in Thailand (Fig 9). Some of the policy drivers foster cross-sector collaboration (e.g. enhanced R&D activities drawing on biodiversity), while others are sector specific. Again, the section is structured according to our main four categories of ecosystems.

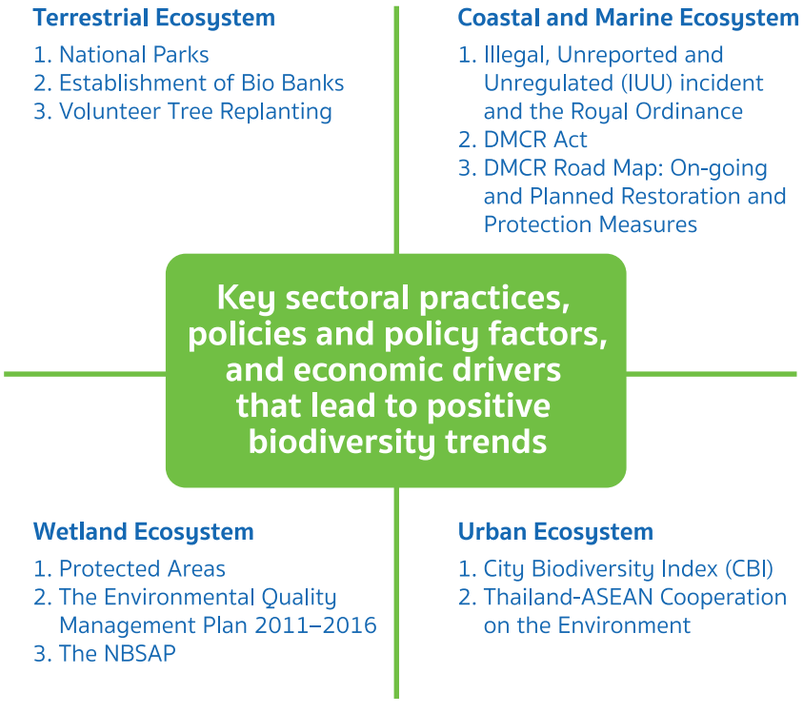


Figure 9: Key practices, policies and economic drivers that lead to positive biodiversity trends in Thailand

Terrestrial ecosystem

Following the diminution of the forest coverage in Thailand, there has been an increase in the number of National Parks throughout the country. Currently, Thailand has been able to establish as many as 465 forest reserves covering an area of 206,793 square kilometers. The forest reserves include, for instance, National Parks, Non-Hunting Areas, Botany, Wetland, RAMSAR sites, etc. Converting the status of some forest reserve areas into National Parks is a policy innovation that has proven effective in Thailand. When forest reserves are managed under national park management, the authority is able to enforce tougher regulations on encroachers as well as being to tap on more public resources for park management.

Attempts to expand National Parks have been rather successful. Many conservation areas have been kept intact after they are declared as national parks. This is, as mentioned earlier, due to the ability of the authority to exercise a stronger set of regulation when the area is declared as national parks compared to a forest reserve. The more recent establishment of R&D activities has proven useful in safeguarding biodiversity resources as well as enhancing its value in economic activities. The establishment of bio-banks, both in-situ and ex-situ enables Thailand to document more than 100,000 plant and animal genetics. This information will become valuable for future research and development in plant and animal genetics.

Given the continued decline of forest coverage, there are several groups of Thai people as well as organizations that volunteer to replant trees in the encroached forest reserves and mangrove areas. These volunteers range from students to employees of companies and organizations who would spend days replanting tree as a part of their CSR activities. During 1994 – 1999, PTT Public Company Ltd already reforested 400,000 acres in 416 forest plantation areas under the Royal Golden Jubilee Reforestation program throughout the 48 provinces in Thailand. The total budget was THB 3,500 million or US$ 97.34 million. The PTT's biodiversity projects are seen as a part of their CSR program.

A more innovative effort is seen in the form of Tree Bank Program that is operated under the Bank of Agricultural and Agricultural Cooperation (BAAC). The aim of the Tree Bank Program is to encourage the villagers to plant trees in their farm and use them as credit for bank collateral. While this program has been successful, its expansion is limited by the BAAC budgetary support.

Wetland ecosystem

Discussed in this section are the enabling policies that promote conservation of wetland. While it has already been noted that at the policy level, there is yet to be full recognition of the importance of wetland, concrete action was taken to register wetland as sites of ecological importance beginning in 2000. This list was revised in 2009, with the numbers of each type of wetland of varying importance described in the earlier section. To this end, Thailand has made the first step towards the identification of conservation measures, together with other leading and supporting agencies responsible for wetland. As a signatory of the Convention on Wetland known as the RAMSAR Convention (entered 1998), to date, Thailand has 14 Ramsar sites. Some of these are located in Protected Areas, namely, areas designated as National Parks or No Hunting Zones while some are located in common lands.

It is significant, therefore, that the acquired status of being a Ramsar site will be followed by a series of protective measures for wetland. The areas in question will become, for instance, Non-Hunting Zones. Landfilling will no longer be permitted and any construction work will only be allowed if there are no negative impacts. Since restoration measures will also have to be identified, the responsible agencies will have to formulate Master Plans, which in principle should lay out measures to be undertaken in the short and the long run.

The commitment under RAMSAR can also be said to have resulted to some concrete measures. The key areas addressed by the wetland conservation policy approved by the Cabinet in 2009 include:

1. Creating awareness of the importance of wetland
2. Management and coordination in conservation
3. Capacity building of concerned agencies
4. Promotion of basic researches to generate information that can be used in establishing a database
5. Setting conditions for land use and obtaining land rights
6. Promoting active and effective enforcement of the laws
7. Promoting cooperation in conservation of transboundary wetland

Thailand has 14 wetland declared as Ramsar sites. Within these sites, there can also be areas that have 'Protected Status'. Protection measures of wetland very much depend on the type of 'Protected' status of the wetland. Thailand has 7 categories of 'Protected Areas', namely (i) National Parks, (ii) Forest Park, (iii) Wildlife sanctuaries (iv) Non-Hunting Zones (v) Environmental Protection Zones, (vi) Forest reserves, (vii) Restricted areas to protect herbal plants. Many of the wetland listed earlier are areas designated as National Parks and will benefit from the protected status as defined by the National Park Act, 1961. The main purpose is to protect natural resources such as flora, forest products and wild animals to ensure the sustainability of natural resources and of the natural landscape. The Act prohibits the occupation of any part of the national parks, clearance of areas, collection of forest products, hunting wild animals and collection of any rocks, sand or stones. The Act does allow entry into the national park areas for educational and recreational purposes. Violators are subject to fines or imprisonment as well as confiscation of weapons, tools and vehicles used in committing the crimes.

There were also wetland located in areas designated as Wildlife Sanctuaries and Non-Hunting Zone. The law that provides protection is The Wildlife Preservation and Protection Act, 1992 support breeding of wildlife species, and to help protect and conserve wildlife species. The principle is also to ensure that Thailand undertakes measures that reflect willingness to cooperate with international communities in the protection and conservation of wildlife and endangered species by declaring designated areas as wildlife sanctuaries and no-hunting zones.

The determination of any kind of wildlife to be protected shall be made by the ministerial regulations with the approval of the committee. The National Wildlife Preservation and Protection Committee has the power and duty to approve of any determination of Wildlife Sanctuaries, to determine the Non-Hunting Wildlife Areas as well as the kind or category of wildlife hunting which is prohibited in such areas.

Strategy 2 of the Environmental Quality Management Plan 2011-2016 highlights the importance of local community participation in reducing the pressure on biodiversity resources, in situ and ex situ conservation, restoration and sustainable uses of wetland biodiversity resources. Meanwhile, the Strategic Plan for Water Resources Management recognizes the need to protect natural water resources within wetland outside protected areas so as to prevent overutilization or conversion to other purposes. Lastly, the current NBSAP can be said to have reiterated the importance of wetland ecosystems both in terms of the number of projects and activities related to wetland as well as budget estimates.

Marine and coastal ecosystem

Rehabilitation of forest, wetland and marine and coastal resources in Thailand tend to be scattered thus rendering efforts generally ineffective with respect to meeting the national targets except in the case of mangroves. Community efforts are critical and very site specific with limited opportunities for replication in other sites. The remainder of this section will discuss the initiatives and policy drivers that are steering change.

Opportunities that Arise out of a Crisis – Illegal, Unreported, and Unregulated (IUU)

A visit from a European Union (EU) representative to Thailand in October 2014 led to a formal warning in February 2015 issued to Thailand for not complying with the IUU. As such, Thailand was given a deadline to amend the situation within six months. A worst-case scenario would be that the EU imposes a sanction on all imports of fishery products from Thailand.[26] Opinions on how this sanction might affect Thailand vary. Some have observed that the overall status of Thailand's fishery exports would not be affected. This is because over 58 percent of the fishery products Thailand exports to Europe are canned and prepared seafood; most of which consists of canned tuna and prepared shrimp where all tuna raw material is imported mostly from Taiwan and the US, while most shrimp raw material is farmed shrimp.[27] The Thai Off-Shore Fishery Society in contrast estimated that despite the fact that the share of exports to the EU represents only around 10 percent of total value of exports, the economic loss could be as high as THB 1,000 million since receiving the so-called warning 'yellow card'. In addition, Thailand's export performance would suffer from the withdrawal

[26] mrtnews January 11, 15, 12:18:45 PM. DG of DOF

[27] The EIC noted however that the impact could be up to USD 500 million if shrimp farmers are unable to validate products' legality because they use small fish in fishmeal to feed shrimp. (EIC)

Generalized System of Preferences (GSP) resulting in reduced competitiveness as Thailand now has to pay higher import tax (20 percent higher for frozen shrimp from the original 7 percent and canned tuna increased from 21 to 24 percent).[28]

The pressure brought has prompted the DOF in collaboration with the Marine Department into more intensive level of action. The DOF reportedly set up 112 mobile units in 23 provinces to expedite the registration process. Cabinet decision is that the Marine Department issue regulations that large fishing vessels of more than 60 tons gross has to install Vessel Monitoring Systems (VMS). A number of vessels have already applied to install the VMS even prior to the official announcement of this regulation.

The pressure from the IUU can be said to have provided the stimulus needed to overhaul the management of Thailand's fishery sector. Indeed, the six action plans included in the IUU Fishing Roadmap were the much-needed measures to control illegal fishing and overharvesting of marine resources. To this end, fishing vessel registration and fishing licensing, Monitoring, Control and Surveillance (MCS) and Vessel Monitoring System (VMS) would be instrumental in improving traceability. Importantly, the continuity of these measures would be assured with the existence of the Royal Fisheries Ordinance to replace the outdated Fisheries Act.

However, one of the preconditions to management overhaul is cooperation among governmental agencies such as DMCR, the Marine Police Division, the Royal Thai Police, the Royal Thai Navy, Thailand Maritime Enforcement Coordinating Center, the Customs Department, the Ministry of Foreign Affairs, the Ministry of Labor and the Ministry of Social Development and Human Security. On 14 January 2016, the Command Center for Combatting Illegal Fishing (CCCIF) reported progress in restructuring of the legal framework, developing key systems, law enforcement, enhancing international cooperation, and assisting victims of illegal fishing. As of November 2015, for example, the Royal Ordinance on Fisheries B.E. 2558 (2015) was enforced, which aimed at achieving two main objectives; namely, elimination of illegal fishing and promotion of sustainable fishing industry. Altogether 28 port-in-port-out (PiPo) Centers and officers from the Department of Fisheries, Ministry of Labour, Marine Department and Mobile Team units. To promote understanding about these major legal changes, a "fishermen's" legal handbook has also been published.

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Monitoring, Control and Surveillance (MCS) system has been established at the CCCIF and the Department of Fisheries. Vessel monitoring systems (VMS) have also been installed in 2,076 out of 2,216 fishing vessels of 60 gross tonnage or more (93.7 percent). Traceability system has also been launched, enabling relevant officers and consumers to detect whether fishery products originate from illegal fishing. Special task force units comprising several agencies have been set up to inspect vessels and enforce the law.

In addition to the government actions, there have been other welcomed developments. A "Task Force" industry alliance, for example, has been set up to ensure that the fishing industry's supply chain is free from illegal and forced labor. The task force includes leading retailers, manufacturers, government bodies, and NGOs such as Costco, WM Morrison Supermarkets, Sodexo, Charoen Pokphand Foods (CPF), Thai Union Frozen (TUF), Oxfam, and the Environmental Justice Foundation (EJF). There were also positive developments on the demand side as manufacturers announced that they will stop purchasing products and terminate contracts with all suppliers that violate human rights or the Royal Ordinance on Fisheries. The action coalition also includes a "Shrimp Task Force" policy to reduce fishmeal use to only 10-20 percent and use by-products from tuna and surimi processing instead.

The changes have not been welcomed by all parties, even those who stand to benefit in the long run. There have been protests from Traditional Fishermen Group (Feb 2016) demanding the withdrawal of Section 34 of the Royal Ordinance, which prohibited artisanal fishermen from fishing beyond three nautical miles from the shore. The Earthnet Foundation reported that around 50,000 households or 80 percent of fishermen were artisanal and this new restriction more or less force them to fish near shore that should technically be conservation zones. There are also widespread complaints against commercial fisheries entering the three nautical miles from shore. A number of fishing vessels were reportedly able to operate but did not do so due to having been 'asked' by the 'Fishermen society' so as to increase the pressure on the government.

In sum, the IUU incident is the external push needed to stimulate the necessary actions. There is no one-size fit all solution, but it appears as though most stakeholders are only concerned with demanding rights while ignoring responsibilities that come in the same package.

Though many might view the IUU pressure in a predominantly negative light, it has brought about positive changes as discussed in the earlier section of this report. With respect to the Royal Ordinance, it goes without saying that the replacement of the Fisheries Act 1952 principally, by introducing elements of control over the number of fishing vessels, the harvesting practices and levels of penalties for non-compliance should result in some level of reduction of overfishing.

The DMCR Act

An important landmark for the management of coastal and marine resources in Thailand is the enactment of the Department of Marine and Coastal Resources Act, which will empower the DMCR to take the lead in many crosscutting issues and act as focal points in areas where collaboration among institutions is needed, such as management of mangroves and coastal erosion. Details of the various dimensions of this Act will now be discussed in connection with the Road Map for Development of Coastal and Marine Resources.

Policy directives concerning mangroves in the past can be contradictory. Cabinet decision 1981 prohibits all kinds of utilization but Cabinet decision in 2000 had permitted building houses but prohibits all other types of use (land conversion, presumable also logging, fishing). Since most mangroves are located in areas classified as national forest reserves, to do anything DMCR had to seek permission from the Director General of the Royal Forest Department. Although such permissions may be granted, there is still no unity of approach. Prior to the existence of this Act, the DMCR has had to abide by many pieces of legislation, namely laws related to mangroves, Chainsaw Act B.E. 2545, National Forest Reserve Act, National Park Act, B.E. 2504, National Forest Act and the Forest Park Act B.E. 2535. Similarly, on management of marine life in the coral reefs, under the Wildlife Protection Act 1992, the DMCR officials can be appointed to be responsible for arresting violators. In practice, the DMCR still has limitations in enforcing the laws to protect coral reefs and marine endangered species such as marine turtles, dugongs, whale sharks and whales.

On-going and planned restoration and protection measures

Among the positive developments, there have been some of the DMCR's planned and on-going measures as follows:

Investment in artificial reefs, restoration of mangroves and sea grass beds: Integrated efforts started since 2010 amongst the DMCR, Royal Forest Department, Royal Thai Navy, and Marine Department through implementation of an Integrated Artificial Reefs Development Plan (2011- 2016) with an earmarked budget of THB 10,043.95 million; Measures to reduce the pressure on coral reefs (buoys, zoning to prevent anchoring and reducing tourism activities in areas that could be harmful to the natural reefs); control the volume of marine debris as well as debris collection and, control density of construction along the coastline; Replant coral reefs using methods that are suitable to underwater terrain; In relation to mangroves, replant mangroves (68,764 rai), supplementary planting 157,363 rai (equivalent to around 15 percent of Thailand's mangroves); and designate areas as mangrove protection zones.

Elevating protected status of selected marine species: Most welcome developments have been the recognition of the risks of extinction of a number of iconic marine species. The species with recent formally elevated protected status include (i) Manta birostris, (ii) Manta alfredi, (iii) Mobula kuhlii, (i) Mobula japonica, (v) Mobula thurstoni, (vi) Mobula eregoodootenkee, (vii) Imantura chaophraya, (viii) Rhina ancylostoma, (ix) Pristis pristis, (x) Anoxypristis cuspidate, Pristis zijsron and (xi) Pristis pectinata. Getting the protected status has been a major step forward, the greater challenge ahead will be how to formulate and implement conservation plans.

Undertaking preparatory measures to declare additional marine protected area: In addition to the types and distribution of Protected Areas discussed earlier, there are still many environmental hotspots that do not have any protected status and there have been initiatives to declare some of these areas, particularly islands, as Marine Protected Areas. While these proposed sites in principle, will benefit from the protection measures, not all have been welcomed by local communities and stakeholders who currently gain economic benefits. Additional work will therefore need to be undertaken to explore the environmental benefits and the economic trade- offs and vice versa.

Involvement of DMCR at international level: The DMCR has also been involved in several international agreements namely APEC Ocean and Fisheries Working Group, Sub-Committee on Marine Science and Technology (SCMSAT), Coordinating Body for the Seas of East Asia (COBSEA), Intergovernmental Oceanographic Commission (IOC), IOC Commission for the West Pacific (IOC WESTPAC), Partnership for Environmental Management for the Seas of East Asia (PEMSEA), Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia (IOSEA Marine Turtle), Memorandum of Understanding on the Conservation and Management of dugongs and their Habitats throughout their range (MOU, Dugong), Memorandum of Understanding between the State of Oceanic Administration of the People's Republic of China and MONRE on Marine Cooperation, and MOU on Marine Cooperation. In addition to CBD, CITES, RAMSAR, UNFCCC, Thailand is also a signatory country of International Convention for the Prevention of Pollution from Ships (MARPOL) and United Nations Convention on the Laws of the Seas (UNCLOS). International and Regional collaboration also include the project on Bay of Bengal Large and Marine Ecosystem (BOBLME), Mangroves for the Future (MFF), Centre for Tropical Marine Ecology (ZMT).

Urban biodiversity

Population increases, land use changes, and pollution problems pose threats to urban biodiversity and ecosystems in Thailand. Nonetheless, important stakeholders such as local city governments have realized the importance of urban biodiversity and ecosystems. As a result, initiatives related to urban biodiversity and ecosystems have been and are being implemented at the city-level in many cities throughout Thailand. These initiatives represent positive forces leading to conservation and enhancement of urban biodiversity and ecosystems in Thailand.

Efforts to conserve, develop, and enhance the quality of urban biodiversity and ecosystems in Thailand are guided by two main policy frameworks: the National Biodiversity Strategies and Action Plans (2015-2021), and the Ministry of Natural Resources and Environment's Strategic Plan (2016-2021). The plans set visions to be achieved, and identify strategies and measures to achieve the visions. Nonetheless, it can be seen from the estimated budget for different measures under both plans that urban biodiversity and ecosystems are not accorded its own category. As such, activities pertaining to urban biodiversity and ecosystems must compete for funds with other activities that fall under the mandate of both plans.

Given the trend of increasing urbanization and the benefits provided by urban biodiversity and ecosystems, it is important to ensure conservation and development of biodiversity hotspots in city areas. The activities that are taking place at the local government level are good initiatives, but more need to be done to combat the trend of increasing urban population and land use changes. Policies should tackle the negative trends as well as enhance the positive trends impacting urban biodiversity and ecosystems. As such, recommended policies should have the following goals:

1. Combat the threat of pollution that harms urban biodiversity and ecosystems. Priority should be given to the reduction of waste, especially plastic waste, and to air pollution prevention and mitigation. Lack of appropriate disposal of plastic waste is harmful to wetland environments. Air pollution is a big threat to flora and fauna in cities.

2. Increase green space in cities through careful management of trees and natural systems in and around cities. This involves more than creating additional green space. It requires careful planning and management of trees and natural systems in order to ensure sustainability of the green space.

Positive trends can help to offset or prevent some of the damage suffered by urban biodiversity and ecosystems. The major driving forces behind the positive trends found in urban areas are local city governments. For Thailand, most city councils are spurred on by initiatives at the global and regional levels. With increasing awareness of the importance of biodiversity and ecosystems, local officials have come up with projects and plans for conservation. In other words, development of cities has taken a more environmentally-friendly approach.

At the global level, the City Biodiversity Index (CBI) or the Singapore Index on Cities' Biodiversity (Singapore Index: SI) was developed under the auspices of the Secretariat of the Convention on Biological Diversity and in partnership with Singapore and the Global Partnership on Local and Subnational Action for Biodiversity. The index was developed through a series of expert workshops conducted in 2009 through to 2011. Intended as a tool for self-assessment by cities, CBI helps to benchmark and monitor undertaken conservation efforts. It comprises of two parts; the first is the profile of the city, and the second comprises of 23 indicators that measure native biodiversity in the city, ecosystem services provided by biodiversity, and governance and management of biodiversity.

In Thailand, CBI is being voluntarily adopted by cities. ONEP actively promotes such adoption and provides assistance to cities interested in developing their own indices. The volunteer cities are at various stages of completing CBI and, they are spread throughout the country. In the Northeast, the municipalities of Sri Saket in Sri Saket province, and Sakon Nakhon in Sakon Nakhon province collected information for their CBI in 2013. In the North, Chiangrai and Phitsanulok municipalities have gathered and shared their CBI information with their peers. Nakhon Sawan municipality, which lies north of Bangkok, has also collected and shared its CBI data with peers. (Urban Environment and Area Planning Bureau, 2013). As of July 2017, more cities are interested in adopting CBI. The municipalities of Krabi in the South, Kalasin in the Northeast, and Saraburi in the Central regions are collecting data for the construction of their CBI.

At the regional level is the ASEAN[29] Working Group on Environmentally Sustainable City (AWGESC). Under the AWGESC, the ASEAN Initiative on Environmentally Sustainable City (AIESC) is endorsed by ASEAN Environmental Ministers in 2005. The program carries out various activities with participating member countries. These activities include pilot testing the revised Environmentally Sustainable City key indicators for clean air, clean land, and clean water. AWGESC also sponsors the ASEAN Environmentally Sustainable City (ESC) Award. There is also the ASEAN ESC Model City program, which promotes environmental sustainability in member countries (ASEAN Cooperation on Environment, 2017).

In Thailand, the cities of Bangkok, Chiangmai, Krabi and Phuket participated in the AIESC. Bangkok won the ASEAN ESC Award in 2008, in the first year it was offered. In the second time the award was offered, Phuket won the award in 2011. In the same year, the cities of Phitsanulok also won the certificate of recognition in the category of Clean Land for Small Cities. In 2014, the third time the awards were offered, Chiang Rai City won the ASEAN ESC Award. Roi-et in the Northeast won the ASEAN certificate or recognition in the category of Clean Land for Small Cities. These awards show that cities in Thailand are increasingly aware of the issue of sustainability and are making efforts to ensure it.

29 ASEAN stands for Association of Southeast Asian Nations.

In addition to the ASEAN ESC Award, there is the AWGESC Model City initiative, which started in 2010. Under the AWGESC cities that have done well environmentally are selected and recognized as model cities for environmental sustainability. At its inception, the program awarded model city status on a recommendation basis. However, since July 2015, a core framework of shared qualities, joint actions and desired results of ASEAN ESC model cities have been adopted. Desirable shared qualities include aspiration, innovation, and contribution to global issues. Actions include environmental education, innovation and experimentation, networking, and communications. Results include quality living environment for the wellbeing of citizens, and impressiveness and inspirational qualities to other cities, visitors, and tourists (ASEAN Model Cities, 2017).

Since its inception, many cities in Thailand have been nominated. These are the cities of Chiangrai, Maehongson, Muangklang, Nongteng, Panusnikhom, Phichit, Phitsanulok, and Renunakhon. Special training has been provided to these cities. Initiatives at the city level have also been taken. Many of the activities and programs are aimed at promoting urban biodiversity. For example, in Chiang Rai, 4 public ESC Learning Centers have been established. The themes are on eco-culture, organic farming, urban resiliency and community-managed forestry. In Muangklang, local communities are trained on implementing low-carbon city projects. Such projects also focus on urban biodiversity, among other aspects (ASEAN Model Cities, 2017).

INSTITUTIONS THAT ARE RELEVANT TO MANAGEMENT, UTILIZATION AND CONSERVATION OF BIODIVERSITY RESOURCES IN THAILAND

INSTITUTIONS THAT ARE RELEVANT TO MANAGEMENT, UTILIZATION AND CONSERVATION OF BIODIVERSITY RESOURCES IN THAILAND

Overview of institutional actors

There are more than 60 agencies in Thailand that have mandates and functions related to biodiversity resources utilization and conservation, both direct and indirect. These agencies are mainly government agencies, although several non-government agencies, academic institutions and private companies also carry out work that relates to biodiversity resources. With such a large number of agencies involved, some agencies tend to have much more direct linkages with biodiversity resources while others have indirect or minimal linkages.

The roles of institutions related to biodiversity resources are grouped into seven categories as follows:

A. Core government agencies. These are agencies within the Ministry of Natural Resources and Environment:

1. Office of Natural Resources and Environmental Policy and Planning
2. Department of National Parks, Wildlife and Plant Conservation
3. Royal Forest Department
4. Department of Marine and Coastal Resources
5. Pollution Control Department
6. Botanical Garden Organization
7. Zoological Park Organization
8. Biodiversity-Based Economy Development Office (Public Organization)
9. Office of Environmental Fund
10. Department of Water Resources
11. Forest Industry Organization
12. Department of Environmental Quality Promotion
13. Regional Environmental Offices
14. Provincial Natural Resources and Environmental Offices

B. Agencies with mandates related to sustainable use and Access and Benefit Sharing agencies. These are mainly agencies within the Ministry of Agriculture and Cooperatives, Ministry of Science and Technology and Ministry of Public Health:

1. Ministry of Agriculture and Cooperatives

a. Department of Fisheries
b. Department of Agriculture
c. Department of Livestock Development
d. Rice Department
e. Department of Agricultural Extension
f. Agricultural Research Development Agency (Public Organization)
g. Office of Agricultural Economics
h. National Bureau of Agricultural Commodity and Food Standards
i. Land Development Department
j. Royal Irrigation Department

2. Ministry of Science and Technology

a. National Science Museum Thailand (MSM)
b. Thailand Institute of Science and Technology Research (TISTR)
c. National Science and Technology Development Agency (NSTDA)
d. National Center for Genetic Engineering and Biotechnology (BIOTEC)
e. Plant Genetic Conservation Project under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn (RSPG)
f. National Science Technology and Innovation Policy Office

3. Ministry of Public Health

a. Department for Development of Thai Traditional and Alternative Medicine
b. Food and Drug Administration Thailand
c. Department of Medical Science
d. Thai Traditional Medical Council
e. Provincial Health Office

C. Mainstreaming agencies/Economic sectors. Ministries and agencies related to the economy are as follows:

1. Ministry of Commerce
2. Ministry of Industry
3. Ministry of Tourism and Sports
4. Ministry of Foreign Affairs
- **a.** Department of International Organizations
- **b.** Department of Treaties and Legal Affairs
- **c.** Department of ASEAN Affairs

2. Ministry of Education

- **a.** Office of The Basic Education Commission
- **b.** The Institute for the Promotion of Teaching Science and Technology (IPST)
- **c.** Office of the Higher Education Commission

E. Local authorities and communities

1. Ministry of Interior
- **a.** Community Development Department
- **b.** Department of Public Works and Town & Country Planning
- **c.** Department of Provincial Administration
- **d.** Local Administration

F. There are also a number of agencies involved in sustainable use and Access and Benefit Sharing (Group B), Implementation agencies and research institutes (Group D) and Local authorities and communities (Group E) namely; National Research Council of Thailand; Office of the Royal Development Projects Board, Research and educational institutes such as universities, and National Biological Control Research Center. The Implementing agencies in this category also include:

1. Ministry of Industry
2. Ministry of Finance
3. Ministry of Tourism and Sports
4. Tourism Authority of Thailand
5. Ministry of Transportation
6. Ministry of Defense
7. Ministry of Commerce
8. Ministry of Culture

G. Private sector and civil society organization. Among the private sector, the key actors identified in this PIR include Electricity Generation Authority of Thailand (EGAT), PTT (Public Company Limited), Charoen Pokphand Foods Public Company Limited and Chevron Thailand. There are also Non-Government Organizations such as the Thai Wetland Foundation and the Thai Water Partnership.

Thai institutions that govern biodiversity resources — Ministry of Natural Resources and Environment, Ministry of Science and Technology, and the Ministry of Agriculture and Cooperative. However, as the pressure exerted on biodiversity resources generally comes from economic activities such as expansion of agricultural land, urbanization, and tourism, this fact suggests that other ministries are indirectly responsible for biodiversity conservation as well. Thus, ministries that have indirect adverse impacts on biodiversity resources include the Ministry of Commerce, Ministry of Industry, Department of Public Works and Town & Country Planning, Department of Lands, Ministry of Tourism and Sports and local government such as municipality. With this in mind, the remainder of this section of the PIR will seek to establish deeper underlying characteristics of the most important policy drivers, policy factors and market forces that contribute to biodiversity and ecosystem change in Thailand.

Understanding the institutional setup in Thailand that contributes to biodiversity and ecosystem change

In Thailand's early stage of development in the 1950s, many government agencies related to natural resources were geared towards income generation. These included, for instance, the Royal Irrigation Department whose role was to provide irrigated water for agriculture or the Royal Forest Department whose role was to issue timber concessions to the private loggers. The Land Development Department, on the other hand, has traditionally worked on soil nutrients to increase farm productivity while the main function of Department of Lands has been to issue land titles to support urbanization and farming.

Although efforts to conserve natural resources have been discussed in Thailand since the 1980s, such attempts did not materialize until the turn of the century. Around the year 2000, there was a major renovation in the Thai ministerial structure where several government agencies were restructured and new ones were established to specifically address conservation. In 2002, the Ministry of Natural Resources and Environment was established with the aim to address resource conservation and sustainability. A key philosophy adopted at that time was to provide checks

and balances between conservation agencies and utilization agencies. For instance, the Department of Water Resources was under the Ministry of Natural Resources and Environment, whose aim was to oversee sustainability of water utilization. The Royal Irrigation Department was under the Ministry of Agriculture and Cooperatives, whose aim was to oversee water utilization in agriculture. Similarly, the Department of Mineral Resources was managed under the Ministry of Natural Resources and Environment, whose aim was to oversee mineral resource conservation. And finally, the Department of Primary Industries and Mines was under the Ministry of Industry, whose aim was to provide mineral resources to support industrialization.

Government agencies with a more direct responsibility for biodiversity research and conservation are mostly under the Ministry of Science and Technology and the Ministry of Public Health. They include the Thailand Institute of Science and Technology Research (TISTR), the National Center for Genetic Engineering and Biotechnology (BIOTEC), Plant Genetic Conservation Project under The Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn (RSPG), the National Science Technology and Innovation Policy Office (STI), Department of Medical Science, Biodiversity-Based Economy Development Office Public Organization (BEDO),the Department for Development of Thai Traditional and Alternative Medicine and the Botanical Garden Organization. These government agencies and the state-owned enterprise, including research activities of universities, are among the leading institutions that aim to enhance the usefulness and the value of biodiversity resources in Thailand.

Given this setting, three issues pertaining to institutional arrangements are identified:

1. The role of public vs. private agencies,
2. The role of central government vs. local government, and
3. The role of resource conservation agencies vs. resource utilization agencies.

We will now take each question in turn.

First, what is the role of the public sector and the private sector in biodiversity conservation?

Historically, Thai society assigns the Government as being responsible for natural resource management and environmental conservation. The more traditional government agencies governing natural resources and environment are the Royal Forest Department, the Department of Irrigation, the Department of Fishery, Land Development Department, the Department of Mineral Resources, and the Pollution Control Department. These agencies are well aligned under the Ministry of Natural Resources and Environment. However, evidence shows that in the case of terrestrial biodiversity resource, such as, forest reserve, the Royal Forest Department has had difficulty in protecting the conservation area. Throughout the past 50 years of forest protection and reforestation, Thailand continued to lose forest coverage despite forest protection effort and replantation programs of the Royal Forest Department. Similarly, the Department of Fishery has not yet been able to curb the fishing effort and the overfishing of Thai fish stock continues to deteriorate.

Along with the inability of government agencies to protect the natural resources, there is an increasing trend of forest replantation, forest protection or community fishery conservation by the local community and the private sector who would engage themselves in conservation activities as a part of their corporate social responsibility activities. These initiatives are reported in the forestry sector, commercial teak plantation, community fishery and community forest. The success of the community and the private sector in conservation efforts provides an opportunity for Thailand to recognize their roles and opportunities to broaden and institutionalize how these partnerships must be nurtured.

Thus, there has been an effort in Thailand to expand the role of natural resource management to include private initiatives. The Payment for Ecosystem Service (PES) is a case in point. Some smaller watershed areas have already been successful in collecting revenue from the beneficiaries of watersheds and using that revenue to finance watershed management. This PES scheme has potential as it will aid the public sector in resource conservation. With an increasing role of the private sector and the community in resource conservation, Thailand needs to step up the governance of its natural resource conservation. Perhaps the next step for Thailand is to clearly assign regulatory responsibility to public agencies. Generally speaking, then, public agencies, such as the Royal Forest Department, can assume the role of a regulator, while the private sector and the community can become the provider in resource conservation.

Second, what is the role of central government and local government? Just before the year 2000, Thailand went through the process of decentralization. Many aspects of government services that were under responsibility of central government agencies were reassigned to the local government such as municipalities. In 2014, local government in Thailand is comprised

of 2,440 municipalities and 5,335 Tambon Administration. Municipalities and Tambon Administration in Thailand are responsible for various forms of public services such as local roads, recreational areas, garbage collection, sanitation, wastewater management, public health and coastal protection. Because each municipality and Tambon Administration has different views, capacity, knowledge, as well as financial resources, their actions on conservation program differ. Municipalities along the coastal areas in Thailand adopt various technologies in curbing coastal erosion in their areas. It was found that some municipalities adopt methods that protect the coastline yet only for its territory, while passing coastal erosion to the adjacent municipality. Hence, lessons show that differences in environmental conservation efforts of different municipalities can have adverse effect on other municipalities. Hence, when ecosystem management has geographical coverage across a large boundary, this may put a limit to the role of local government in natural resource conservation. For these reasons, perhaps the central government should play a larger role in conservation. The role of central government in conservation may include watershed and ecosystem management, marine and coastal resource management, fish stock regulation, wetland management, land use planning at the watershed and national level, conservation boundary mapping and so on.

Third, what is the appropriate balance between resource utilization and resource conservation? With reference to many drivers and practices previously identified, the policy and institutional setting in Thailand seems to place substantial weight on resource utilization via attaining the current benefit from economic growth or urbanization by sacrificing the future benefit from biodiversity conservation. This can be seen in the case of rapid urban development, expansion of tourism or coastal development, which have all come at the expense of biodiversity. As a basis for policy recommendations regarding the institutional arrangement for Thailand, there is a strong case that more emphasis needs to be placed on conservation. This can be done by integrating conservation objectives in economic policies, such as, supply chain traceability in the agricultural sector.

Legal and institutional framework related to the management of terrestrial ecosystem

First, it should be noted that in terms of research and development, Thailand has made gains in establishing capacity in biodiversity research. Public agencies and universities have begun contributing academic research on the benefits and the possible use of biodiversity resources in Thailand. Listed below are government agencies that have been established and have engaged themselves in bio bank activities, biodiversity research and dissemination. The work of many of these research institutes is already linked with the private users and is generating economic value for society. These include:

- Department of Medical Science
- Thailand Institute of Scientific and Technological Research
- National Center for Genetic Engineering and Biotechnology
- Biodiversity-Based Economy Development Office (Public Organization)
- Department for Development of Thai Traditional and Alternative Medicine
- Plant Genetic Conservation Project Under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn
- The Botanical Garden Organization

Now, in terms of the management of Thailand's terrestrial ecosystem, the institutional setting is still oriented towards natural resource management. In this regard, Thailand forest resource is governed under two government agencies –The Royal Forest Department (RFD) and the Department of National Park, Wildlife and Plant Conservation (DNP). This dual organizational setting was established in Thailand in 1992 when the Ministry of Natural Resources and Environment was founded and each natural resource was assigned to be governed by two government agencies: one agency to oversee resource utilization while another to oversee resource conservation. This counter balancing approach of natural resource management is still prevalent in Thailand today.

Actors that are involved in management, utilization and conservation of terrestrial resources and forest resources in particular consist of agencies both in the public and private sectors, local government units, academics and NGOs. The public agencies in principle operate under different pieces of legislation. These are described in Table 10, which also includes a summary of the key agencies involved in the management of forest resources and details of their areas of responsibilities.

Table 10: Key legislation relevant to terrestrial forests

Legislation	The National Park Act, 1961.
Main features	The main purpose is to protect natural resources such as flora, forest products and wild animals to ensure the sustainability of natural resources and of the natural landscape. The Act prohibits the occupation of any part of the national parks, clearance of areas, collection of forest products, hunting wild animals and collection of any rocks, sand or stones. The Act does allow entry into the national park areas for educational and recreational purposes. Violators are subject to fines or imprisonment as well as confiscation of weapons, tools and vehicles used in committing the crimes.
Agency responsible	Department of National Parks, Wildlife and Plant Conservations
Main functions of agency	• Conserve and restore forestry resources, wildlife and plants in Protected Areas by protecting existing forests and by restoring degraded forests. • Create awareness among local communities to create incentives to protect and jointly look after natural resources in their localities to ensure the balance of ecosystems, maintain the conditions of the watersheds, biodiversity resources, wildlife habitats, sources of food and recreation.

Legislation	The National Forest Reserve Act, 1963
Main features	Declares any part of the forest areas as a national forest to ensure the sustainability of the resources. The Act prohibits entry into the declared forest reserve areas, and occupation of land inside the boundary of the forest reserve. It also prohibits any type of construction, clearance of forest areas, or any activities that may result in destruction and depletion of forest resources. The responsible agency is authorized to evict the violator from the forest reserve areas and to pull down any construction works. In case of degraded forest areas, it is within the authority of the Director General of the Royal Forest Department to allow occupants to remain within the degraded forest area and to utilize the land. Violators are subject to fines or imprisonment and confiscation of tools used to engage in the violation, regardless of whether the possessions belong to the violators.
Agency responsible	Royal Forest Department
Main functions of agency	• Protect and prevent encroachment of forest resources. • Plan and mobilize cooperation in reforestation to restore the conditions of forest resources and the ecosystem. • Promote participation of local communities in reforestation and management of community forests and promote planting of commercial forests. • Issue allowance for utilization of forest land and collection of non-timber forest products. • Conduct research on forests, timber and non-timber forest products. • As with all public agencies, the RFD can be engaged in any activities mandated the law, Ministerial Orders, or Cabinet Resolutions.

Legislation	The Wildlife Preservation and Protection Act, 1992
Main features	Support breeding of wildlife species, and help protect and conserve wildlife species. The principle is also to ensure that Thailand undertakes measures that reflect willingness to cooperate with international communities in the protection and conservation of wildlife and endangered species by declaring designated areas as wildlife sanctuaries and no-hunting zones.
Agency responsible	• Department of Marine and Coastal Resources • Department of National Parks, Wildlife and Plant Conservations
Main functions of agency	• Responsible for conservation and restoration of coastal wetland such as mangroves, sea grass, beach forests.

Legislation	The Wildlife Preservation and Protection Act, 1992
Main features	The determination of any kind of wildlife to be protected shall be made by the ministerial regulations with the approval 71 of the committee. The National Wildlife Preservation and Protection Committee have power and duty to approval of any determination of Wildlife Sanctuaries, to determine the Non-Hunting Wildlife Areas as well as the kind or category of wildlife hunting which is prohibited in such areas.

Legislation	The Land Development Act, 2008
Main features	The main public agency to execute measures under this Act is the Land Development Department undertakes to define policies and planning the making use of the land in agricultural areas, survey and classify soils, conserve soils and water, improve and maintain soils, through providing services and transferring technology in land development, soil information, and utilization of land to increase agricultural productivity and make sustainable use of it.
Agency responsible	Land Development Department

Main functions of agency	• Conduct soil survey and produce soil resource maps, including survey to obtain census of the land data concerning land economics. • Conduct land use planning for the sustainable of land resources • Conduct research and experiments in relation to soil, land improvement, soil and water conservation, watershed conservation, and other relevant issues pertaining to land development and farmers' requirements. • Disseminate land development technologies to relevant government personnel, farmers, and farmers' requirements.

Legislation	The Land Development Act, 2008
Main features	The Land Development Committee shall have the power concerning statistics under the law on statistics in matter relating to the preparation of census of land. In the case where a farmer wishes the Land Development Department to 72 carry out the analysis of a soil sample or carry out soil or land improvement for his agriculture, if the soil sample is brought to the Land Development Department, the expenses shall be waived and the Land Development Department shall inform the applicant of the result of the analysis of the soil sample within reasonable time including giving advice on the soil or land improvement for agriculture.

Legislation	Enhancement & Conservation of National Environmental Quality Act, 1992.
Main features	This Act empowers the National Environment Board to formulate environmental policies; monitor changes in environmental quality; clarify boundaries of wetland and environmental protection zones; and set guidelines for undertaking Environmental Impact Assessment.
Agency responsible	Office of Natural Resources & Environmental Policy and Planning
Main functions of agency	• National contact point for RAMSAR • Responsible for formulating policies and plans for conservation and management of wetland as well as coordinate with concerned agencies to ensure that plans are implemented as stipulated by Sections 46 and 51 of the Environmental Quality Promotion Act, ONEP is responsible for reviewing EIAs of any projects that might have adverse environmental impacts on wetland of international and national importance. This include projects of both public and private sectors.

Legislation	Enhancement and Conservation of National Environmental Quality Act, 1992.
Main features	In case that any area is characterized as watershed area, or characterized by unique natural ecosystems that are different from other areas in general, or naturally composed of fragile ecosystems that are sensitive and vulnerable to destruction or impacts of human activities, or worthy of being conserved due to its natural or aesthetic values or amenities, and such area is yet to be designated as a conservation area, the Minister of Natural Resources and Environment shall, with the advice of the National Environment Board, be empowered to issue ministerial regulation designating such area as an environmentally protected area. In the environmental protection area, one or more protective measures shall be prescribed under land use for preserving the natural conditions of such area or for preventing its natural ecosystems or its aesthetic values or amenities from being adversely impacted; prohibiting of any acts or activities that may be harmful or adversely affect or change the pristine state of the ecosystems of such area, specifying types and sizes of projects or activities undertaken by government agencies; stating enterprises or private entities, to be constructed or operated in such area, which shall have the legal duty to submit reports of environmental impact assessment; and prescribing of any other protective measures that are deemed proper and suitable to the conditions of such area.
Agency responsible	Office of Natural Resources and Environmental Policy and Planning / Pollution Control Department / Department of Fisheries / Royal Forest Department / Department of National Parks / Wildlife and Plant Conservation / Department of Marine and Coastal Resources
Main functions of agency	• Set standard, measures as well as formulate plans and action plans to control pollution at source so as to maintain the water quality in both inland and coastal water source. The PCD is also responsible for monitoring and control sources of pollution and has the power to issue Ministerial Orders and regulations when these are necessary to prevent and control pollution. • Manage and conserve aquatic resources in wetland areas which are fish habitats. • Engage in conservation and management of fishery resources to ensure sustainable use over the long run.

Legal and institutional framework related to the management of wetland ecosystem

Like coastal and marine and terrestrial forestry resources, there does not seem to be a lead agency in charge of wetland. This is partly because wetland can be located in areas already under the responsibilities of other agencies. A further observation can be made that there is no clear boundary of the wetland itself. For example, the Tha Chin river basin in Thailand stretches in length to over 300 kilometers. In this way, the basin covers five provinces with a whole range of economic activities taking place.

Thus, in order to identify the key actors and institutions and to simplify the issue somewhat, this section lists the laws that are relevant to various dimensions of wetland, also showing the agencies that are responsible for implementing those laws (See Table 11 below). Specifically, the key pieces of legislation listed are related to flora and fauna, fishing, water resources, irrigation, navigation. In addition, there are also other pieces of legislation that can have direct bearing on wetland. These include Town Planning Act 1975, Building Control Act 1979, The Wildlife Preservation and Protection Act 1992, Tambon Council and Tambon Administration Organization Act 1994, Provincial Administration Act 1997, Royal Irrigation Act 1942, Royal Decree Prohibiting the import of aquatic species, and The Navigation in Thai Waters Act 1913.

Table 11: Legal provisions and regulations related to wetland

Legislation	The National Park Act, 1961.
Details related to wetland	Within the National Parks, Section 16 prohibits any actions that might result in changes or alterations of water sources (such as streams, rivers, lakes, swamps, creeks). This also applies to obstruction of water flows, changes or diversion of water channels.
Agency responsible	Department of National Parks, Wildlife and Plant Conservations
Main functions of agency	Protect and conserve natural resources in wetland that are located in various categories of Protected Areas under their jurisdiction. This include mangroves, peatlands, swamps, canals, waterfalls

Legislation	The National Forest Reserve Act, 1963
Main features	Within National Forest Reserve, Section 14 of the Act occupation of land for production purposes and, for establishing residents are prohibited. This means that cutting trees, burning and collecting non-timber forest products are not allowed. Similarly, any actions that result in the obstruction of water flows, changes or diversion of water channels are also prohibited.
Agency responsible	Royal Forest Department
Main functions of agency	Manage all types of wetland in areas under their jurisdiction which include mangroves, peatlands, swamps, canals, waterfalls

Legislation	Fisheries Act 1947 amended in 1985
Main features	Various sections in this Act provides protection for protection of aquatic species in wetland, e.g. designating certain zones as fish sanctuary and therefore prohibiting all fishing activities, fish farming, building fish traps or fish ponds. Where fishing is permitted, there are also prohibitions against discharging wastewater, contaminants, and toxic substances. Uses of any substance in fishing that may cause pollution or toxicity is also restricted (except where this is for scientific research purpose and has received permission by concerned agencies.
Agency responsible	Department of Fisheries
Main functions of agency	• Manage and conserve aquatic resources in wetland areas that are fish habitats. • Engage in conservation and management of fishery resources to ensure sustainable use over the long run.

Legislation	Environmental Quality Promotion Act 1992
Details related to wetland	Authorizes the National Environment Board to set environmental standards that also applies to how land is used in wetland. The Minister has the power to specify types and size of projects of both public and private sectors that may have environmental impacts and therefore must conduct EIA. This also applies to projects that might have impacts on wetland. Section 35 of the Act stipulates that an Environmental Quality Management Plan (that also covers wetland). Under Section 43 and Section 44, the Minister has the power to issue Ministerial Orders to protect any areas of ecological importance, which may be adversely impacted or risks being impacted by any human induced actions. Section 69 stipulates that the Minister has the power to identify types of sources of pollution that must be monitored on discharge of wastewater into natural water sources.
Agency responsible	Pollution Control Department
Main functions of agency	Set standard, measures as well as formulate plans and action plans to control pollution at source so as to maintain the water quality in both inland and coastal water source. The PCD is also responsible for monitoring and controlling sources of pollution and has the power to issue Ministerial Orders and regulations when these are necessary to prevent and control pollution.

Finally, further to the above, Table 12 below contains a list of other agencies, which could be seen to have mandates related to the management of wetland ecosystems in Thailand.

Table 12: Agencies that have mandates relevant to wetland

Agency	Authority and Mandates
Office of Natural Resources and Environmental Policy and Planning	• National contact point for RAMSAR • Responsible for formulating policies and plans for conservation and management of wetland as well as coordinating with concerned agencies to ensure that plans are implemented • As stipulated by Sections 46 and 51 of the Environmental Quality Promotion Act, ONEP is responsible for reviewing EIAs of any projects that might have adverse environmental impacts on wetland of international and national importance. This includes projects of both public and private sectors
Royal Irrigation Department	• Manage water resources for irrigation purposes that may involve building dams, dykes, weirs, and, changing water channels for draining and transportation purposes.
Department of Marine	• Protect water resources including wetland that are part of the transportation network such as rivers and canals
Department of Environmental Quality Promotion	• Create awareness of the importance of preserving the environmental quality that also include conservation and restoration of wetland. The Department is also involved in developing educational curriculum as a channel for communicating and, understanding, and creates recognition of the importance of wetland. The Department could also communicate such information through various media channels.
Department of Marine and Coastal Resources	• Responsible for conservation and restoration of coastal wetland such as mangroves, sea grass, beach forests.
Department of Mineral Resources	• As with the DWR, the mandates of this Department are not directly related to wetland. However, to set standards for extraction of mineral resources (which may well be located in wetland), the actions undertaken to prevent adverse impacts can have positive effects by reducing potential harm to wetland.
Department of Water Resources	• This Department is responsible for formulating policies and plans as well as identifying measures for management, conservation and restoration of water resources. It is also responsible for transferring technologies on water resources management to ensure sustainability of supply. This involves c apacity building of local government units and water resources management network. Although the prime mandate of this department is to ensure stability of water supply and prevent water shortage crisis, undertaken actions do indirectly contribute to the protection and conservation of the wetland.
Department of Lands	• Responsible for issuing title deeds which recognize private property rights of land holders. The role of this department will only be relevant if there are claims of private ownership on wetland or if any area of wetland should be reclaimed for development.
Department of Local Administration	• Responsible for looking after communal lands or land belonging to the public domain that will include many wetland sites. The department has authority to restrict or prohibit access to such public domains to protect plant varieties and aquatic species.
Tambon Administration Organization	• Responsible for looking water resources in area under their jurisdiction for multiple uses such as agriculture, water supply production, transportation and drainage. Note that the role is to protect wetland for these purposes.
Bangkok Metropolitan Administration	• Responsible for inland water sources such as rivers, canal, lakes that are located in the metropolitan area.
Ministry of Education	• Responsible for developing an educational curriculum that will create basic understanding of the importance of conserving and restoring wetland ecosystems.

Legal and institutional framework related to the management of coastal and marine Ecosystem

Table 13 below represents the various agencies in Thailand that have key roles in the management of the Coastal and Marine Ecosystem. The table highlights the nature of the agencies' involvement, the level of impact (direct/indirect), and if relevant, the legal authority.

Table 13: Summary of management of coastal and marine ecosystem and role of agencies

Nature of involvement	Impact	Agencies	Roles	Legal authority
Conservation	Direct	DMCR	Conservation, restoration and management of marine and coastal resources.	Promoting Management of Marine and Coastal Resources Act, 2015

Conservation	Direct	DNP	Management of coastal and marine resources that are located in marine national parks	DNP Act
Utilization	Direct	DOF	R&D on fisheries; control and regulate fisheries, and biosafety measures; ensure sustainable uses of fisheries resources	Royal Ordinance on Fisheries B.E. 2558 (2015)
Utilization	Direct	Ministry of Tourism and Sports	Promoting revenue generation from tourism activities	-
Reducing pollution	Indirect	PCD	Setting pollution standards and other measures to control pollution at source	-
Policy and supporting role	Indirect	BEDO	Promoting biodiversity-economy based revenue generation; Compiling and updating databases on biodiversity resources as well as local traditional knowledge	-
Supporting	Indirect	Marine Depart-ment	The responsibilities in terms of coastal infrastructure development, could bear negative impacts if ignoring the external impacts on the environment. On the positive side this agency is now (in collaboration with the DOF) in registration of fishing vessels (together with the DOF) and could be instrumental in establishing and optimal level of harvest.	-
Supporting / Conservation / Protection	Indirect	Royal Thai Navy	The RTN is one of the lead agencies implementing the measures against IUU. Over the years, the RTN has also played an active role in marine turtle conservation	-

Legal and institutional framework related to the management of urban biodiversity

In addition to the policy frameworks and activities laid down in the National Biodiversity Strategies and Action Plans (NBSAP), one other key policy framework regarding biodiversity can be found in MONRE's Strategic Plan. The latest plan covers the years 2016 through to 2021, making it overlap with NBSAP (2015 – 2021). MONRE's Strategic Plan aims to make MONRE the key agency in the sustainable management of natural resources and the environment. Participation to achieve a good quality of life also forms an important part of MONRE's vision. In order to fulfill this vision, MONRE identifies five core strategies as follows:

Strategy 1: Preserve, conserve, restore, and manage natural resources by using an integrated approach that is responsive to development and allows sustainable and equitable resource use.

Strategy 2: Manage surface water and groundwater in an integrated and efficient way.

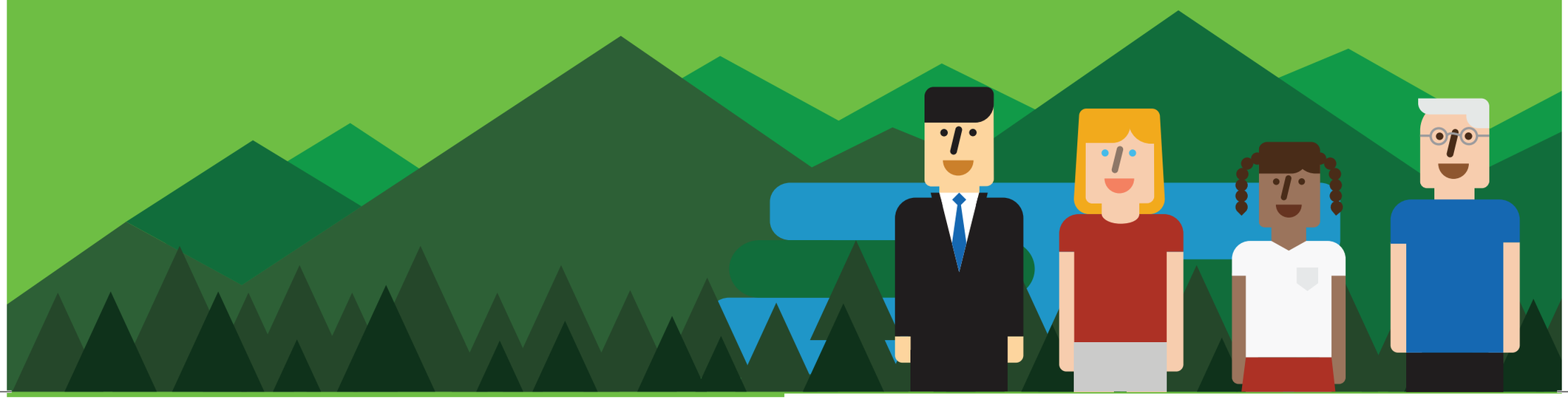
Strategy 3: Maintain and restore environmental quality using a participatory approach.

Strategy 4: Prevent and reduce the impacts, and promote adaptation to natural disasters and climate change.

Strategy 5: Improve efficiency in the management of organizations and the management of natural resources and the environment.

In terms of urban biodiversity and ecosystems, strategies 1 and 3 are especially relevant. Conservation and protection of natural resources and the environment are directly related to the conservation of urban green areas that are hotspots for biodiversity in city areas. Strategy 3, which deals with environmental quality, is directly linked to the pollution problem that endangers urban biodiversity and ecosystems.

SUMMARY OF KEY POLICY RECOMMENDATIONS AND POTENTIAL FINANCE SOLUTIONS



SUMMARY OF KEY POLICY RECOMMENDATIONS AND POTENTIAL FINANCE SOLUTIONS

Based on the previous discussion of the various dimensions of the terrestrial, marine and coastal, wetland and rivers, and urban biodiversity, this final section of the integrated Policy and Institutional Review for Thailand summarizes fundamental issues and recommends measures that address root causes including policy and institutional failures. For each major ecosystem, finance related solutions shall be identified including issues that result from lack of funding and those that result from inefficiencies in implementation (cost efficiency), institutional overlaps (delivering better), and anticipating and avoiding future costs.

In the current situation and where the public sector is concerned, biodiversity financing in Thailand is characterized by situation of underfunding, and oftentimes uncoordinated approaches of the concerned public agencies. Solutions that might contribute to alleviating and eliminating the problems have been identified together with a specific focus on biodiversity finance solutions that could be instrumental in bringing about change. This section included a summary of key finance-related capacities projected for each of the ecosystems, as well as potential biodiversity finance solutions for strengthening the institutionalization process. The identified problems and the proposed finance solutions and needed groundwork are all summarized in the form of a table at the end of each section. As many of these financial solutions are new to Thailand, there may be substantial preparatory work that would need to be undertaken in respect to implementation. Thus, the principle of mainstreaming biodiversity policy and institutional arrangements in Thailand will be the key in creating a recognition that financing biodiversity cannot be an add-on, or an afterthought but must be an integral part of the planning process from the on-set.

Terrestrial ecosystem

One of the fundamental problems affecting the terrestrial ecosystem in Thailand is the continued encroachment and persistent threat to convert areas under forest to alternative land use. A variety of legal, institutional and technical measures has been adopted with limited success. As such, the on-going One Map policy is highlighted and should be supported. This policy aims to synchronize forest reserve boundary lines of various government agencies and hence reduces any intentional and unintentional forest intrusion and unlawful land title issuance. Other policies that require a thorough review due to theirs negative impact on biodiversity include agricultural price support that has led to the expansion of plantation areas and forest encroachment. Likewise, the poverty reduction policy has led to perverse incentives and exerts negative pressure on forest conservation. The Thai Government needs to end the land title issuance program and focus its poverty reduction effort more on providing appropriate know-how and equal opportunity to the poor.

Meanwhile the crafting of finance solutions is cognizant of the economic returns from alternative land use, which fails to internalize the long-term environmental impacts (and economic losses) resulting from deforestation and forest conversion. Bringing in all costs and benefits accruing to stakeholders would ensure that decisions are based on trade-offs that do not treat the services of ecosystems services as underpriced or free goods. For instance, such economic incentives could be introduced to one of the measures discussed over several decades, namely the concept of creating 'buffer zones' around the Protected Areas. Technically, if communities can generate adequate living out of the natural resources within the buffer zone areas, they would become the human buffer against encroachment and technically provide around-the-clock surveillance of the forest areas as an interested party for the concerned public agencies.

Table 14 summarizes forest and agricultural landscape issues that have links to finance/economics; thus, the solutions and actions are likewise defined in this realm. For Thailand's terrestrial ecosystem, several financing mechanisms can be adopted. Several financing mechanisms can potentially create incentives to raise the revenue from conservation activities including Payment for Ecosystems Services; Eco-tourism, and Voluntary carbon offsets.

Another one, on forest bonds, can raise revenues from the private sector in view of scarce budgets provided by public sector agencies. Via bond issuance, the forest ecosystem bond mechanism will attract private funds from the private sector that can be used for forest conservation. The forest rehabilitation programs supported by bond issuance will then generate benefits to society and hence revenue can be generated. The expected revenue can be generated from commercial timber production, water supply, carbon sink or carbon credit, eco-tourism or biodiversity resources. As for the forest encroachers who currently occupy forestland and grow commercial crops,

these workers can now work in the afforestation activities. Their commercial crops can be turned into sustainable forest communities. Therefore, the forest bond mechanism will provide an opportunity for funds to be mobilized from the private sector and the public to help finance forest rehabilitation programs.

In terms of reducing adverse pressure on biodiversity, externalities in animal feed supply chain, sustainable fishery and responsible tourism need to be addressed. Agricultural exports that rely on untraceable inputs, such as corn that is grown in conservation areas, will have difficulty entering the export markets. Thus, in order to sustain the exports of Thai agricultural products the Thai Government could ensure that Thai agricultural exports can be certified and all the inputs in the supply chain are environmentally friendly. As for tourism, the Thai Government needs to establish a certification scheme where only responsible tourism will be permitted. Tourism in Thailand needs to adhere to a set of mandatory practices and must not exceed the carrying capacity of the ecosystem.

Three additional financing mechanisms are discussed in greater detail, namely (1) Wildlife Conservation License Plate, (2) Biodiversity offsets and (3) Bio banking, which directly support the implementation of the "Plant Protection Act".

Wildlife Conservation License Plates refer to the use of a surcharge paid for vehicle licenses indicating that the owner of the vehicle has contributed a sum of money towards conservation of wildlife species, which is also usually pictured on the license plate. Among the financing mechanisms possible for Thailand's terrestrial ecosystem, this would appear to be one of the 'low hanging fruits' and would involve the cooperation of the Department of Land Transport on the one hand, and clarification over the species habitat conservation activities that can be financed with the generated revenue.

By definition, Biodiversity Offsets are actions designed to compensate for significant residual biodiversity loss arising from project development after appropriate prevention and mitigation measures have been taken. Offsets can, for example, deliver biodiversity benefits through a transaction, where offset sellers sell offsets to developers who seek to compensate the residual biodiversity loss resulting from a development activity. Although Thailand has in place a requirement that investment projects undergo an EIA process, beyond demonstrating the environmental impacts, whatever adverse impacts have been identified should go through the following interlinked stages of assessment for offsetting biodiversity impacts. Thus, the key is to first develop alternative project designs that avoid adverse impacts. This can be done by considering measures that can be adopted to minimize the impact, and, crucially, how the residual impacts can be off-set. The concept of biodiversity offsets acknowledges that negative impacts on biodiversity resources are unavoidable, however, the principle is also to consider what can be done to compensate for that loss in ways that could even generate net gains to society. With respect to terrestrial forests in Thailand, many sites within and outside of Protected Areas could be developed as potential offset sites and the requirement to offset the loss would create demand for enhancing conservation measures in areas that are potential offset sites.

Indeed, as discussed in earlier sections of this report, pressure on biodiversity resources and the natural environment in Thailand's terrestrial ecosystem results from the way land is being used for agricultural production. One of the most common impacts on the environment in Thailand is the heavy use of chemicals. Accumulation of chemical residues contaminates the soil, while leakages into the water system result in increasing concentration of nitrogen and phosphorous. Thai farmers fall into vicious cycles of poverty and debt partly because of the rising costs of agricultural chemicals relative to the prices of agricultural commodities. While sustainable land management practices offer higher net benefit in the medium and long run, many farmers remain unconvinced while others claim that lack of financial resources makes the switch. Given that adoption of sustainable land management practices, however, generates both private benefits and social benefits, it makes economic sense to provide support or economic incentives to compensate for any loss or reduction of revenue during the transitional period of the changes; hence our assessment that Payment for ecosystems services in agricultural landscapes (PESAL) is a financial mechanism should be explored in depth.

Bio-banking is proposed as a financial tool that will strengthen the enforcement of the Plant Protection Act. As the previous limitations initiated by the Department of Agriculture shows (see agricultural promotion policy in section 4.1), Thailand stands to gain from going beyond basic conservation activities, towards innovative approaches that provide actual incentives for landowners to protect plant species. Here, bio-banking schemes, which aim to create markets in biodiversity credits, are tailor-made to encourage this shift. Thus, by providing a potential source of income for landowners helping to conserve biodiversity, the continued development of bio-banking offers the prospect of a finance solution for Thailand's terrestrial ecosystem.

Table 14: Problems, solutions and potential financing mechanism for biodiversity in terrestrial ecosystem

Problem	Solution	Potential Financing Mechanism	Groundwork that needsto be covered
i) Forest landscape: Continued forest encroachment ii) Agricultural landscape: heavy use of chemicals that generate adverse impact on the soil and in the water sources. There is also health impact on the farmers themselves as well as on consumers.	• Ensure that economic returns from keeping land as forest generates higher net welfare gains than conversion for alternative use. • Ensure that communities in the so-called buffer zones can generate sufficient revenue so that they function as living 'Buffers' to protect the 'Enclaves'. • Convert negative subsidies to positive subsidies. • Demonstrate that the net returns from sustainable land management practices is higher than the medium and long run.	1. Payment for Ecosystems Services targeting only buffer zone areas 2. Voluntary carbon offsets additional avenue for generating income for local communities through sales of carbon credits from changes in carbon stocks in the forest areas they are looking after 3. Ecotourism: selected buffer zones can be developed as ecotourism sites 4. Conservation license plates 5. Biodiversity offsets: Selected Protected Areas and buffer zones can be restored as sites used for offsetting impacts from biodiversity resulting from development projects	o DNP has baseline data on carbon stock from different types of terrestrial forest that can be used as baseline data; Nabangchang O. and Vincent J have worked on the economic value of forest water purification function that is part of the ecosystems services of watershed forests o Need studies on potential to generate revenue in the voluntary carbon markets; Need capacity building of local communities to monitor o Need studies that can demonstrate the economic returns from ecotourism in selected target sites
		6. PESAL: Payment for ecosystems services in agricultural landscapes: the principle being to provide subsidies to farmers who adopt sustainable land management practices 7. Bio-banking: A means of providing incentives for protection of native flora and fauna species by translating them into biodiversity credits that can be traded as compensation for residual impacts that cannot be avoided from investment projects in similar ecosystems	o There is the Economics of Land Degradation (ELD) Project conducted by the EEPSEA team in 2017 that can provide economic arguments for Sustainable Land. Management (SLM) i. Economic analysis of health impact from exposure to agricultural chemicals ii. Economic analysis of costs of water contamination for leakages of agricultural chemicals into the water sources

Wetland ecosystem

Thailand's wetland and rivers are continuously under pressure, mainly due to the demand for farmland and increasing urbanization. Rivers and canals that may have been rich in freshwater biodiversity resources are being threatened by the unregulated discharge of wastewater stemming in activities from farming, factories and households.

With the last nationwide survey of wetland in Thailand dating back to 1996, wetland have largely been treated on a site-specific basis, with more recent surveys conducted either for the purpose of designating wetland as RAM-

SAR sites or sites of international and national importance. An implication of having an outdated database means that Thailand lacks a clear definition of the boundaries of what constitutes an inland wetland ecosystem. Without clear boundaries, efforts to officially declare the importance of wetland may have limited value. In this way, Thailand's wetland ecosystems are absent a formal champion with a number of agencies working on wetland but guided by their own mandates. As such, the management of Thailand's wetland may somewhat resemble the 'Tragedy of the Commons' situation.

A central policy goal, then, concerns the need to provide management plans that cover wetland of all levels of importance, from RAMSAR sites to wetland of importance at local, national and international levels. The policy gesture of declaring wetland (particularly those of local importance) as public domains may well prove to be novel for Thailand, but executing this may well intensify existing land conflicts.

The vulnerability of wetland, particularly those that have not yet been recognized as being of international, national or even local importance, stemming from the lack of information on their ecological functions and how this translates into monetary values. Therefore, there is a need to demonstrate the economic value of those ecological functions of wetland, which can then be used as information for assessing and comparing the trade-offs from alternative land uses. The information will also provide the knowledge base for possible financing solutions for Thailand's Wetland ecosystems. At this stage, these financing solutions have been identified as Biodiversity Offsets and mitigation banks (i.e. wetland banking).

Wetland banking

First, for wetland areas under pressure for conversion, granting investment approval should answer the following set of three questions: (i) Are there alternative approaches that would not create adverse impact? (ii) Can the adverse impact be minimized?; and (iii) What is the residual that needs to be offset?

Here, the concept of 'wetland banking' is useful as it aims to generate 'credits' from wetland that can be developed as potential offset sites that can be bought to compensate for adverse impacts from investments in other similar ecosystems. These credits by definition are areas that have been preserved, restored or have benefited from enhanced conservation efforts. Technically, the number of 'credits' that can be generated by a particular site will depend on the nature of the ecological values. Following the above, we believe that the combination of biodiversity offsets and wetland banking can link demand and supply for wetland. Again, we also recognize that for both mechanisms to be adopted, substantial ground work will have to be undertaken and these are indicated in Table 15 below.

Table 15: Problems, solutions and potential financing mechanism for biodiversity in wetland ecosystems

Problem	Conversion for alternative land use
Solution	Demonstrate the economic value of the ecological functions of wetland as information for assessing and comparing the trade-offs from alternative land use
Potential Financing mechanism	**1. Biodiversity offsets** For wetland areas under pressure for conversion, any future conversion should follow the three main steps: a. Are there alternative approaches that would not create adverse impact? b. Can the adverse impact be minimized? c. What is the residual that needs to be offset? **2. Wetland banking** The wetland that can be developed as potential offset sites can benefit from this concept. The combination of biodiversity offsets and wetland banking can link demand and supply for wetland.
Groundwork that needs to be covered	1. Develop a standard database of ecological functions of wetland 2. Gradually conduct valuation studies of the different types of economic uses

Marine and coastal ecosystem

Despite how marine and coastal resources have contributed to the well-being of the Thai people, these resources are also under severe negative pressure from over-fishing, shrimp farming, tourism and coastal infrastructure development. These negative pressures have contributed to the degradation of fish stock, corals, seagrass, seabed shoreline and mangrove. This pattern of unsustainable use of marine and coastal resources will severely limit how they can contribute to the wellbeing of the Thai people in the near future. Policy factors that exert negative pressure on marine and coastal resources include aquaculture promotion policy, urban and infrastructure development, tourism policy and decentralization policy.

Meanwhile, there is a sign of improvement as the Thai fishery sector is undergoing rapid changes such as fishing vessels registration, fishing gear

regulation and fishing efforts will be strictly regulated through the newly imposed registration and licensing scheme. However, there has not yet been a positive sign of improvement for coastal tourism. When comparing the economic sectors, based on the study of Padermsak et. al (2007), we found that the two sectors that do not explicitly rely on the coastal and marine resources yet by the nature of their operations pose the greatest risk to the latter, are maritime navigation and the energy sectors. Many incidents in the past, even in the present, tend to confirm that environmental concerns are generally compromised, giving way to investments that supposedly favour economic growth. For example, in the controversial Pakbara project to accommodate the river outlets, the Department of National Parks will have to withdraw the 'protected' status of the Pak Bara river mouth area to allow for the construction of a deep-sea port. Similarly, the Department of Marine's plan to build a structure near Tha Tako river outlet located in Chumphon MNP will not only affect the revenue of restaurants and resorts located in private land in that area, but the natural resources in the 50 rai area in which the actual dam will be constructed will also be damaged in addition to the 254 rai where there will be dredging activities. These are two examples demonstrating that EIA by itself is not an adequate screening process for investment projects and that some additional requirements are needed to demand additional investments to reduce the adverse impacts.

In contrast, the contribution of the economic sector that is most dependent upon biodiversity resources, namely the fishery sector, is almost negligible. Though value might increase if the entire value chain is considered, i.e., the employment and revenue generated at different levels of processing of aquaculture and seafood products, storage, transportation and marketing, the total revenue generation combined will still be far before the maritime and energy sector. Nevertheless, the fishery sector is an important stakeholder. Apart from being an economic sector that is heavily dependent on biodiversity resources, a major source of revenue for local coastal communities and a food security safety net, it is also a sector that is most often associated with illegal activities and a reason why Thailand has been under heavy scrutiny by the IUU. It must also be said that illegal activities occur at all scales of operation from small-scale artisanal fisheries to larger scale commercial fishing. Fishing practices described earlier can be highly destructive causing irreversible harm to the habitat, and where substances such as cyanide are used, fishing practices cause a potential hazard to consumers.

The other economic sector that depends on the diversity and abundance of coastal and marine biodiversity as well as the quality of the coastal landscape is the tourism sector. So far, it appears as though natural resources are treated as open access resources to be exploited rather than natural capital stock which guarantees sustainable flows of revenue. There is lack of communication between those responsible for tourism promotion and those that are looking after the nature-based sites, with the latter providing the attraction to create tourism demand in the first place. Until this communication gap is reduced, many tourism destination sites will be exploited beyond their carrying capacity. In the long run, Thailand faces a so-called "lose-lose scenario" with losses of revenue as well as a degraded environment.

Substantial work has already been made to identify the biodiversity hotspots. Investment requirements can be minimized if the efforts of the different agencies responsible for the management of different types of Protected Areas can be combined. Given the sectoral approach to budget allocation, the level where integration can be made arguably sits at the provincial level. In the absence of integration, agencies are holding different pieces of a jigsaw and no one knows what the whole picture looks like. Worse still, fragmentation of efforts may mean that scarce resources are used in a duplicative and wasteful manner.

The presence of Protected Areas indicates that the ecological importance of these areas is recognized. But they will be no more than 'Paper Parks' in the absence of plans and realistic budget allocation. Many of the measures proposed in the DMCR Road Map are relevant to these designated protected areas. As an initial step, it may be worthwhile to invest time and efforts in matching these DMCR proposed measures to give them an area dimension. Given the resources constraints, agreement would need to be reached on the 'what' and the 'where'.

Many external costs to coastal and marine resources could be avoided if adequate precautionary measures are put in place. As will be made clear in the Workbook 2, restoration costs, (if the damages are reversible), are much higher than prevention costs. There are already legal and regulatory requirements to assess environmental impacts as a precondition for investment approval. The politics of the negotiations and approval of EIAs aside, there seems to be an aversion to putting information from the EIAs under a thorough cost benefit analysis, which would involve taking into consideration the monetary values of both positive and negative externalities.

There are costs associated with placing the objective of increasing the number of tourists above all other considerations. Consumers/tourists are not

paying for the full costs of their visits to nature sites. Many studies have been conducted in Thailand, which show that tourists have no aversion to paying higher entrance fees for access to nature sites. At the risk of over simplification, the tradable components of coastal and marine resources are underpriced, which there are inadequate legal provisions and economic instruments to make economic agents (producer and consumers alike) internalize the costs of dealing with negative externalities.

In terms of providing avenues for possible finance solutions, featured below in Table 16 is a summary of the potential finance solutions relating to the specific problems of the coastal and marine environment discussed above. Similarly, the proposed set of solutions will need to be further explored to assess their economic, social and legal feasibility.

Biodiversity offsets

Proposed as a financing mechanism that may contribute to avoidance of adverse impact, reduction of the scale of the impact and implementation of measures to offset the residues of adverse impacts that cannot be avoided.

Performance bonds

It is called 'Parametric Insurance' and referred to as 'Environmental Risk Insurance' in the BIOFIN Workbook 2017. Performance Bonds is a form of insurance that allows for near- immediate payouts enabling timely response to events of environmental disaster. We believe that this provides extra precautionary measure in addition to the requirement that investors conduct EIA and in addition to our recommendations that CBA should also be added as a requirement before any investment projects are approved.

Payment for Ecosystems Services (PES)

Two types are proposed. The first targeting the coastal-fishery dependent communities as service providers to be engaged in activities related to protection and conservation of fish- habitats such as mangroves, seagrass and coral reefs. In the second type of PES project, ecosystem services refer to measures to protect and restore natural habitats such as coral reefs that attract nature-based tourists. In both types of PES projects, the objective is to develop a system to tap 'payment' from the beneficiaries and to ensure that such payment is channeled towards funding both the activities and the service providers resulting in changes or improvement in the quality of the environment that is measurable.

Island visitation fees for destinations outside of Marine National Parks

Island visitation fees is a form of user charge that is similar to entrance fees to Marine National Parks in Thailand. Without such charges, access to natural resources is 'free'. Under supply of efforts to protect and maintain the quality of the natural resources base will be unavoidable. Subject to carefully designed modality for collection and management of revenues collected, this mechanism could potentially generate a steady flow of revenue that could be used to put in place the necessary protection and conservation measures.

Sustainability standards

What is advocated here is that private businesses voluntarily adopt environmental standards with respect to fishing methods or nature-based tourism. Apart from guaranteeing the steady flow of goods and services resulting from sustainable practices, the market potential to collect premium prices from consumers who are willing to pay could well compensate for the reduction (if any) of the volume of goods and services sold.

Impact investment

This is proposed as one of the potential financing mechanisms as investment in protecting the environment makes business sense particularly for businesses that rely on the quality of the environment either to generate the flow of goods (as in the case of fisheries), or to attract potential clients (as in the case of tourism).

Table 16: Problems, solutions and potential financing mechanism for biodiversity in coastal and marine ecosystems

Problem	Expansion of physical infrastructure investment in locations that have adverse environmental impacts
Solution	Adding a requirement that in addition to EIA, economic analysis must be conducted by professionals in the field.
Potential Financing mechanism	1. Biodiversity offsets as a condition for granting investment approval 2. Performance Bonds: Environment al Risk Insurance: This is a form of insurance that allows for near- immediate payouts enabling timely response to events of environmental disaster.
Groundwork that needs to be covered	1. Develop a standard database of ecological functions of wetland 2. Gradually conduct valuation studies of the different types of economic uses

Problem	Destructive fisheries (IUU sanctions)
Solution	• Withdraw adverse subsidies • Provide positive incentives
Potential Financing mechanism	3. Payment for Ecosystems Services (PES): • to engage coastal- fishery dependent communities in activities related to protection and conservation of habitats such as mangroves, seagrass and coral reefs • to engage service providers in efforts to protect and restore coral reefs and other coastal and marine recreational sites 4. Sustainability standards for fish harvest from non- destructive fishing practices 5. Impact investments targeting in seafood industries
Groundwork that needs to be covered	1. Conduct an economic analysis of habitat protection and conservation cost; An economic analysis of the monetary benefits for ecosystem services provided by those three habitats 2. Market research on willingness of consumers to pay a premium price 3. Cost benefit analysis the investments to demonstrate the net welfare gain to society.

Problem	Marine National Parks and island destinations
Solution	Lack of sustainable flow of revenues to protect and restore natural resources
Potential Financing mechanism	6. Introduce visitation fees in island destinations outside of Marine National Parks 7. Impact Investment. For innovative investments to protect or reduce the pressure on natural resources base
Groundwork that needs to be covered	4. Review the institutional and legal framework for collecting island visitation fees

Urban biodiversity

The urban sector and expansion of built-up areas constitute one of the pressures on terrestrial, wetland as well as coastal and marine ecosystems. Yet biodiversity resources and pockets of natural ecosystems can be found in urban areas. In order to increase and sustain activities to conserve and expand urban biodiversity and ecosystems, it is crucial to have financing available. Funds to undertake conservation and expansion efforts could come from the following avenues: earmarking budgets indicated in the NBSAP and MONRE's Strategic Plan, budget the national government allocates to local city governments: mobilizing funding from beneficiaries of the conservation and expansion of urban biodiversity and ecosystems and, tapping funds from Corporate Social Responsibility (CSR) budget and crowd funding. While these avenues may be desirable at a broader policy level, the financing mechanisms that appear in the Table below focus on arguably the most important problem that can be potentially addressed by the financing mechanisms proposed. The problem in question is the problem of plastic waste. The amount of waste that ends up in the ocean is around 700,000 ton-1,000,000 ton/year earning the unwanted reputation of being the country with the fifth largest volume of marine debris in the world. According to the DMCR, the plastic debris such as plastic bags, plastic straws, plastic caps from water bottles account for 31 percent of the total volume of marine debris and the source of these plastic debris is most likely to be the urban population and Bangkok residents in particular. The two financing mechanism we propose are targeted at the producers as opposed to the consumers. These are Sustainability standards and Impact investments targeting at selected businesses that produce or use plastic. In addition, we also recognize that agencies such as the Board of Investment

and the Ministry of Finance could also consider providing tax incentives for investments that involve innovative technologies for reducing or getting rid of plastic waste resulting in reduced volume of plastic waste that ends up in the natural habitat.

Table 17: Problems, solutions and potential financing mechanism for biodiversity in urban ecosystems

Problem	Urban biodiversity
Solution	In addressing problems of plastic pollution, BIOFIN will focus on actions that will reduce the pressure not only on urban ecosystems but also on the coastal marine ecosystem.
Potential Financing mechanism	1. Sustainability standards 2. Impact investments targeting at selected businesses that produces or uses plastic 3. Providing tax incentives for investments that involve innovative technologies for reducing or gets rids of plastic waste resulting in reduced volume of plastic waste that ends up in the natural habitat
Groundwork that needs to be covered	1. Market research on willingness of consumers to pay a premium price 2. Cost benefit analysis the investments to demonstrate the net welfare gain to society 3. Review country experiences to generate information for consultant with Ministry of Finance

The policy recommendations and finance solutions identified in this section will need to undergo preliminary screening and detailed technical analyses. Likewise, each solution, and the mix of solutions, shall be evaluated using the information derived from the other BIOFIN workbooks, namely the BER and FNA. These processes and the suite of finance solutions to address the biodiversity issues in Thailand shall be articulated in the Biodiversity Finance Plan.

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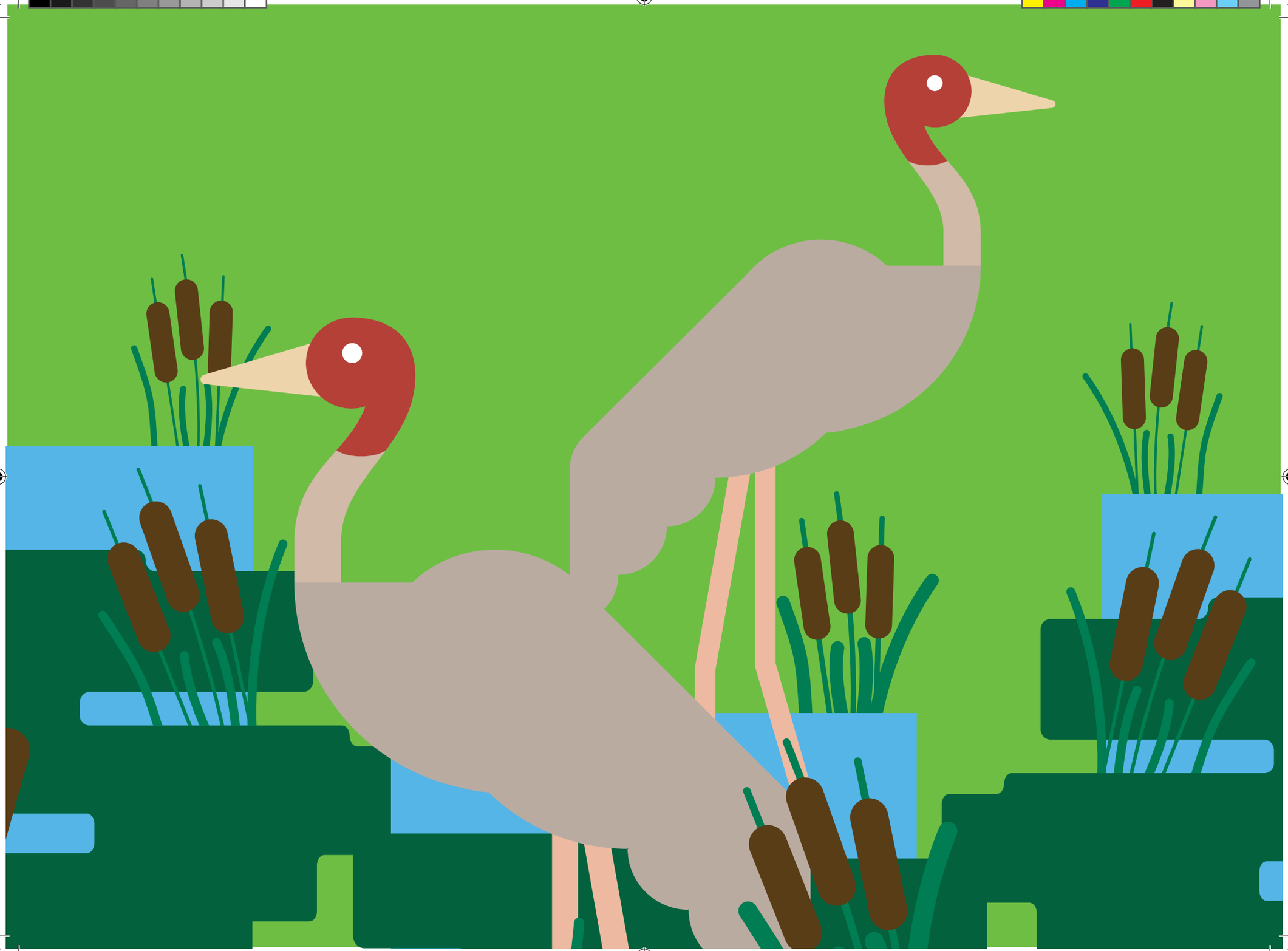

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