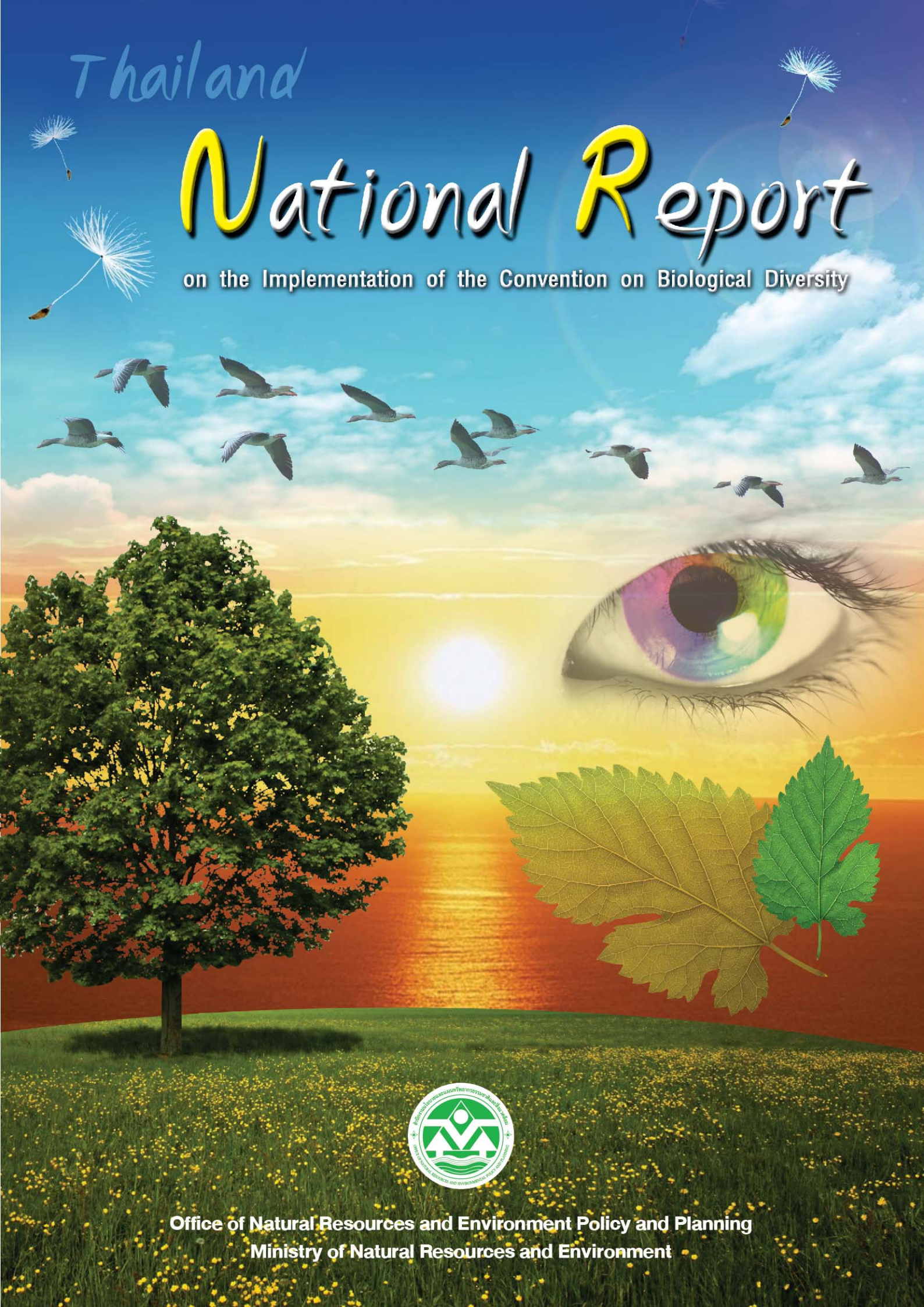


Thailand

# National Report

on the Implementation of the Convention on Biological Diversity

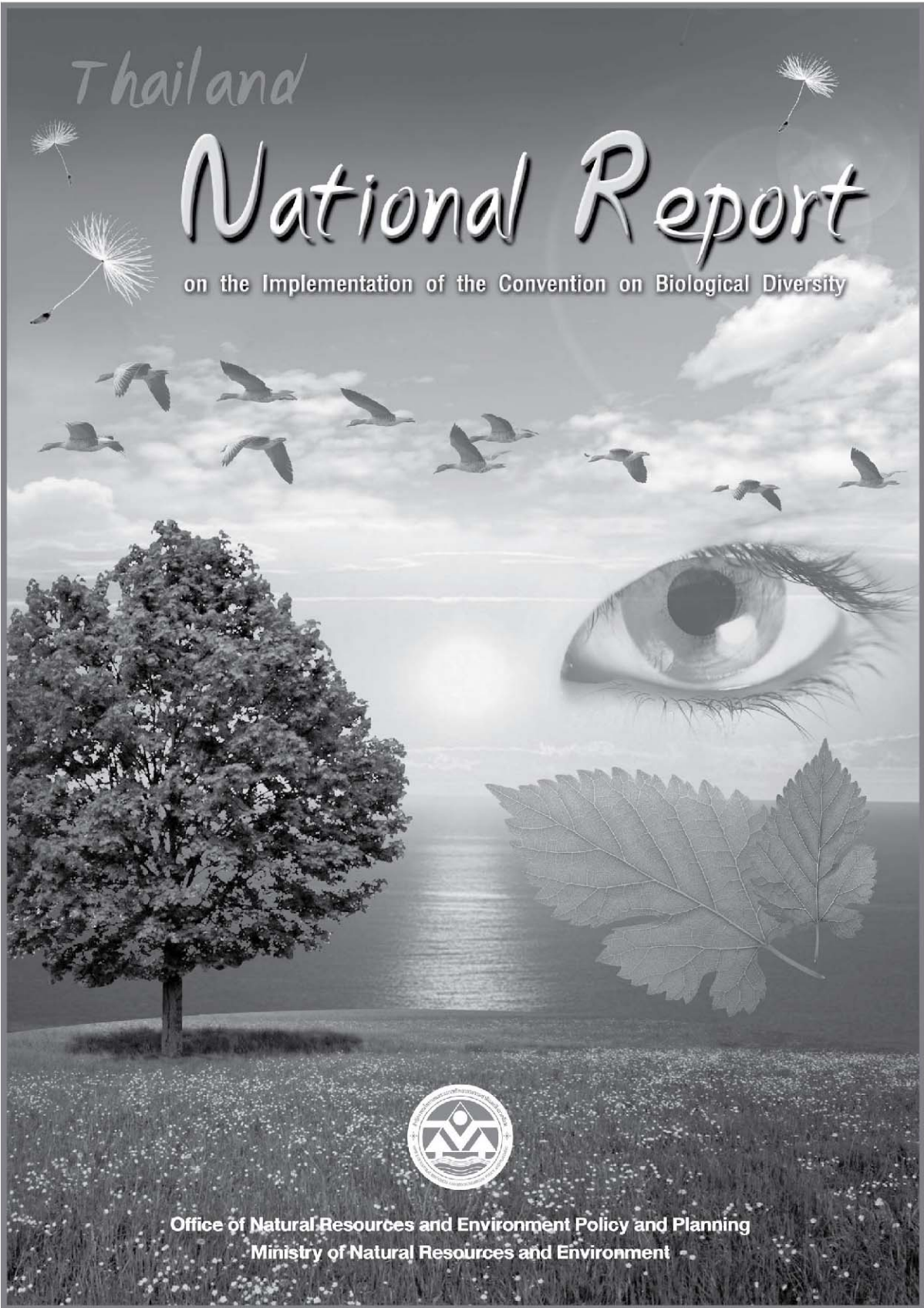


Office of Natural Resources and Environment Policy and Planning  
Ministry of Natural Resources and Environment

Thailand

# National Report

on the Implementation of the Convention on Biological Diversity



Office of Natural Resources and Environment Policy and Planning  
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# *Foreword*

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Biodiversity's contribution to wealth and well beings of Thailand has long been recognized. Such awareness spawned many activities that lead to the conservation of important ecosystems and associated species as well as genetic resources of these organisms. The recognition also become the driving factor for Thailand's signing of the Convention on Biological Diversity in 1992 and ratification of the Convention in October 2003, becoming the 188th Contracting Parties to the Convention.

The 2011-2020 Strategic Plan and Aichi Biodiversity Targets are the Convention's significant tools to encourage parties strengthen awareness and understanding on biodiversity to all stakeholders, including public, government and private sectors, encouraging implementation to address threats to biodiversity resources, promoting the value of ecosystems service and sustainable use, and raising awareness and mainstreaming on the conservation and sustainable utilization of biodiversity resources in their country.

Thailand has long dependent on its fertile and abundant biodiversity resources on their livelihoods, including socio-economics, cultural aspect, and as main sources of National income, in particular the export and tourism. In general, biological resources in Thailand tend to be decreased from many factors and threats. However, the country has implements various efforts, measures and mechanisms to address problems occurred, and to achieve the Convention's Strategic Plan, and the Aichi Targets. The outcome of the implementation was successful in some aspects, for example, the total areas of forests and mangrove forests in many areas have been gradually increased.

Thailand's 5<sup>th</sup> national report on implementation of the Convention on Biological Diversity is a chronicle of the country's actions undertaken to ensure biodiversity conservation and sustainable use, in accordance with 20 aichi targets (Chapter 4), as well as information on status and trends of biodiversity in Thailand (Chapter 2), review of the National Policies, Strategies and Action Plan on the Consevation and Sustainable Use of Biodiversity (NBSAP) 2018-2012 (Chapter 3), and overview of National Biodiversity Strategies and Action Plans (Chapter 5). The Office of Natural Resources and Environment Policy and Planning sincerely believes that this report is not merely a presentation of Thailand's implementation of the CBD, but also an instrument in reflecting effectiveness of activities undertaken to preserve the nation's biological wealth. The ONEP is convinced that the report's most valuable asset can be relized when lessons documented are applied in actual conservation works, either in the field or in planning process.

**Office of Natural Resources and Environment Policy and Planning**

# Chapter 1

## Value and Importance of Biodiversity to Economic and Society of Thailand

Thai people has exploited biodiversity for subsisting basic needs in life such as four requisites and as resources for well being livelihood since prehistoric era. In Thai culture, even in present day, there is a phrase usually use for describing wealthy of biodiversity resources as “in waters (there was) plenty of fish and in paddy field plenty of rice”.

Locating on the felicitous geography, Thailand is noticed as one of the world’s bounties on natural biodiversity resources and being rank as the first twentieth country those posses the world’s most abundant on biodiversity. Thai people has subsisted on and derived their tradition as well as culture with local biodiversity. It might be said that from being delivered to buried, Thai people would be associated with biodiversity. Biodiversity is important to Thai people for several dimensions such as food, herbal medicine, part of worship or ritual ceremony, main sector for national income and part of basement knowledge for development of science and technology. Furthermore, biodiversity also be important part of beautiful scenario which is the most important component of country tourism industry.

Biodiversity is important to Thailand as follows:

### Important of biodiversity as food resources

As rice is main carbohydrate source for Thai people, thence Thailand presume to a nation that retain excellent knowledge base about rice such as culture techniques, breeding and strain selection, geographical proper varieties, postharvest technology such as storage technique and also processing technologies for example. Other than that, rice is also contributed to numerous indigenous knowledge and traditional believes which unique for each part of country. Rice are also part of national income for several decades, it might see from the graph that Thailand had exported rice more than 2,000 billion US\$ annually.

Apart from rice, there are hundreds species of native flora and fauna reported as food source in Thailand. Except all main economic species such as poultry and swine, other important protein source in Thailand is aquatic organisms both from freshwater and marine habitats. The

freshwater fish species was mainly yielded from aquaculture and wild caught. However, nearly most of freshwater fish production (about 200 tons/ year) was used for country demand, just only few (less than 5%) used for export. Marine shrimp and fish are also important to Thailand economic, in 2008, the FAO had reported that Thailand had export frozen fish, frozen marine shrimp and other processed marine organisms about 104.2 billion US\$ which equal to 1.2 percent of gross national product (GDP) and the most revenue (about 60%) was contribute to labors and associated expense while 40% belonging to fishermen.

Other than rice and aquatic organisms, there are various organisms that utilized for food sources in Thailand such as indigenous vegetables, insects, land snails, frogs, snakes, birds, rodents and also wild mushroom. These kinds of organisms would be harvest on special area and season not for year round. On the survey of the Botanical Garden Organization in northern of Thailand during 2009-2010, it was found 141 species of indigenous vegetables, 191 species of invertebrates mainly was insects such as beetles, dragonfly nymph, crickets, ant larvae and scorpion for example, and about 60 species of seasonal wild mushroom such as the Barometer Earthstars (*Astraeus hygrometricus*), termite mushroom (*Termitomyces fuliginosus*), cockle’s shell mushroom (*Schizophyllum commune*) and the grisette (*Amanita vaginata*), were use as food by local residence in Lampang province (Northern of Thailand).

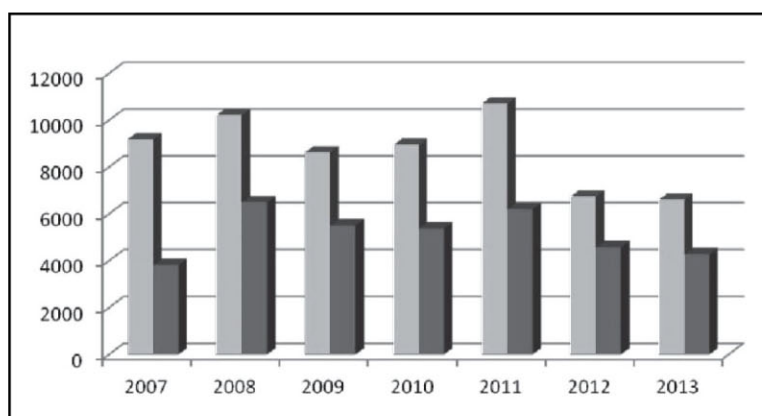


Figure 1: Net weight (thousand metric tons) and values (billion US\$) rice export of Thailand from 2007 to 2013

## Important of biodiversity on human health as medicine and herbs

Since ancient time, Thai communities had closely got along with natural resources. When members in community suffering from disease or illness, curing by using of plants, animal carcasses and minerals was occurred. This indigenous knowledge is finally develop into unique traditional medicine as known as Thai Traditional Medicine. Nowadays, Thai traditional curing was accepted by government to be an alternative curing method in some government hospitals. Surveys form Faculty of Pharmacies, Mahidol University had listed 1,459 species of medicinal plants used in Thai Traditional Medicine. In 2011, the Department for Development Thai Traditional and Alternative medicine, Ministry of Public Health was estimated market value of Thai medicine and herbs would equal to 354.8 billion US\$ for medicine, 5,483.8 billion US\$ for cosmetics and 2,580.6 billion US\$ as dietary supplement. In addition, value from spa therapy and traditional Thai massage roughly about 413.3 billion US\$ might be added into the value of traditional medicine. Despite the cosmetics and dietary supplement share highest market value in traditional medicine and herbs in Thailand but nearly all of them are imported. However, there are attempts from Thai scientists to develop native herbs into modern and easy to use products such as ointment balm, capsule or essential oil for example. Example of important plants for Thai Traditional medicine are king of bitterness (*Clinacanthus nutans* (Burm.f.)), Kwao khrua deang (*Butea superba* Roxb.), the creat (*Andrographis paniculata*), turmeric (*Curcuma longa*), extract of longan seed (*Dimocarpus longan* Lour.), and extract of tamarin (*Tamarindus indica* Linn.).

**Table 1:** Export value of Thai Traditional medicine and herbs in US\$ and Thai currency (Baht)

Year	Value (million Baht)	Value (million US\$)
2008	182.78	5.99
2009	219.67	7.20
2011	325.28	10.66
2012	225.32	7.39
2013	245.85	8.06

## Important of biodiversity on way of life and cultural

As life is depending on rice consumption, thence some tradition and believes would definitely evolved by receptiveness of rice. These traditions included worship to rice goodness prior beginning of new crops, ceremony for opening and closing of rice grain storage barn, the royal Ploughing Ceremony before new crops, the cerebation for new rice by using unripe rice grain to produce rice milk and Thai rice cracker as worship souvenir to agricultural god for example. The royal Ploughing Ceremony is very important to Thai farmers because in this ceremony, the King would spread rice grains and other cereal grains onto imitate royal rice field. After the ceremony is finished, ceremony attendees would combat for picking of the royal seeds for lucky. Some grains using for ceremony would be packed and delivered to farmers as sign of lucky and good breeds for their new crops. Furthermore, the ceremony would also remind farmers to begin their new crops.

Other flora and fauna that related to Thai culture and being genealogical transfer to young generation such as handmade paper from mulberry tree, staining of cotton clothes by using of indigo tree (*Indigofera tinctoria*) and culturing of silk work for example.

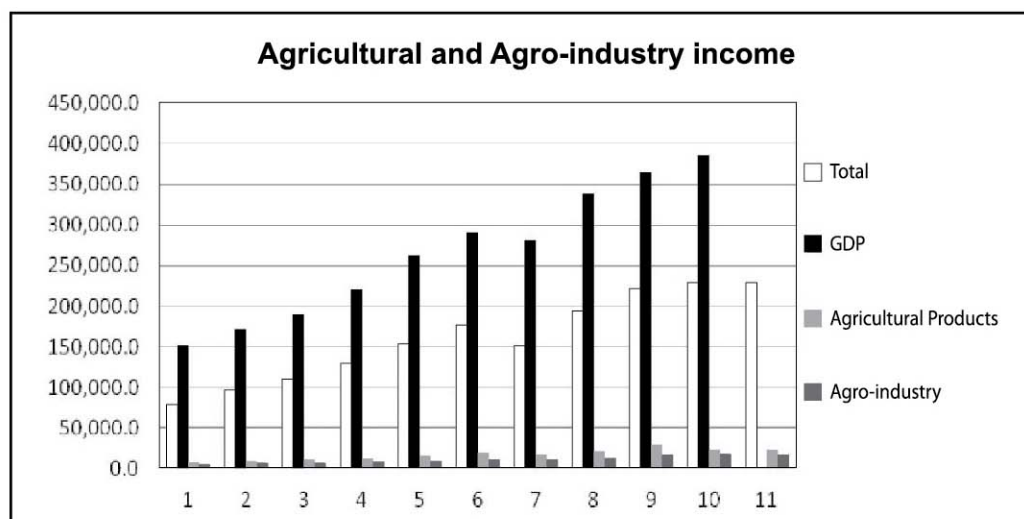
## Important of biodiversity on socioeconomic and country development

For decades, biodiversity resources such as agricultural products (rice, rubbers, chili pepper for example), forests products (timbers, wildlife carcasses, and spices) and processed or dried aquatic animals were served as primary GDP of Thailand. Till the late of the 20<sup>th</sup> century, country main income had shifted into industrial and service industrial instead. However, agricultural products and agro-industry products still contribute 9-12 percent in national GDP.

**Table 2:** Total export value of agricultural products and agro-industry products compare with national GDP of Thailand during 2003-2013

Year	Total value (million US\$)	Agricultural products (million US\$)	Agro-industry products (million US\$)	GDP (million US\$)
2003	80,040.0	8,797.1	5,950.1	152,000.00
2004	96,502.8	10,327.1	6,369.9	172,600.00
2005	110,937.7	10,447.3	7,008.8	188,600.00
2006	129,720.4	13,131.2	7,970.6	220,800.00
2007	153,865.0	15,167.7	9,489.5	261,800.00
2008	177,775.2	20,139.4	11,714.0	290,000.00
2009	152,426.5	16,429.9	11,264.5	279,700.00
2010	193,298.1	21,526.1	13,222.9	338,000.00
2011	222,579.2	29,042.3	17,476.9	364,700.00
2012	229,236.1	23,450.8	18,144.7	385,700.00
2013	228,529.8	22,709.8	17,296.0	

**Sources:** Center for information technology and communication, Ministry of Commerce



**Figure 2:** National income in Agricultural and Agro-industry

Total national income from agricultural products and agro-industry products comparing to GDP of Thailand during 2003-2012

Another native species that importantly contribute to Thailand's GDP is marine shrimp (*Penaeus* spp.). By the way, the exporting volume and value trend to be decreased, due to declining of environmental conditions such as acreage of mangrove forest and epidemic diseases.

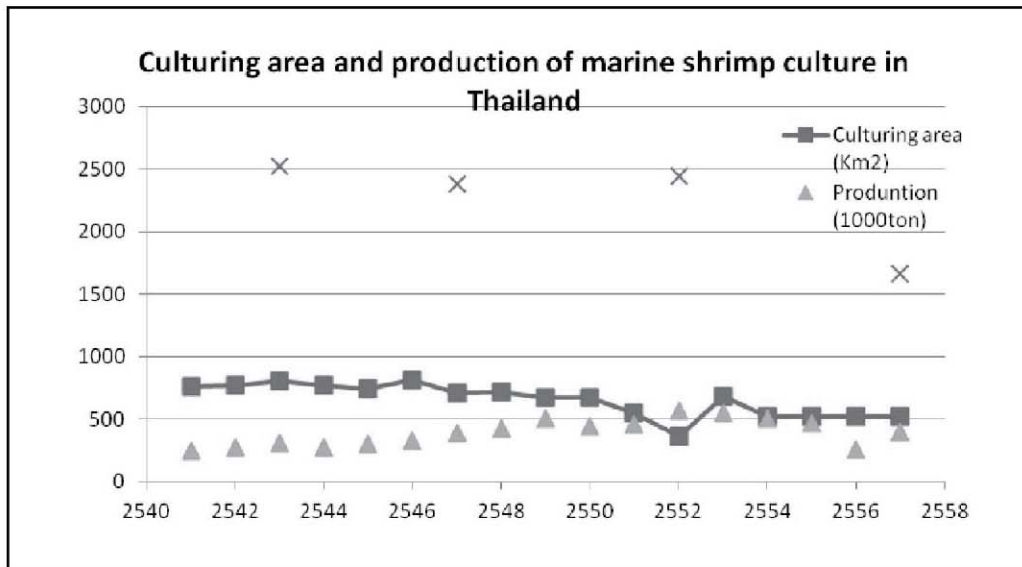


Figure 3: Culturing area and production of marine shrimp in Thailand comparing to area of mangrover forest from 1997-2014

For conclusion, even Thailand had shifted main income from agricultural base into industrial and service industrial base country, but the biodiversity still strongly embed into Thai tradition and way of life. Because descending from agricultural society, till now most of Thai still achieve their life basing on agriculture and fisheries. This is indicating that Thailand has to contribute financial resources and human resources to prolong her basement of tradition and her biodiversity resources for ever sustainable condition.



# Chapter 2

## **Situation of Biodiversity**

Although Thailand once had a high biodiversity, it was much destroyed. Currently, the biodiversity is in the 16<sup>th</sup> rank of the world (according to the order of WCMC in 2004) including only the species of amphibians, birds, reptiles, mammals, and vascular plants.

The diversity of species and abundance of plants, animals and microbes results from the location in the biogeographic region of Oriental Region or Indo – Malayan Region. This is the biogeographic region with diversity in the second rank of the world consisting of 3 floristic regions; Indo-Burmese Elements, Indo-Chinese Elements, and Malaysian Elements. It is also the overlapping area of 3 zoogeographical boundaries; Shino-Himalayan, Indo-Chinese, and Sundiac.

With such biogeographic region, the forest in Thailand has a wide range of not less than 15 categories including rainforest, dry evergreen forest, mixed deciduous forest, limestone forest, beach forest, and mangrove. The diverse ecosystem thus contributes to the habitat of plants and wildlife abundantly.

There are at least 10,250 kinds of vascular plants and gymnosperms such as fern, color moss, livervet, green algae, fungi, lichen totally for not less than 5,000 kinds. This is considered as 5 percent of the entire in the world. There are at least 4,722 kinds of vertebrate species calculated as 8% of the entire in the world. There are also not less than 124,526 species of insects, crayfish, snails, shrimps, crabs and other coral species calculated as 12 percent of the entire in the world.

In Thailand, there are few mountains of over 2,000 meters high above sea level. However, considering the mountains of over 1,000 meters high above sea level, it is found that the mountain area is approximately 150,322.45 square kilometers (93,951,533 rai) representing 29.3 percent of total land area. There are 25 large alluvial basins covered by forest such as Salween River Basin, Mekong River Basin, Chao Phraya River Basin, and river basins in southern Thailand. There are 43 main rivers. In the watershed line, it is abundant of aquatic animals, especially fish which is found for more than 300 species in the forests in the north. In the cave, there are also 9 endemic fish species which are considered as many as in the 4<sup>th</sup> rank of the world.

Forest is the important ecosystem of the country. In 1961, the first survey of the forest area was conducted using aerial photographs. It was found that there was 53.33 percent of the forest area of the country. After that, the forest reduced rapidly. Until 1989, the forest reduced to only 27.95 percent resulting in the cancellation of all forest concessions. Nevertheless, in 2013, it was found that the remaining forest area was 163,360 square kilometers (102.1 million rai) or about 31.57 percent of the total land area. This decreased by almost 50 percent from the existing one.

There are approximately 316,118.3 square kilometers of coastal and marine areas in Thailand divided into two areas of the Gulf of Thailand in the Pacific Coast and the Andaman Sea which is part of the Indian Ocean. The coral reefs cover the area of about 153 square kilometers containing over 400 coral species calculated as 10 percent of the amount available in the world. It was found in the Gulf of Thailand with the area of 74.8 square kilometers and the Andaman Sea area of 78.56 square kilometers. There is the sea grass source covering the area of 149.97 square kilometers growing in the shallow water. This is important to the livelihood, cultivation, and a nursery of fish species including dugongs, turtles, lobsters and sea grass found in 19 coastal provinces. A total of 12 species of sea grass is found form about 58 species of sea grass found worldwide.

Other important marine animals of the world found in the seas of Thailand include sea turtles, dugongs, dolphins, whales and whale sharks.

The mangroves are found in all 23 coastal provinces covering the area of 2,501.94 square kilometers. In the mangroves and estuaries, there are more than 500 species of fish and there are 35 species of true mangroves from 50 species found worldwide.

### ■ **Drive**

The biodiversity in Thailand is destroyed from many reasons. The most important reason is to focus on developing the country by wasting the resources. This results from the economic growth demand and the demand of competition to be in the first rank of the world in exporting goods such as aquaculture, rice, and rubber as well as the increase of population in the average of 0.45 percent per year. Until the year 2013, the population of Thailand reached 64.89 million along with the urban growth. Moreover, the past government policies resulted in more demand on water, food, residence, and medicine. The trade with both domestic and international competition also causes the biodiversity which is the basic resource essential for life to be destroyed most.



## ■ Economic growth demand

**Demand on agricultural land:** Thailand is an agricultural country. The National Economic and Social Development Plan Volume 1 (B.E.2504-2509) focuses on raising the standard of living of people to a higher level by using the resources of the country most usefully in expanding the production and increasing the national income more quickly. Therefore, there is the investment in the agricultural infrastructure such as irrigation projects, forest conservation projects, crop production improvement and promotion projects, and rubber breeding improvement projects.

However, many farmers have inadequate or no arable land to do the agriculture. This leads to the encroachment of forest area for doing the agriculture. It is found that the land in Thailand is approximately 513,104 square kilometers (320.69 million rai). The land use changed for doing agriculture for 21.52 percent in 1962 and it increased to 46.54 percent in 2011. The forest area decreased while the agricultural area increased. Over 50 years ago, the forest area decreased 19.9 percent of total land area. However, the agricultural area increased by 25 percent. Most lands used for doing agriculture are from forest encroachment.

The agricultural lands were cultivated with crops for many consecutive years repetitively especially for rice, cassava, maize, rubber, sugar cane, and oil palm. This caused the soil to lack of abundance. The nutrients are absorbed from the soil all the time. This leads to the use of chemical fertilizers to increase agricultural productivity and the use of chemical pesticides. It was found that in 2012, Thailand imported disease and pest control chemicals about 134,377 tons. Considering total volume of imported products from the past to present, it is expected to remain in the soil and additive in water in enormous quantities.

The deforestation causes the stream to dry up. In the drought, farmers do not have enough water for cultivation. This leads to the creation of irrigation projects, irrigation canals, reservoirs, dams and levees which use the areas of forest and natural wetlands. In some irrigation areas, the rice can be grown for 5-6 times in just two years. This is excessive for the maximum capacity of the soil and the demand on water use increase too much. However, in the flood season, water reservoir cannot bear the water resulting in the flood to destroy crops. The marshy plain of the river is changed into farming area.

The traditional way of life of the communities changes. The original seeds cannot be used anymore because the conditions of soil, water, and climate change. We have to rely on the seeds from companies resulting in the higher costs. The local fishing cannot be conducted as the natural sources turn into the reservoirs. People need to find jobs in the cities causing the cities to gradually expand.

The urban population increases steadily resulting in the expansion of land for building the residence. Therefore, the farm lands around the cities have changed to become residential areas and industrial estates leading to an increase in air and water pollution as well as waste to water sources and seas eventually.

**Being competitive in the global market:** Thailand has the coastline of over 2,614 kilometers long. Over 27 million of population or 40 percent of the residents of Thailand live in the coastal provinces. In the past, Thai seas were abundant. Thailand had a great success in fishing and was famous worldwide. In 2010, Thailand caught aquatic animals in the 13<sup>th</sup> rank and the export of aquatic products was in the 3<sup>rd</sup> rank of the world. However, it was mainly on trading by ignoring the environmental impact. This caused the coastal and marine ecosystem to be too destroyed to improve.

In 2013, Thailand had the large fish processing industry with 13,263 commercial fishing vessels accounted for 22.8 percent of all fishing vessels. These large fishing vessels caught over 90 percent of all quantities of aquatic animals while coastal fishing vessels representing 77 percent of all fishing vessels caught only 10 percent of the total caught aquatic animals. This was because of the drastically reducing abundance of Thai seas. The large vessels were out fishing off the seas and the aquaculture products were likely to decrease since 2006. The rate of change in the products between 2003 and 2012 fell by an average of 5.1 percent per year. The data from the Food and Agriculture Organization of the United Nations (FAO) shows that fishing in Thai seas declines from 300 kg per hour in 1961 to only 25 kg per hour in 2011, representing 8 percent of the rate that had been achieved. Moreover, in the last decade, the numbers of caught adult fish that have economic value reduced and such fish was not needed including the increase of not fully grown up fish. Among the fish caught by trawl vessels, there were the fish species and sizes of economic value as required for only 40 percent. 19.2 percent of fish and aquatic animals were not grown and another 40.2 percent was the fish without value used for making the feed. Meanwhile, the fish processing industry of Thailand is large and has to rely on fish from other sources for more than 40 percent of the fish entering the fish processing industry. Thus, the total exported products are still in the top rank of the world. But in fact, Thai seas are degraded as much as the forest ecosystem.

## ■ Basic knowledge, awareness, and beliefs

**Basic knowledge:** Thai people are proud to have the numerous forests all over the country. But such pride is without the awareness that the forests may disappear from Thailand one day. In the texts of environment of Thailand, the forests are considered as renewable resources. In fact, when the forests are destroyed, the ecosystem will change. Several species and several kinds may be lost or extinct without resuming the biodiversity. Thai people may understand that the forests are natural resources that should be preserved. However, as they understand that the forests are natural resources as officially called by relevant agencies, Thai people turn the forests into person's estates.

Thai people have the tradition to apologize to the rivers and streams that have been heavily utilized all the time. But with the abundance of water sources and aquacultures, Thai people have never thought that rivers and streams are limited natural resources. They were not careful to preserve them to exist forever. From the ancient time to the present, Thai people continue to invade rivers and streams, discharge waste into the water sources, and occupy the river banks and the inundating areas. The swamps in the dry season become the bare lands in the eyes of everyone from local people to the agencies responsible for land development. The persons responsible for land development and many universities try to expand the areas into the swamps as they are the areas that have not needed to be bought. If there is the prosecution to the Court, they will build the buildings for occupying the areas so that they are not be sentenced to demolition.

### Awareness

- Almost all Thai people love to enjoy the beauty of the seas, sandy beaches and rocky beaches but they do not bother to preserve those for their children to appreciate nature. Thai people think that the seas can serve all things as the seas are vast and infinite. A lot of Thai fishing vessels used to catch aquatic animals incessantly. When it exceeded the domestic consumption, the products were exported overseas. The waste water was discharged from the hotel industry in spite of regulated by laws.

- In 1964 to 1992, the novels motivating people to hunt the animals were published and were very popular. Therefore, in 1973, 60 officials from public and private sectors took the helicopter to do the hunting in Thung Yai Naresuan and the helicopter fell down. A lot of animal dead bodies were found there. Although there is a serious objection from the conservation groups and the issue becomes a major political issue, the hunting is still a popular on weekends throughout the time. The trend rose a lot in 1974-1982 with the idea that there are plenty of wildlife that can be always hunted.

- Most of Thai people have never been taught to conserve public property so they do not help preserving nature. They think it is not their business and the government is responsible for everything. Moreover, the officials in the agencies do following the minimum standards regulated by laws. They think if they do much more than this, they will be in trouble. So, they let the problems arise without solving.

- Thai people believe that the Serow oil can heal the wounds and strengthen the bones, the Manatee's tear drop can make attractiveness. Chinese people believe that tiger penis, rhino horn, flesh and blood of the hogs, paw and gall of bears can increase sexual performance. Consequently, such animals are slaughtered brutally. Moreover, rosewood which is believed to be auspicious wood becomes the driving force that causes more hunts and illegal logging leading to the extinction that cannot be solved easily.

- A lot of Thai people have very little awareness in protecting nature. They have never strict on the persons who destroy nature and the environment. They have never acted socially campaign to eliminate the misconceptions such as releasing birds or turtles for eliminating bad lucks become animal cruelty. This helps releasing the invasive species into nature.

- Currently, the people with the most nature-loving awareness on mountains, rivers, forests, streams, swamps, seas, beaches, canals, and coral reefs are the communities living nearby as they understand that protecting natural resources should be done for the happy living of everyone mainly depending on nature.

## ■ Loss of ecosystems

The biodiversity status becomes worsened as the forest areas of Thailand seriously decline. The trafficking of wild animals and wild plants continues severe and becomes a hot issue in both national and international levels. In addition, the wetlands ecosystem is also invaded by invasive species and is destroyed from the invasion of lands for growing crops according to the government's policy. The coral reef ecosystem is aggravated by the impact of climate change in spite of having been seriously affected by the land and water activities.

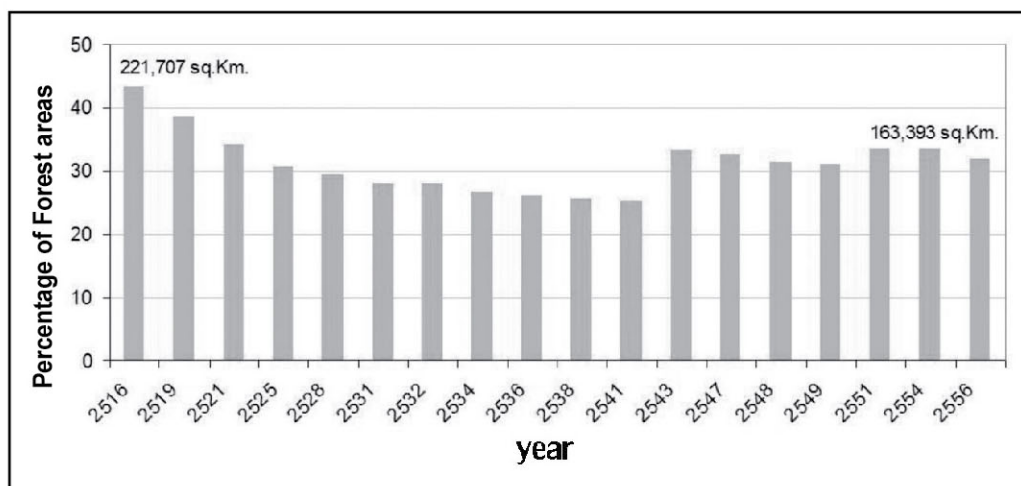
## Status

The natural ecosystem has lost a lot of lands. The forest areas are lost in the average of 2,560 square kilometers per year. Since 1961, rivers, canals, and swamps were destroyed for more than 50 percent and the Thai coast and seas were degraded resulting in the drastic declination of aquatic products. That is a major cause of species loss of Thailand for more and more. For examples, for vertebrate species, in the last four decades, Thailand has to lose 7 species extinct from the worldwide and another 8 species are going to be extinct from nature. The lack of genetic plants and animals also slowly occurs. As it relates to community's way of life, there is the trend to improve the breeds. However, there is an effort to bring the crane back to nature and the status of endangered species in nature (EW) can successfully turn into extremely endangered (CR).

### ■ Loss of ecosystems

Forest ecosystem, inland water source systems, and coastal and marine ecosystems are destroyed most in this decade. Although most of the high mountain ecosystems is protected by the National Parks, the Sanctuary Wildlife and wild hunt prohibited areas are destroyed a lot and mostly change to the agricultural areas. Some areas become mine, water storage dams, monasteries, etc.

**Forest encroachment:** The continuous use of forest areas in the past four decades causes Thailand to lose the forest area in the average of 2,560 square kilometers per year (1.6 million rai). Since 1961, the forest areas in Thailand remained for less than 53.3 percent of total land area. The report on statistical information about the forest of Bureau of Land Management, Department of Forestry, Ministry of Natural Resources and Environment, stated that in 1973, Thailand had the forest area of 221,707 square kilometers or calculated as 43.21 percent of total land area. However, 11 years later, the forest area of Thailand declined annually. In 21998, the forest area of Thailand was only 129,722 square kilometers or 25.28 percent of the total land area. According to the survey in 2008, it was found that the total forest area of Thailand was 171,585.65 square kilometers or calculated as 33.44 percent of the country area. Later, in 2014, the Department of Forestry announced that Thailand had the forest area of only 162,200 square kilometers accounted for 31.6 percent of total land area. Within five years, the forest area lost in the average of 1,600 square kilometers or one million rai per year. That the forest areas had been invaded a lot in the 4-5 years was partly from the promotion of rubber and oil palm planting.



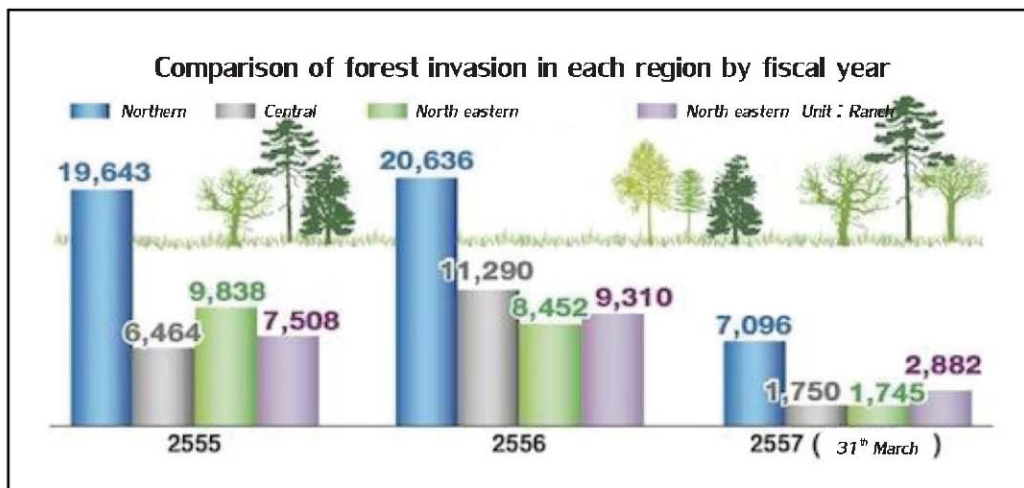
**Figure 4:** Change in the forest areas of Thailand between 1973-2013

The statistical data of forest area encroachment of Bureau of Protecting Forests and Forest Fire Control, Department of Forestry, in the latest 2 years rises. In the fiscal year of 2012 (1<sup>st</sup> Oct. 2011 - 31<sup>st</sup> Sep. 2012), the forest area was invaded for 43,455 rai 1 ngan 85 square wa. Later, in the fiscal year of 2013 (1<sup>st</sup> Oct. 2012 - 31<sup>st</sup> Sep. 2013), the forest area was invaded for 49,690 rai 3 ngan 51 square wa.

Recently, in the fiscal year of 2014 (1<sup>st</sup> Oct. 2013 – 31<sup>st</sup> Mar. 2014), only in the first 6 months, the statistical data of Department of Forestry reveals that the forest areas have been encroached for 13,474 rai 1 ngan 37 square wa.

In the fiscal year of 2013, the most cases of forest area encroachment were in the northern region for 1,116 cases and the forest area was encroached for 20,636 rai. The less was in the southern region for 642 cases and the forest area was encroached for 9,310 rai, in the northeastern region for 512 cases and 8,452 rai, and in the central region for 472 cases and 11,290 rai.

However, considering each province, it was found that the 10 most province with encroached forest areas were Kanchanaburi for 7,310 rai, Lampang for 4,025 rai, Tak for 3,808 rai, Chiang Mai for 3,616 rai, Krabi for 3,554 rai, Loey for 2,049 rai, Kamphaeng Phet for 1,781 rai, Chiang Rai for 1,747 rai, Yala for 1,379 rai and Phitsanulok for 1,112 rai.



**Figure 5:** Forest area encroachment in each region of Thailand (following the fiscal years)

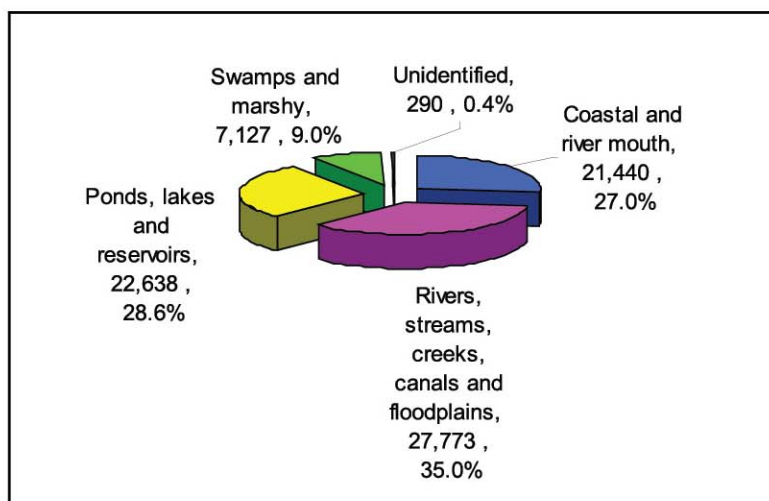
In Maehongson, the most proportion of forest area per province area is 86.89%. The less is in Tak for 72.03%, Lampang for 70.81%, Chiang Mai for 69.49%, and Kanchanaburi for 62.51% of the province area.

The provinces with the most decreasing forest area are Chiang Mai, Nan, Lampang, Uttaradit, and Loey.

The situation of illegal cut of rosewood remains in crisis particularly in the northeastern forest areas and some parts of eastern region which is the ultimate source of the world's rosewood in Phu Wiang National Park, Phu Phan National Park, Phu Sithan Wildlife Sanctuaries, Thap Lan National Park, Ta Phraya National Park, etc. The rosewood logging involves the logging process supported by operators outside the country and the armed forces. The statistic of illegal cut of rosewood in 2014 stated that 3,252 cases arrested with 1,930 accused. 92,957 pieces of rosewood were seized valued 1,463 million baht. Especially in June 2014, 244 cases were arrested up from May for 80 cases. The export price is million baht per cubic meter from the domestic sale price of 5-6 hundred thousands baht which is the continually increasing price motivating the continual illegal logging continues.

**Destruction of water sources, streams, and swamps**

The wetlands in Thailand consist of rivers, streams, canals, and floodplains for not less than 27,773 km<sup>2</sup>. The less are swamps and marshy in the total areas of not less than 7,127 km<sup>2</sup>. The coastal and estuary cover the total areas of not less than 21,440 km<sup>2</sup>.

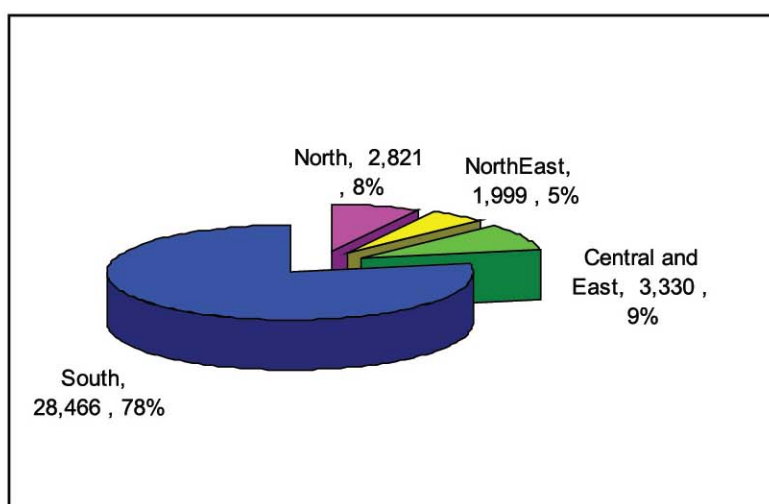


**Figure 6:** Areas and percentage of areas of wetlands and the wetland areas of Thailand (square km.) Suchat Sailamai, 2013

Currently, the floodplains along the river banks are transformed into the farmlands for agriculture and industry. The ponds and swamps are transformed into the irrigation reservoirs in squared form without water flow out naturally. There are only the drains. The natural ditches and creeks are converted to irrigation and drainage canals and local rice fields as well as buffalo swamps. This results in the decreasing areas of wetlands in Thailand affecting the community's way of life who use the wetlands as a source of food, water and animal feeding such as buffaloes, cows, and ducks.

In addition, many of the wetlands of several swamps and marshy especially in the northern and northeastern regions are invaded by alien species; the giant mimosa and the land ownership. The rivers in the central region including Tha Chin River and Bangpakong River are invaded by water hyacinth and giant *Salvinia cucullata*. Many swamps are filled and dug for drainage. Some are burnt for building the reservoirs, hotel buildings, factories, or planting economic crops such as Kuankreng Swamp, Banmaikao Swamp, and Maerampueng Swamp.

The loss of wetlands in the northeastern region is found for 40-60 percent compared with the data of 2009-2012. In 2013, the loss of wetlands in the northern region was 62.39 percent compared with the data of 2009 and 2001.



**Figure 7:** Areas and percentage of areas of wetlands in international level of Thailand (square km.) Suchat Sailamai, 2013

The current data reveals that most of the wetlands are in the south. In the northern, northeastern, and central regions, the wetland areas are not much different.

### Degradation of marine and coastal ecosystems

**Mangrove:** In 2009 and 2013, it was found that the mangrove area in Thailand increased to 1.525 million million rai and 1.568 million rai, respectively. Comparing the mangrove areas between the Gulf of Thailand and Andaman Sea, it is found that in the Gulf of Thailand, there is less mangrove area and the mangrove loss rate is more than in the Andaman Coast. However, the mangrove area begins to lose less since 2004 and the trend is constant at present. This is due to the conservation and reforestation with the cooperation from both public and private sectors such as in Trang, Phetchaburi, and Surat Thani.

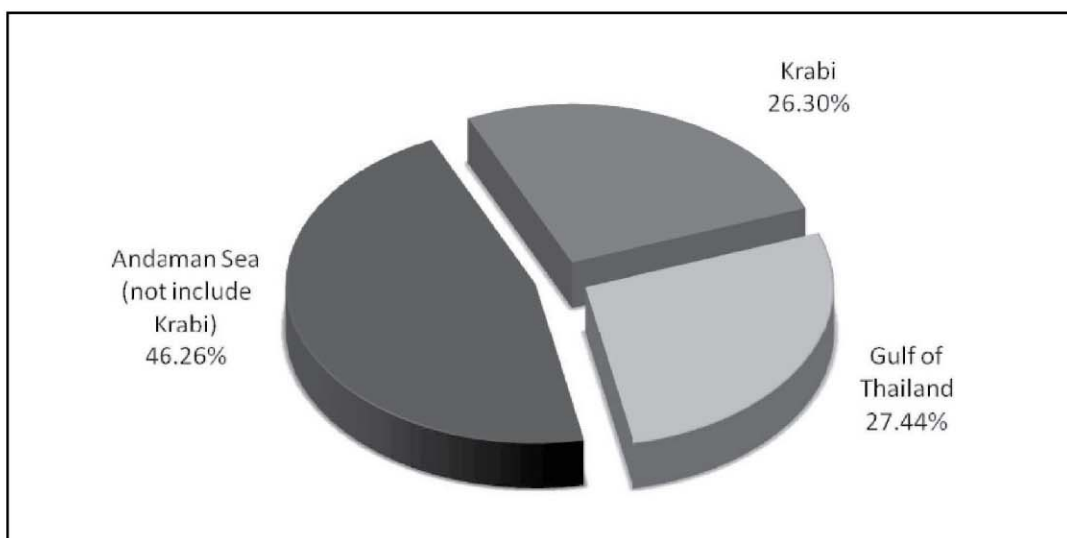
The provinces with declining mangrove areas because of invasion are tourist provinces such as Krabi, Phuket, and Satun with the illegal logging due to the motivation of wood price from neighboring countries.

### Sea grass sources

Thailand has a total area of 189.86 km<sup>2</sup> for sea grass sources consisting of Andaman coast for 137.76 km<sup>2</sup> (72.56 percent) and the Gulf of Thailand for 52.10 km<sup>2</sup> (27.44 percent). The most sea grass sources are found in Krabi in the area of 49.93 km<sup>2</sup> (26.30 percent).

The survey and observation of the changes in the status of seagrass in Thailand in 2013 reveals that in the upper part of Andaman Coast, the sea grass is in the constant level to abundance. In the lower part of the Andaman Sea, the sea grass is the constant level to abundance. This is the area of abundant sea grass. In the east coast of the Gulf of Thailand, the sea grass status is quite stable in the medium abundance as well as the central part of the Gulf of Thailand. Except for the lower Gulf of Thailand, it is found that the sea grass status is deteriorated and degraded by natural conditions.

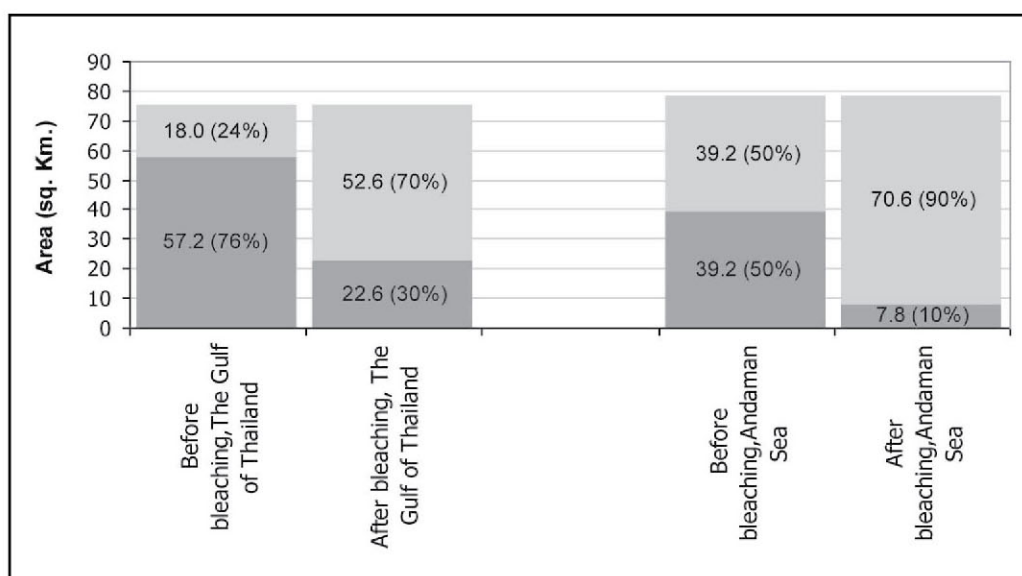
The main cause of sea grass degradation is from the change in the environment condition. The severe storm waves cause the movement of the dunes and natural sediment on the natural grass line. The coastal development makes more sediment in the sea. The development in coastal areas for tourism, the dredging or fishing jetty, the wastewater discharge from industrial plants, houses, large coastal communities, and shrimp farms cause the sea water quality to be degraded. This includes illegal fishing in the areas of sea grass sources such as nets and pods, etc. (Department of Marine and Coastal Resources, 2013).



**Figure 8:** Representing the numbers of sea grass sources in Thailand

**Coral reefs:** They are found in the Gulf of Thailand and Andaman Sea in similar size of 47,000 and 49,000 square kilometers, respectively. The coral reefs are threatened by a number of reasons including the deposition of sediments from the rivers, pollution of the river mouth, sewage from communities, industry, coastal hotels, and fishing with destructive fishing tools.

But in 2010, the phenomenon of coral bleaching occurred in a wide area. It was found later that the ratio of reef degradation increased markedly from the coral reefs both in the Gulf of Thailand and the Andaman Coast. The coral reefs in the Andaman Coast degraded to 90 percent of the total area or calculated as 70.6 square kilometers. In the Gulf of Thailand, the degradation of coral reefs was 70 percent of the total area or calculated as 52.6 square kilometers (Figure 9 Office of Marine and Coastal Resources Conservation, 2011).



**Figure 9:** Status of coral reefs studied in 2012-2013 and compared with the previous data before the bleaching coral reefs in 2010

According to the survey in 2013, it is found most coral reefs in Andaman Sea for 87.4 percent is in the destroyed and most destroyed conditions. The live coral reefs cover the average area of 22 percent while the dead coral reefs are of 62.4 percent.

■ **Status of species**

**Vertebrates**

In 2013 – 2014, Office of Natural Resources and Environmental Policy and Planning (ONEP) has managed to discuss for several times to update the status of vertebrates of Thailand (Thailand red data). It is found that in Thailand, there are 4,722 species of vertebrates classified into 336 species of mammals, 1,010 species of birds, 394 species of reptiles, 157 species of amphibians, and 2,825 species and fish. 555 species of vertebrates have been classified in threatened status (118 species of mammals, 168 species of birds, 49 species of reptiles, 18 species of amphibians, and 202 species of fish) (Figure 10).



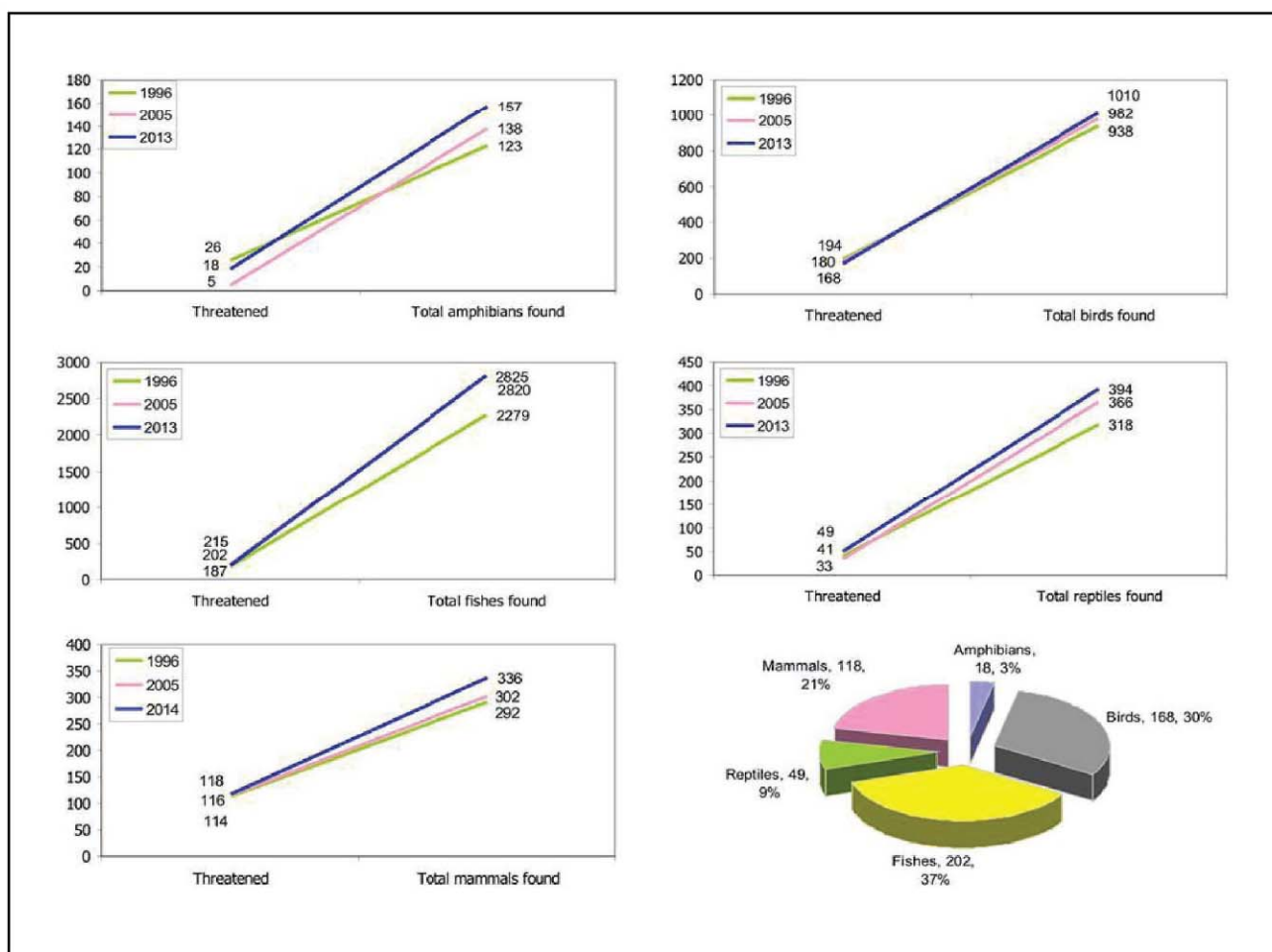


Figure 10: Representing the classification of vertebrate status in Thailand compared between 1996, 2005, and 2013

Table 3: Vertebrate status in Thailand in 2013

Classification	Vertebrate status									Total
	EX	EW	threatened				NT	LC	DD	
			CR	EN	VU	Total				
Mammals	4	0	13	32	73	118	30	153	31	336
Birds	2	1	44	59	65	168	126	713	0	1,010
Reptiles	0	1	16	17	16	49	62	267	15	394
Amphibians	0	0	0	4	14	18	13	108	18	157
Fish	1	6	23	64	115	202	61	2,455	100	2,825
Total	7	8	96	176	283	555	292	3,696	164	4,722

According to 4,722 species of vertebrates found in Thailand in 2013, 7 species were extinct; *Rucervus schomburgki*, *Bos sauveli*, *Rhinoceros sondaicus*, and *Dicerorhinus sumatrensis*, *Pseudibis gigantea*, *Graminicola bengalensis*, and *Platytrapius siamensis*. 8 species were naturally extinct; *Pseudibis davisoni*, *Tomistoma schleglii*, *Pristis microdon*, *balantiocheilos ambusticauda*, *Datnioides pulcher*. 555 species were threatened for 11.75 percent. The most threatened group was mammals for 35.12 percent. The less is birds for 16.63 percent, the reptiles for 12.44 percent, the amphibians for 11.46 percent and fish for 7.15 (Table 4).

**Table 4:** Numbers of species of vertebrates found in Thailand and threatened species

Classification	Species found in Thailand	Threatened species	
		Numbers (kinds)	Percentage
Mammals	336	118	35.12
Birds	1,010	168	16.63
Reptiles	394	49	12.44
Amphibians	157	18	11.46
Fish	2,825	202	7.15
Total	4,722	555	11.75

**Fish:** 2,825 species are found for approximately 8.6 percent of the world or  $\approx 32,847$  species (referred from www.fishbase.org searched on 27<sup>th</sup> June, 2014). These are classified into 812 species of plain water fish and 2,013 species of sea water/brackish water fish. 1 species is in the extinct status which is *Platytrapius siamensis*. 6 species are in the extinct in the wild status; *Anoxypristis cuspidata*, *Pristis microdon*, *P.zijsron*, *Scleropages inscriptus*, *balantiocheilos ambusticauda*, *Datnioides pulcher*, and *Hemiaris verrucosus*. 23 species are in the Critically Endangered status such as *Carcharhinus hemiodon*, *Yasuhikotakia sidthimunki*, *Himantura polylepis*, *Pangasius sanitwongsei*, *Trigonostigma somphongsi*. 64 species are in the Endangered status such as *Galeocerdo cuvier*, *Himantura kittipongi*, *Cromileptes altivelis*, *Datnioides undecimradiatus*, *Catlocarpio siamensis*, *Botia histrionica*, *Oreoglanis siamensis*. 115 species are in the Vulnerable status such as *Rhincodon typus*, *Manta alfredi*, *Kryptopterus vitreolus*, *Cirrhinus microlepis*, *Trigonostigma heteromorpha*, *Ompok fumidus*, *Wallago micropogon*, *Akysis pulvinatus*, *Oreoglanis suraswadii*, *Mugilogobius rambaiae*, *Betta splendens*, *Indostomus spinosus*, *Mastacembelus erythrotaenia*.

**Amphibians:** 157 species are found and 4 species are classified into the nearly extinct; *Limnonectes malaysianus*, *Babina Lini*, *Hylarana luctuosa*, *Rana johnsi*. 14 species are in the endangered such as *Ansonia siamensis*, *Theلودerma gordonii*, *Quasipaa fasciculispina*, *Limnonectes paramacrodon*, *Hylarana faber*, *Rhacophorus prominanus*.

**Reptiles:** 394 species are found. 1 species is classified into extinct in the wild status which is *Tomistoma schleglii*. 16 species are classified into the Critically Endangered status such as *Crocodylus porosus*, *C. siamensis*, *Batagur borneoensis*, *Erettamochelys imbricate*, *Dermochelys coriacea*, *Chitra chitra*, *Pelochelys cantorii*, *Cyrtodactylus chanhomeae*, *Leiolepis boehmei*. 17 species are classified into the nearly extinct status such as *Platysternon megacephalum*, *Manouria emys*, *Pseudocalotes floweri*, *Cyrtodactylus tigroides*, *Larutia nubisilvicda*, *Opisthotropis maculosus*, *Trimeresurus phuketensis*. 16 species are classified into the Endangered status such as *Physignathus cocincinus*, *Pseudocalotes feae*, *Cyrtodactylus jarujini*, *Isopachys roulei*, and *Opisthotropis spenceri*.

**Birds:** 1,010 species are found and 2 species are classified into the extinct status; *Pseudibis gigantea* and *Graminicola bengalensis*. 1 species is classified into extinct in the wild status which is *Pseudibis davisoni*. 44 species are classified into the Critically Endangered status such as *Rhizophora longirostris*, *Arborophila charltonii*, *Lophura ignita*, *Polyplectron malacense*, *Asarcornis scutulata*, *Ciconia stormi*, *Ephippiorhynchus asiaticus*, *Leptoptilos javanicus*, *L. dubius*, *Ichthyophaga ichthyaetus*, *Eurynorhynchus pygmeus*, *Sterna acuticauda*, *Aceros corrugatus*, *Pitta gurneyi*, *Pseudochelidon sirintarae*. 59 species are classified into the nearly extinct status such as *Rollulus rouloul*, *Pavo muticus*, *Tringa guttifer*, *Aceros nipalensis*, *Megalaima rafflesii*, *Copsychus pyrrropygus*. 65 species are classified into the Endangered status such as *Argusianus argus*, *Aythya nyroca*, *Anhinga melanogaster*, *Rynchops albicollis*, *Strix seloputo*, *Pericrocotus igneus*, *Temnurus temnurus*, *Napothera crispifrons*, *Cyornis rufigastra*, *Calliope obscura*.

**Mammals:** 336 species are found and 4 species are classified into the extinct status; *Rucervus schomburgki*, *Dicerorhinus sumatrensis*, *Bos sauveli*, *Rhinoceros sondaicus*. 13 species are classified into the Critically Endangered status such as *Eothenomys melanogaster*, *Manis pentadactyla*, *Prionailurus planiceps*, *Lutra sumatrana*, *Rucervus eldii*, *Bos javanicus*, *Bubalus bubalis*. 32 species are classified into the nearly extinct status such as *Niviventer hinpoon*, *Prionailurus viverrinus*, *Panthera tigris*, *P. pardus*, *Craseonycteris thonglongyai*, *Macaca assamensis*, *Hylobates pileatus*, *Muntiacus feae*, *Bos gaurus*, *Dugong dugon*, *Elephas maximus*. 73 are classified into the endangered status such as *Ratufa affinis*, *Neofelis nebulosa*, *Cuon alpinus*, *Mustela kathiah*, *Hipposideros lekaguli*, *Nycticebus coucang*, *Hylobates lar*, *Orcaella brevirostris*, *Rusa unicolor*, and *Capricornis sumatraensis*.

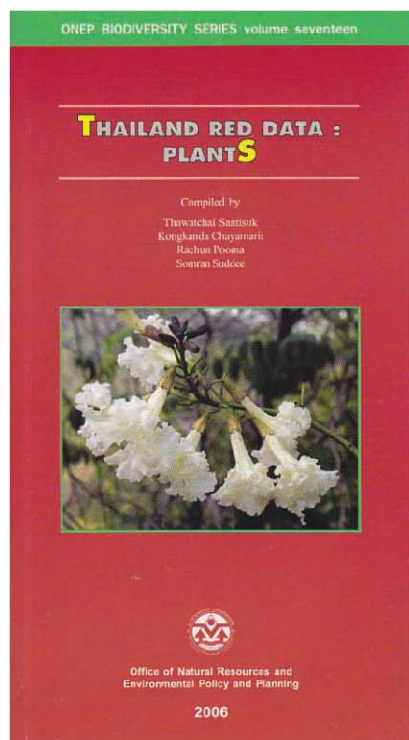
## Plants

In 2013, the Office of Natural Resources and Environmental Policy and Planning arranged the meetings to improve the classification of status of threatened species. The experts had estimated from about 10,250 kinds of plants expected to be found in Thailand as follows: plants expected to be found in Thailand as follows:

**Table 5:** Numbers of plants expected to be found in Thailand

Types	Kinds	Families
Ferns and similar plant groups	658	132
Gymnosperm	25	7
Flowers	9,551	263

For the preliminary assessment and analysis of status of plant species that are already classified for the status of Thai plants are in 1,407 species. Thailand red data has collected into 1,407 kinds of 135 families (2006) as detailed



**Table 6:** Numbers of plant species classified by group of plants

Groups of plants	Numbers of kinds
Ferns	42
Gymnosperm	27
Monocotyledon	417
Magnoliopsida	924

**Table 7: Numbers of plant species found Thailand**

Class	EW	CR	EN	VU	NT	Endemic	Semi-Endemic	R	RT	Total red data sp.	FamRed
Pteridophyte				13		19		27	2	42	17
Gymnosperm				8		6		17		27	8
Angio-dicot	1	19	30	242		528	11	629	6	922	94
Angio-monocot			101	103		211	4	206		416	19
Total	1	19	131	367		764	15	879	8	1407	135

**Remark**

- Leguminosae Family has 3 sub-families counted as 1 family.
- status shown in the table counted for both with and without parenthesis such as EN as shown in the table is from the sum of EN+(EN)

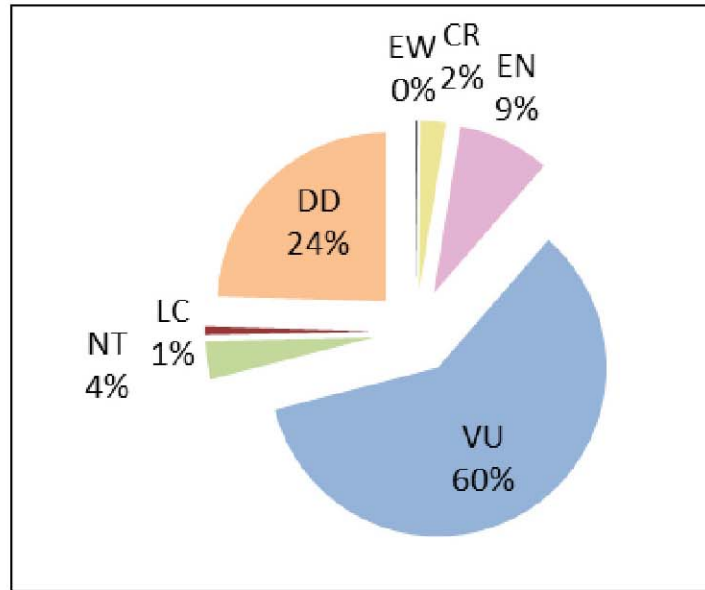


In 2014, Office of Natural Resources and Environmental Policy and Planning has A Checklist of Plants in Thailand Volume 1 consisting of Pteridophytes, Gymnosperms, and Angiosperms-Monocotyledons for assessing the status of plant species. The status of 1,224 kinds of plants are determined and classified into 730 species of Magnoliopsida and 487 species of monocotyledon as follows:

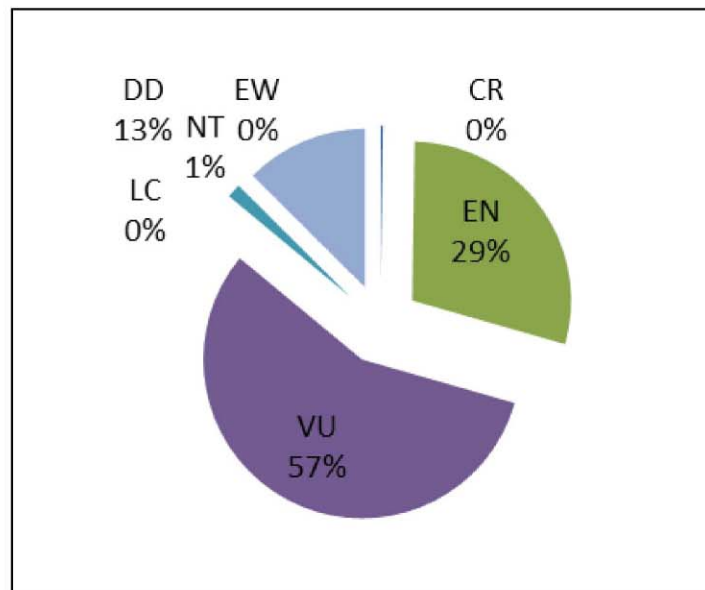
**Table 8: Numbers of plant species from a Checklist Plants in Thailand Volume 1 (2014)**

Class	EX	EW	CR	EN	VU	NT	LC	DD	Total
Angio-dicot	-	1	18	65	440	27	6	181	730
Angio-monocot	-	1	-	142	275	7	-	61	487
Total	-	2	18	207	715	34	6	242	1224

**Source:** Office of Natural Resources and Environmental Policy and Planning



**Figure 11:** Status of Magnoliopsida in 2014



**Figure 12:** Status of monocotyledon in 2014

**Note:** EX = Extinct EW = Extinct in the wild CR = Critically Endangered VU = Vulnerable NT = Near Threatened  
 LC = Least Concern DD = Data Deficient

The new species, the rare, the endemic, the new record, and the new locality are discovered. 56 species of them are in the threatened status. 20 kinds are in the nearly extinct status and 36 species are in the endangered status such as:

### New species



***Plectranthus phulangaensis* Suddee, Suphuntee & Saengrit**

Status: Endangered A1cd B2 b(i,ii)  
Photo by Dr. Woradol Jaemjamroon



***Bauhinia nakhonphanomensis* Chatan**

Status: Vulnerable A1cd  
Photo by Dr. Woradol Jaemjamroon



***Ixora phulangkaensis* Chamch.**

Status: Endangered A1cd B2 b(i,ii)  
Photo by Dr. Woradol Jaemjamroon

## New record of plant species found in Thailand



***Liparis acutissima* Rchb. f.**  
Status: Vulnerable A1cd  
Photo by Dr. Woradol Jaemjamroon

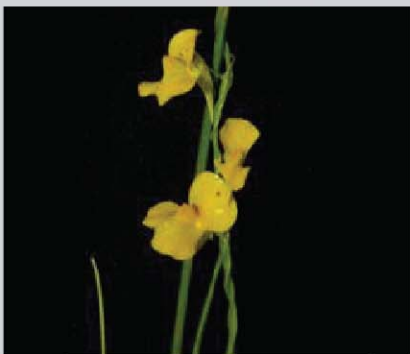


***Lithocarpus corneus* (Lour.) Rehder**  
Status: Vulnerable A1cd  
Photo by Dr. Woradol Jaemjamroon



***Chionanthus verticillatus* (Gagnep.) Soejarto & P. K. LÔc**  
Status: Vulnerable A1cd  
Photo by Dr. Woradol Jaemjamroon

## Plant species reported to be found in new locality



***Utricularia involvens* Ridl.**  
Status: Vulnerable A1cd  
Photo by Dr. Woradol Jaemjamroon

## Rare plants and endemic plants



***Osbeckia cochinchinensis* Cogn.**  
Status: Vulnerable A1cd B1 b(i,ii)  
Photo by Dr. Woradol Jaemjamroon



***Ceropegia thailandica* Meve**  
Status: Endangered A1cd  
Photo by Dr. Woradol Jaemjamroon



***Argostemma monophyllum* Sridith**  
Status: Vulnerable A1cd  
Photo by Dr. Woradol Jaemjamroon



## Genetic loss

As an agricultural country, therefore Thailand recognizes well the importance of conserving plant, livestock and pet genetic resources, including wild varieties as well as species with economic and cultural value. Besides, the popular trend of today's consumers gives priority to native species due to concern over the likely extinction after many species have become extinct already. In consequence of such trend, there are a large number of public network and community organizations that try to conduct activities for conserving and restoring native species.

### ■ Native plants

Many species of native plants are in danger of extinction, including various vegetables, fruits and flowering plants. The examples of fruits in this regard are *Garcinia (mapood)*, madan, some varieties of mangosteen, langsung, custard apple, fruit of rambutan family, e.g. Kho Laen or hairless rambutan, lychee-like Silaman, neck orange, tangor, malabar tamarind, Buddha's hand. This includes especially the original varieties of durian which are the sources of popular species today such as Thongsuk, breeder of Kanyao durian variety, Kampan variety, breeder of Montong variety, Nokyib, Karaked, E-Luang varieties. All this is on the verge of extinction.

The genetic loss of native plants affects sequentially the traditional way of life. *Garcinia cowa (Chamuang)* is a native vegetable of people in Chanthaburi Province. It has been popularly used for making pork curry with Chamuang. This rare vegetable is also considered to be at risk of extinction. The locals of Chanthaburi Province may not have pork curry with Chamuang for eating anymore if *Garcinia cowa* tree is no longer in existence. The reasons for vulnerability of these garden plants to extinction are because people see no economic value and the cultivation for sale cannot fetch a good price. As a result, the garden owners or anyone possessing these plant species fail to emphasize and cut away them in order to use the area for growing other plants of value instead. Consequently, many varieties of native plants in Thailand, which are considered to exist in the only place in the world, are on the verge of extinction.

The National Rice Seed Storage Laboratory for Genetic Resources, Rice Department, has collected the germplasm of **native rice varieties** from across the country of at least 20,000 germplasm samples due to the estimation of more rice species than that has been stored. Therefore, the Rice Research Center has accelerated the survey, database preparation, classification, evaluation of typical characteristics of varieties and value assessment of native rice germplasm throughout the country anew in order to push for more collection, conservation of native rice germplasm continuously.

Thus, the Rice Department has speeded up conservation of wild rice varieties in natural state at the Rice Research Centers in Prachinburi and Sakon Nakhon Provinces. Also, the wild rice species have been prepared for use in improving rice varieties to be more resistant to diseases and pests in the future. In doing this, the Rice Department has allocated a budget of over 80 million baht for implementing the project to conserve wild rice genetic and native rice varieties of the whole system within the years 2012 – 2016.

Most farmers have used high-yielding rice varieties for cultivation rather than native rice species. Therefore, when native rice varieties have not been used, they could no longer remain. As a result, the Rice Department has planned the selection of native rice varieties with special qualities, i.e. giving high yield, drought-tolerance, brown planthopper BPH- resistance and having high nutritional value. Approximately 100-300 varieties per year have been chosen as breeder for selecting and improving the pure line of native rice species with abilities to give high yield, resist disease, insects and suitability for commercial cultivation. The purpose is to encourage the farmers to produce native rice of good quality extensively even more. In doing this, the intention is that the Rice Department would be able to certify an average of 2-4 varieties of pure line native rice per year.

In 2012, the Rice Department certified the pure line of 3 native rice varieties intended for encouraging farmers to grow commercially, namely Leum Pua Glutinous Rice, Banna rice and flood-resistant jasmine rice. All varieties give high yield and quality based on the needs of the market in terms of both direct consumption and use for processing to be products as well.

The current trends in consumption of nutritious rice for health gain increasing popularity. As a result, the Rice Department has developed and improved Leum Pua Glutinous Rice to be pure variety of good quality and contain high antioxidants. As for Banna rice variety, it gives a high yield of averaging approximately 400 kg per rai<sup>1</sup> and can be used for processing many kinds of food. Above all, it is floating rice. This creates an alternative for enabling the farmers to grow rice and fight the threat of flooding in the future. Similarly, jasmine rice can resist flooding well with harvesting period appropriate to the conditions of cultivated land in the Northeast.

<sup>1</sup> Rai = Unit of area equal to 1,600 square meters

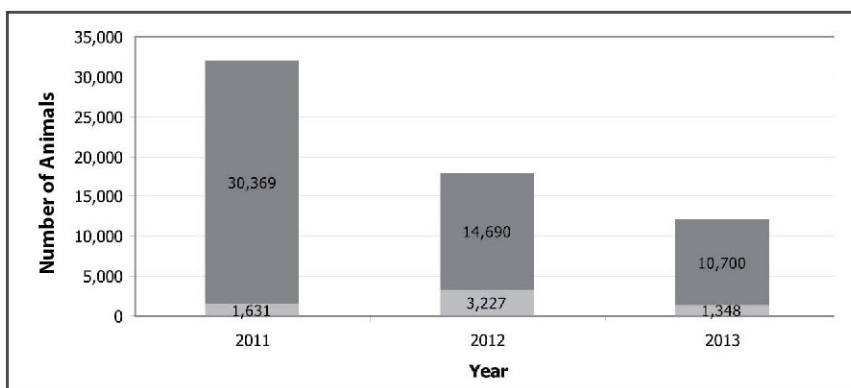
Furthermore, deepwater rice varieties have been selected, e.g. Plaingam Prachinburi 2 Ayutthaya 1 Gor Kor 45 and Khao Banna so as to accommodate the flood problem. However, Prachinburi Rice Research Center, which is responsible for producing rice seeds of all 5 varieties, has been unable to enhance the capacity to meet the needs of farmers. The Rice Department has planned to use the network of Community Rice Seed Centers for dealing with producing seeds to accommodate the needs of farmers in the areas vulnerable to flooding more. The Rice Department intends to encourage each province to establish the rice seed bank and rice seed production village. The purpose is to ensure the availability of rice seeds of good quality, cheap and proper standard for use in localities. The Rice Department deals with producing seeds for propagation and forwarding to various Farmer Service Centers nationwide.

Plenty of native plants, vegetables, fruits are on the verge of extinction because they are not popularly consumed and are not used. The examples are Kradon vegetable, Ceylon Spinach, Vegetable Humming Bird, wild betel (*Chaphlu*), mullilam, Wild Almond, Korlan (*Nephelium hypoleucum*), Garcinia cowa (*Chamuang*), Prickly Custard Apple, Garcinia, Malabar tamarind, etc. Moreover, some plants were abandoned by farmers, e.g. Kamphaeng Phet native stumpy banana (*kluai khai*), Uttaradit native langsat. The said farmers have turned to cultivating other economic crops such as rubber, sugar cane in line with economic trends. As a result, the Department of Agriculture has made efforts to tackle the problem of risky extinction of **native plants**. The method is based on trying to **create more value** so that people return to growing or conserving the species. The example in this regard is the promotion of processing these plants to be OTOP products of localities such as traditional medicines, e.g. Garcinia (*Malabar tamarind*) capsules or canned curry pork with Chamuang. The ability of people to develop these garden plants to be saleable products would result in more propagation and additional cultivation instead of destroying or cutting away.

Besides, the Department of Agriculture has endeavored to restore native plants for cultivation in local areas. The examples are durian for plantations in Nonthaburi Province; Thong-dee and Kao Nampueng pomelo varieties for Nakhon Pathom Province and Kao Tang Kwa pomelo variety for Chai Nat Province. In 2011, due to severe flooding in such areas, various varieties were damaged in consequence. The Department of Agriculture recovered the varieties before and during flooding. Subsequently, the Department of Agriculture propagated species and distributed this back to farmers along with original varieties from the royally-initiated genetic conservation project as well. The reason is because it was a great opportunity to return native and endemic species disappearing from the areas long ago to the original localities. This includes durian cultivars, i.e. Kob Mae Tao, Kob Chai Nam, Med Nai Yai Prang, Yammaewat, Chok-loi, Kradum Sinak, Kob Phikun and Kob Saonoi. Thereafter, in 2012 the Department of Agriculture returned another 40 native durian varieties to Nonthaburi Province, e.g. Nok Yip, Kop Chaokhun, Kop Mae Tao, Kratoei Nueakhao, Kanyao, Si Nak, Foi Tong, Chat Seetong, Toontawai, Chok-loi, Tong Yip, Kop Suwan.

■ **Wildlife trafficking**

Thailand is the transportation hub of Southeast Asia, including the routes by land, air and sea. As a result, the illegal wildlife transportation across the countries is feasible quite easily by means of smuggling, hiding, mixing with other products or intentionally reporting false quantity. Despite numerous checkpoints of import – export along the border and stringent control in the airport and port areas today, the illegal wildlife trafficking is still ongoing and cannot be controlled thoroughly. According to the data on legal proceedings during the years 2011 – 2013, there were 1,838 criminal cases related to wildlife, seizures of 55,759 wild animals as stolen goods and 6,206 carcasses of wildlife.



**Figure 13:** Statistics on wildlife trafficking, quantity of wild animals as stolen goods seized during the years 2011-2013 (Unit in number of bodies)



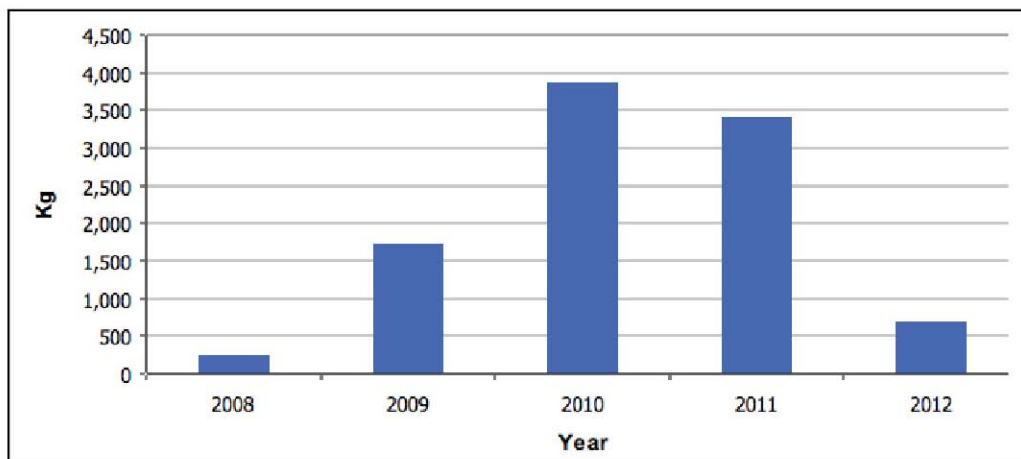
*Illegal wildlife hunting in the forest area in the West of Thailand*

The 10 wildlife species of most trafficking include pangolin, Bengal tiger, bear, loris, orangutan, red-whiskered bulbul, hornbill, elephant, clownfish and turtle. This is due to the demand for parts / organs of wild animals for consumption, use as ingredients of traditional/ Chinese medicines as well as the popularity of raising rare animals. The roles of wildlife traffickers in Thailand range from: 1) being the importer for selling to customers in the country, 2) undertaking the transfer to the destination countries, 3) being the producer for domestic sale and 4) being manufacturer for export.

African ivory is the most monitored part of wildlife in illegal business due to large quantities and high value. Thailand has been used as a transit spot before forwarding to the destination countries. According to the statistics on arrests during the years 2008-2012, there was smuggling of ivory with total weight of 9,922.29 kg, worth of over 600 million baht. However, the routes used for transporting wild animals and these products are unpredictable, hence difficulty in control and prevention.

Wild animals that are illegally smuggled in the top ten ranges include pangolin, tiger, bear, loris, orangutan, red whiskered bulbul, hornbills, elephant, clownfish, and turtle. This is because there is a need in parts or organs of wild animals for consumption and for using as an ingredient for traditional medicine and Chinese medicine and for keeping as a pet. The roles of Thai wild animal illegal traders are 1) importing to sell to customers living abroad, 2) sending to sell in the third country, 3) producing to sell in the country and 4) producing to sell abroad.

The African elephant's ivory is one of the most outstanding cases of illegal trading because there is a large volume in trading and its price is very high. Thailand is used as a channel before sending to the third country. Based on statistics during 2008 – 2012, it found that the total weight of ivory which is illegally smuggled is 9,922.29 kilograms and is worth more than 600 million bahts. The route of these illegal trading is not certain, making it hard for its control and prevention.



**Figure 14:** Statistics of Illegal Trading of Ivory in Thailand, showing a quantity of ivory confiscated during 2009 – 2012.

The illegal trading of wild animals to be a pet or a collection has a centre in Chatuchak Market in Bangkok and other markets in nearby provinces. The sellers will receive an order through a website and open a pet shop to cover their illegal action. The illegal trade occurs behind the shop. Based on the statistics during 2011 – 2012, 139 illegal traders were captured and 5,046 animals were seized. Most of the animals are Red-whiskered bulbul - *Pycnonotus jocosus*) (2,526 birds) and *lonchura punctulata* (1,326 birds).

The red-whiskered bulbul is a member of the Pycnonotidae family. The red-whiskered bulbul is about 20 centimeters in length. It has brown upper-parts and whitish underparts with buff flanks and a dark spur running onto the breast at shoulder level. It has a tall pointed black crest, red face patch and thin black moustachial line. The tail is long and brown with white terminal feather tips, but the vent area is red. It is found across South Asia, South East Asia and East Asia in different landscapes, from the top of mountain, the plain area, the field, the forest and nearby human living area. This bird is popular because of their nice voice and is used for competition, like Zebra dove - *Geopelia striata*, especially in the southern provinces, such as Narathiwat, Pattani and Yala, of Thailand. Bleeding this bird is a part of culture and lifestyle. Its life span is 11 years. The one which has a present voice and wins a competition can be valued a million.

In present, the red-whiskered bulbul is included in a list of protected wild animals under the Wild Animal Reservation and Protection Act B.E. 2535. There is an attempt by people who love this bird to make it legal to breed; this movement receives both a support and a refuse because at present almost all of the bird come from the nature – this can lead to extinction.



*Red-whiskered bulbul*

## Wood smuggling

During the 16<sup>th</sup> meeting of Convention on International Trade in Endangered Species of wild fauna and Flora-CITES in March 2013, Thailand proposes to classify *Dalbergia* wood to be under a risk of extinction because there is a need to use the wood to build furniture and music instruments, such as guitar and its market price is extremely high. It is now registered in the second list of CITES for controlling its trading.

The Dalbergia wood smuggling in Thailand is under an alarming situation. There are smuggling gangs, consisting of both Thai and foreigners. It also found that foreigners smuggle to cut Dalbergia wood in the national park and other conservation areas along the broader, such as Phanom Dong Rak Wildlife Sanctuary and Phu Jongnayoy National Park, etc.

Thai people also smuggle and cut Dalbergia wood in Phu Sithan Wildlife Sanctuary and Phu Pha Yon National Park in the northern northeastern Thailand. Nearby communities join the gang and cut all of Dalbergia wood. The community capitalist receives an order from foreign capitalists.

Statistically, Dalbergia wood seized by Department of National Parks Wildlife and Plant Conservation from 2006 – 2013 consists of 23,812 logs/squares/plate or is equal to 2,239.90 sq.m. The total price is worth more than 559 million baht. From this amount, 1,362 logs/squares/plate or is equal to 147.13 sq.m. now belongs the property of the nation. The Dalbergia wood grows in 34 sanctuaries in Thailand. In 2012, most of the cases were reported in Phu Pha Yon National Park and Phu Sithan Wildlife Sanctuary. The Forest Department now is responsible taking care of 50,452 logs/squares/plate of Dalbergia wood or 4,069.26 sq.m. Out of this amount, 20,771 logs/squares/plates or 1,730.38 sq.m. belong the property of the country. The rest is under a legal process. Customs Department seized 115,489 logs/squares/plates or 12,129.31 sq.m. of Dalbergia wood in different ports and customs. In total, there are more than 18,437 sq.m. of Dalbergia wood and these are worth more than 4 billion baht.

### ■ Wild Orchid and Plants Smuggling

The smuggling is found with 1,236 species of plants according to Forestry Act. B.E. 2484. These plants are needed as a collection of many people and its high price is a motive for people to smuggle to sell, especially along Thai and Myanmar's broader, Sing Khon Boundary Post in Prachuap Khiri Khan Province, Mae Sod Boundary Post in Tak, Chiang Saen Boundary Post in Chiang Rai as well as other temporarily permitted areas between Thai and Lao in the northeastern provinces. These orchids and plants include popular species, such as wild orchid, Siam orchid, Dendrobium chrysotoxum, Rhynchostylis coelestis, and Phoenix Orchid. Other plants are included Aristolochia indica, popped rice, ball fern, and Rafflesia kerrii Neijer. Its high price is a good temptation; some fern's price is during 500 – 600 baht per meters after it's sent to Bangkok.

The deforestation for the palm plantation, rubber tree, corn farm, street and train makes it easy to smuggle wild plants because big trees are cut and there is no place for orchid to live. For example, Paphiopedilum exul is cost 10,000 Baht while other types of orchid are sold 1,000 – 2,000 Baht per tree. These that are seized by the police die because no one can take care plants.

## Overfishing

The fishing in the gulf of Thailand continues to decrease in the last ten years but the total fishing production remains the same because the fishing activity expands to neighboring countries, such as Indonesia, East Tomor, Papua New Guinea, etc. However, if considering from the number of the boat, it found that its number increases or decreases in a small scale every year. Most of fishing boats are large fishing boats and can travel in the sea for at least 2 weeks.

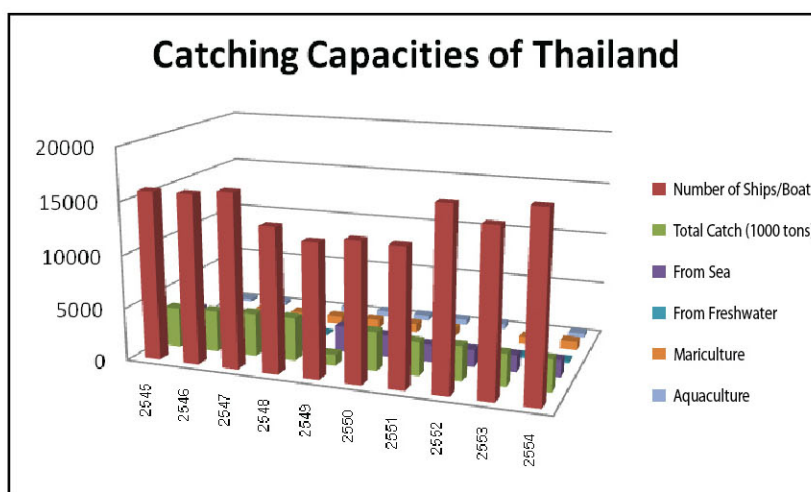


Figure 15: Catching Capacity in Thailand, Divided by each water source, from 2002 to 2011

The production that can replace the fishing is raising aquatic animals. Thailand is a country that succeeds in raising aquatic animals and most of the production is from the coastal area and can raise numerous types of animals, such as canned fishes, grouper fish, blood cockle, Asian green mussel, horse crab, etc. The most successful aquatic animals are white prawn and tiger prawn and its production for export is the no. in the word. The aquatic animal farm can lead to deterioration of mangrove forest and other natural resources.

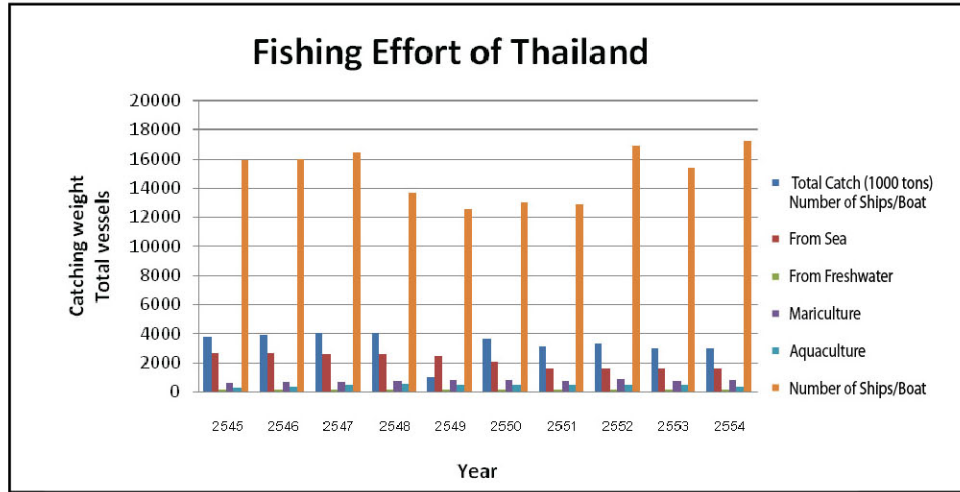


Figure 16: Effort of Thailand divided by water sources And fishing production during 2002 - 2011

The value of freshwater fishing industry in Thailand is in the high level in the last ten years because most of the fishing industry areas are in water reservoirs above dams. The management can protect fishing industry, especially, the method to release small fishes in water sources and the method to prevent fishing during the season when fishes lay eggs. However, there is a sign of decreasing of a number and species of fishes in the major rivers due to the pollution in environment.

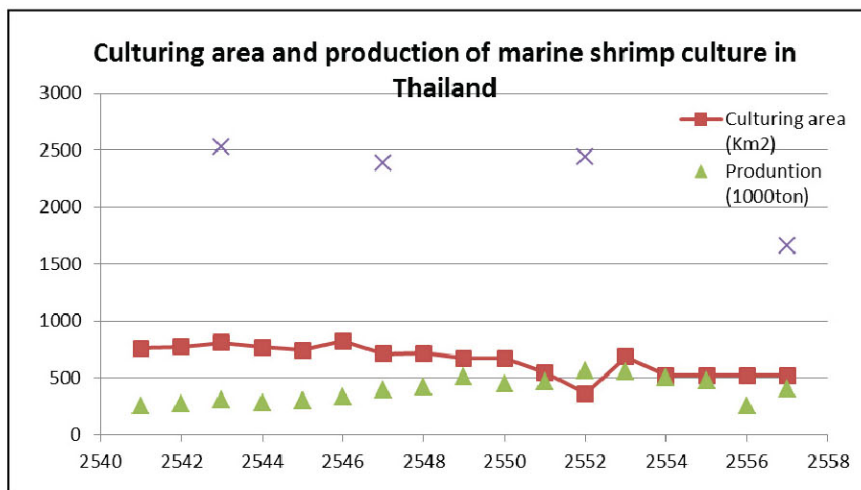


Figure 17: Areas and production of prawn breeding and sea shrimp Comparing with mangrove forest

## Pollution

An urban population increase due to an economic growth, but a quality of ground water continues to decrease. In 2010, Thailand produces 26.78 million tons of garages; this increases from the year 2012. The community water treatment can support only 10% of waste water and fails to cover all areas of large communities. Communities located along rivers release waste water directly to the river. The method of refuse disposal covers only 11.5% of all municipalities across the country. The municipalities can collect the garbage only 54% of their area and eventually remaining garbage will contaminate water sources and the sea.

In 2013, Department of Marine and Coastal Resources collect more than 12 tons of the garbage from the sea. These wastes are from coastal activities and recreation and can be divided into 7,000 pieces of plastic and 12% is the cigarette. Only in July 2014, the department collects more than 4 tons of wastes in 60 kilometers in Khor Lanta, Krabi Province, Patong Beach, Phuket, Pattaya Beach and Bangsaen Beach in Chonburi. The wastes, especially a plastic, accumulate exceedingly in these coastal lines and encroach on the areas where endangered animals live and breed as well as affect their food chain and are risky to become extinct.

The boat containing 2,400 tons of brown sugar submerged in Chao Phraya River at Phu Khao Thong Sub-district, Phu Khao Thong District, and Ayutthaya Province on 31 May 2011. Department of Fisheries concluded that more than 60 species of fishes in the river were seized to sell for at least 50 - 60 tons. In the first five days, more than 20 tons of fishes were killed because of a lower level of oxygen in water in the submerged sited and 12 kilometers down the river. The level of sugar increased from a normal rate at 1.1 - 2.5 milligrams per liter to 5 milligrams per liter. All fishes in conservation areas in more than 50 temples died. Four Himantura chaophraya fishes which lived on the river ground and were endangered to become extinct were found dearth. The size of fishes was larger than 3 meters in width and 6 meters in length and its weight was more than 300 kilograms. Moreover, many rare and endangered fishes, such as barbus orphoides, sheatfish, common sheatfish, freshwater silver perch, siamensis pangasius, pangasius conchophilus, pangasius elongatus, red fish, and great white sheatfish are under a risk of becoming extinct and a concern is raising regarding male and female breeders of fishes in the nature.



*Crude oil leaked from an oil tanker at Ao Prao Beach, Koh Samet, Rayong Province (30 July 2013)*

On 8 January 2014, a crude oil leaked into the sea in Bualuang Source, Petroleum Exploration Oil Field No. B8/38, which was located near Koh Tao in the west of the Gulf of Thailand. The site is 110 kilometers from a mouth of Chumphon River. The area is responsible by Salamander Energy (Bualuang). The oil spill moved to the south. The longest location that an oil spill was found is 6.4 kilometers from the location of the floating offloading ship. The company responded with international standard emergency responsive plan of petroleum industry for crude oil leakage by using buoys to protect oil from expanding and spraying chemicals to destroy oil - the said chemical is called COREXIT 9527A, which is the high effective chemical and is allowed by Pollution Control Department to destroy oil stain. In addition, Department of Mineral Fuels ordered to collect water sample and sea sediment in order to follow up and monitor an impact with environment.

On 8 March 2014, a substance which is similar to a coal tar was found on Bang Ma Praw Beach, Lang Suan District, Chumphon, covering an area of 5 kilometers from the coast. After cleaning the beach, the said substance was sent to check and expected that it will come from oil drilling rigs nearby. In addition, similar substance was also found on nearby beaches.

In the territorial water of Thailand, hundreds of oil drilling rigs are located. Its operation may affect environment and nature. For example, fishermen found out that PTT Chemical Co., Ltd's Rig Cosl Power Drilling Rig released a liquid into the sea. This incident caused a concern of people living nearby because the area is where mackerel fishes - one of the most important fishes of the country - lay their eggs and the fishery is prohibited by Department of Fisheries. The area is located near Angthong Islands National Marine Park, Surat Thani Province.

Invasion of Alien Species. More than 3,500 alien species were imported into the country. Among these, at least 81 species invaded into the ecology, causing it to loss its diversities. The ecology that losses its diversity the most is the earth. The agriculture ecology was invaded by alien plants and it's important to economy and health of consumers.

The ecology system in swamps is full of *Minosa pigra*. In rivers and canals, *Eichornia crassipes* and *Salvinia cucullata* are commonly found and expand to cover a large area that is equal to a football field.

- *Minosa pigra* grows and expands rapidly, on the same rate when it grows on plains, marshes, swamps, and wet area from a sea level to 1200 meters above a sea level. It's mostly found in the North, the Northeast and the Central. *Minosa pigra* produces a large number of seed every year, its ripened seeds can travel along the river, especially during the flood, making it spread in the wider area. *Minosa pigra* can grow anywhere, has a lot of thorns, and grows rapidly in a dense group. Water birds and small animals cannot live or lay eggs and people also cannot use the water source. *Minosa pigra*, once it grows densely, will prevent the light to reach plants along the river, such as Umbrella Plant and grass, etc. These plants will not grow and die eventually. The area will also change from marshes to the land and eventually will be occupied by the landlord.

- *Eichornia crassipes* expands widely in Chao Phaya River and Thachin River where it receives waste water from agriculture area, communities, fish pond, and pig farm. This water contains a lot of nutrients and it makes *eichornia crassipes* growing faster. In addition, Thachin River has a lot of bridges and foundation pillars blocks a flow of *eichornia crassipes*. After *eichornia crassipes* accumulate more and more, it will blocks water transportation, makes it impossible for a light to go through water, lowers a quantity of oxygen and aquatic animals, and causes polluted water. People living along the river cannot consume water. Community life styles also continue changing; more and more people turn to use a car and work in factories. The intention in the large river is getting lower and lower.

- *Salvinia cucullata* expands rapidly. Once it covers a water surface, other plants, such as *Ruellia tuberosa* and *Rubiaceae*, etc. will not be able to expand. It also causes a decrease of aquatic animals.

- *Hypostomus plecostomus* – sucker catfish breed rapidly in rivers and water sources and its number increases dramatically. This fish eats eggs and small fishes; it causes lowing a number of other fishes and destroys an ecology system.

Agroecosystem. The rice farm in the northeast and the central was severely invaded by the golden apple snail. The coconut farm in the south decreased continuously due to coconut black-head caterpillar and coconut hispine beetles.

- *Pomacea canaliculata*, *Pomacea insularum* – golden apple snail was first imported into the country in 2005 as a food and a decoration in the fish tank. It was found in an environment and starts to spread in 1995. The golden apple snails lay 260 eggs every 7 – 10 days. Currently, the golden apple snails spread across the country and 10,000 – 20,000 apple snails can destroy 1 rai of rice within one night. After the spread of the golden apple snails, other types of snails are gradually less and less found because the golden apple snails also eat small animals and snails. The spread of golden apple snails, therefore, are risky for an existing of other local snail species.



- *Opisina arenosella* - coconut black-head caterpillar starts spreading severely during 2010 – 2012, covering an area in 12 provinces, especially in Prachuap Khiri Khan. This caterpillars destroy coconut production by eating coconut's leaf and trunk and damaging coconut trunk in 10 provinces with an area of 68,750 rai as well as Asian Palmyra palm, Java Palm, Foxtail palm, and MacArthur's plam. *Brontispa longissima* – coconut hispine beetles start spreading in 2011 and this beetles eat young top of coconut and cause a lower of production.

- Currently, many foreign species are found in Thailand. It expects that they come with foreign plants, adjust themselves with our environment and spread rapidly. They cause a large scale of impacts. For example, *Phenacoccus manihoti* – pink mealy bugs eat a top of plant and can lay 300 – 500 eggs without reproduction and its life cycle is only 18 days.

Mountain Ecosystem was invaded by Mexican sunflowers and the festival was held every year while croton weeds grow along with seasonal plants.

- *Ageratina adenophora* – croton weeds spread widely in the northern highland; it is found in an environment with the sea level from 500 – 600 meters and it is not found in the low land. The croton weeds grow densely, making it hard for other plants to grow. Its leaf and trunk also contains a chemical which can suspend a growing rate of other plants. It is also commonly found along roads, grove woods and rivers.

- *Tithonia diversitohia* – Mexican sunflowers spread and cove entire mountains, such as in Doi Maeukor in Mae Hong Son. The Mexican sunflower can sustain a growing of other plants and destroy local plants. The old ecology system is destroyed along with wild animals. The Mexican sunflowers can promote tourism but it also found that more and more community forests are destroyed in order to expand the Mexican sunflowers

- *Leucaena leucocephala* can expand into the national part for 150 meters, especially in the dry evergreen forest. *Leucaena leucocephala* expands in the area which one side is closed to the village and one side is closed to the national forest and where it was once affected by a forest fire. *Leucaena leucocephala* cannot expand into the pin forest because the pin forest is covered with the tree. It also cannot expand into the dry dipterocarp forest which located in the different area. Based on the study of Department of National Parks, Wildlife and Plant Conservation, it found that *Leucaena leucocephala* grows as a group and can prevent a growing and an expending of other plants in the said area; a good management can lower a spreading of *Leucaena leucocephala*.

## Forest Ecosystem

- Department of National Parks, Wildlife and Plant Conservation, according to the research during 2008 to 2011, reported that in Kaeng Krachan forest, 294 species of foreign plants were found and 110 species were reported invading. The most top ten invading species are included *Chromolaena odoratum*, *Praxelis clematidea*, *Leucaena leucocephala*, *Synedrella nodiflora*, *Panicum maximum*, *Pennisetum polystachyon*, *Mimosa pudica*, *Lantana camara*, *Aeschynomene Americana* and *Passiflora foetida*. It is mostly found in an open area along the water reservoir, roads, agriculture area, denuded forest, forest plantation, and natural forest, both mixed forest and dry evergreen forest, as well as along rivers and under trees.

## Marine and Coastal Ecosystem

- *Mytilopsis sallei*. The embryo of *Mytilopsis sallei* is expected to come with water tanks or boats. It was first found in La Kune Beach, near Songkhla port. This type of shell can stand for different levels of salinity (from fresh water to sea water) and temperature as well as pollutions and it can easily adjust with new environment. One *Mytilopsis sallei* can lay more than one million eggs; its veliger larva can travel with water and attach with all types of materials under water. It can multiply its population quickly and densely, and lower a level of oxygen in water. In an economic aspect, *Mytilopsis sallei* can attach with boats and floating basket – lowering a flow of water and efficiency of fishing tools. The fisherman is needed to waste money for employing the labor to change the floating market. *Mytilopsis sallei* can grow in a narrow area and this can block water pipe and gutter in the future. Currently, *Mytilopsis sallei* can be found in a large area, covering Songkhla Lake river basin, Songkhla Province and Pak Panang river basin in Nakhon Si Thammarat Province.

- *Litopenaeus vannamei* – Pacific white shrimp is imported to be a food in coastal provinces. The shrimp is a carrier of White Spot Syndrome, Taura Syndrome and Yellow Head Syndrome and can transmit to Tiger prawn and Giant malaysian prawn which are local species. Chulalongkorn University worked with Chachoengsao Coastal Fisheries Research and Development Center to study a pacific while shrimp and it found that the white shrimp in the nature can create its own reproduction cells and eat the same food as local species.

## Climate Change Threat

The change of weather atmosphere in 1991, 1995 and 1998 caused a severe coral reef bleaching in Andaman Sea. During 1997 – 1998, ENSO (El Niño and La Niña) caused another incident of severe coral reef bleaching in the gulf of Thailand. In some area, the coral reef was affected more than 60% and it still continues to expand until now.

In 2010, Department of Marine and Coastal Resources surveyed a coral reef bleaching in Thailand's water; it found that the coral reef bleaching was caused by an increasing of water temperature (a normal temperature is between 28 – 29 degree Celsius). The study found that water temperature was higher than 30 degree Celsius since 20 March 2010. The water temperature was 31 degree Celsius on the last April (The temperature that initiates the coral reef bleaching is 30.1 degree Celsius.).

If the coral reef is under a temperature which is higher than 30.1 degree Celsius more than 3 continuous weeks, the coral reef bleaching will happen – this happened in the third week of April in Thailand. Besides Thailand, the coral reef bleaching was also found in India, Sri Lanka, Maldives, Sesel, Myanmar, Malaysia and Indonesia.

According to the data survey in Thailand, it found that the coral reef bleaching occurs in all provinces in Andaman Sea. After the coral reef bleaching, 70% of the coral reef can survive and after one month, 40 -50% of the coral reef will die, depending on each location. In the gulf of Thailand, the coral reef bleaching is severe, the same as in Andaman Sea. The coral reef bleaching is largely found in the upper part of Chonburi (Koh Sichang, Koh Nok, Koh Krok, Koh Jun) than other parts of the sea.

In Similan National Park, eight stations found that 25% of Nam Chai Bay was affected by the coral reef bleaching. In Surin Island National Park 10 stations found that 30 – 50% of both northern surin and southern surin island was affected by the coral reef bleaching. Outside the national park, the coral reef bleaching was found in 70% of diving areas in both Pangnga and Phuket. In the gulf of Thailand, the study surveyed Koh Chang in Trat province, Koh Samet in Rayong province, Khanom Sea in Nakhon Si Thammarat and found the coral reef bleaching but the situation does not severe. In Chumphon National Park, it found the coral reef bleaching for 70 – 80%.

## Impact

The loss of biological diversity affects lifestyle, well-being, and food security of Thai people. It also leads to the loss of a beauty of nature, people's happiness and tourism; this includes a balance of the nature. When there is a disaster, destroyed ecology system cannot withstand and its consequence is hard to anticipate.

## Ecosystem Loss

The invasion by alien spices severely affects aquatic ecosystem plus an intrusion into the land near swamps for the benefit of development or poverty as well as a climate change. This will eventually affect a lifestyle of communities as the example in Nong Lom Swamp and Beung Ka Loh; it also can happen in other swamps in the country.

Nong Lom Swamp in Mae Chan District, Chiang Rai, originally was a swamp and a low plain in Chiang Saen District. The original area was 30,000 rai but now leaves only 15,000 rai. The swamp was intruded by private sectors for agriculture because they thought the land has no ownership in the last 30 years. The invasion blocked water ways and the giant Mimosa pudica, which came with animals, cloth, vehicle and agriculture equipment, started to spread over the area. Its root can penetrate deeply for 2 meters into the land. When no action was made to confine it, it started to spread more and more, covering many thousands rai of the land. The swamp then started to be shallow and a fire occurred more after. The government sector saw that it's an empty land so they allocated to more people and claimed that it complied with Regulation of the Prime Minister regarding a solution for government land intrusion B.E. 2545. The swamp is under a management of 4 Tambon Administrative Offices where their development approach for Nong Lom Swamp is different and lacks of the same vision toward Nong Lom Swamp which consists of complicate ecosystems. Many projects, such as reservoirs, streets, ridges, etc. were implemented without an engagement of communities to make a decision. At the same time, grasslands were changed to rubber tree plantation and swamps were filed up. This led to a change of a lifestyle of communities; people cannot raise animals, public water resources for fishing were damaged, and food production and people's happiness decreased. The nature of swamps was completely destroyed.

Beung Ka Loh is located in Muang District, Uttaradit Province. Its original area was 7,500 rai and it was an area to bear water from Nan River. Later, it was blocked by two main highways from the north and the west of the swamp, causing less and less water to pass into the area. The swamp started to be shallow and weeds, such as Typha angustifolia Linn, started to spread around the swamp. In 2011, a huge fire engulfed the entire swamp. After that more and more government

sectors moved in to use the land and constructed buildings by educational institutes. More than 2,000 rai of the land were occupied. Therefore, during the flood season, the river cannot support an amount of water and submerge thousands rai of rice fields and nearby areas. Many organizations tried to unearth the swamp but it was made randomly. The ridges were created in the swamp and caused a spread of alien species and finally made it impossible for fishery. In the last 30 - 40 years, Beung Ka Loh was a huge marsh and was full of water birds, communities used the boat to fish and collect lotus stems; their original lifestyle connected closely with the nature.

## Loss of Ecosystem Resilience

One role of the ecosystem is to ease impacts from the nature, whether it is caused by climate change, flood, storm, and tsunami. The deforestation, intrusion of swamp, river, water ways and drainage basin, releasing of waste water from houses, industries, hotels and tourism, wastes from fishing boats, over-fishing, and illegal collecting of corals, turtle's eggs, etc. lead to the loss of ecosystems' resilience, making it risky to be destroyed from the climate change.

The great flood in October 2011 inundated the central region which is residence area, agriculture area and industry area. The flood covered a large and its impact to economy and society was severe. The flood was caused by La Niña which led to more rain amount - lots higher than an average. Each storm brought a lot of rain water and it is too much for dams to support. The giant dams on the upper part of the county need to release large amount of water. This combines with the last storm in the central and in the east. However, the real reason of the flood is management of organizations concerned; each has different systems to distribute water during the dry season and to release water during the rainy season. They ignore to maintain natural water resources, such as river, stream, swamp, marsh, and other drainage basins which are blocked by houses, villages, factories, and government offices. The river itself is jammed by houses along with the river. Therefore the large amount of water flows into people's houses because natural protection lines are destroyed. The flood damaged 12.60 millions rai. The damage covers to local plants and local animal species. For example, the durian, frogs and other special plants in Nonthaburi, and pomelo of Nakorn Chaisri were inundated for more than 2 weeks, died and were under a risk to become extinct.

During the flood, there was report that many alien species, such as alligator gar, arapaima, cichlid, fancy carp, and crocodiles which were raised by individuals were found in rivers. These species mostly are large and eat other species as a food. After they slip out into environment, they will compete with local species and will decrease an amount of local species.

Besides the impact found in fresh water, the large amount of water affects aquatic animals in coastal areas. The structure of benthic animals was changed; their amount decreased substantially during the flood and started to recover after the water mass passed. The outstanding benthic animals after the flood are earthworms; their present is 50 times after anormal period in the last year. It also found that rare animals, such as Bryde's whale etc., change their evacuation route. When the freshwater concentration decreases, the whale follows aquatic animals in the deep sea. In addition, the flood affected fishermen; the fresh water causes the death of many economic animals, such as blood cockie, green mussel and oyster.

Marine and coastal ecosystem in Thailand extremely deteriorates. More than 50% of the coral reef is damaged. Currently, more than 60% of the coral reef has a percentage of living coral reef less than 50% because deforestation, land usage, pollution from nutrients and waste water from the river mouth and the coastal area as well as unregulated fishing near the coral reef, tourism, and wastes thrown away into the sea. These problems are not solving until the present. The coral reef also was damaged by a high temperature more than 30 degree Celsius during the end of March 2010. In the next three weeks, the coral reef bleaching created an impact to the large area in Andaman Sea and the Gulf of Thailand. The staghound coral was affected more than massive coral but the entire coral did not die, in some places it may recover if there is no other impact.

The loss of coral reef which is a habitation of many aquatic animals affects fishing industry, tourism industry, economy, local lifestyle, and breakwater.



*Fruit gardeners try to block water from their durian plantation*



*Impact from the flood to durian plantation in Nonthaburi*



*Bryde's whale (*Balaenoptera brydei*) in the gulf of Thailand*

The change of mangrove forest into shrimp farms, the development of coastal area for tourism, and the pollution from industry and communities deteriorate mangrove forests and seagrass. The otter trawl damages seagrass and habitation of dugong dugon, which currently only 150 are left in Andaman Sea. The occupation of the beach by hotels is risky for four species of turtles, including *dermochelys coriacea*, hawksbill turtle, *chelonina mydas* and Olive ridley sea turtle because there is no appropriate place for them to hatch. In the present, there are few places for turtles to hatch and there are only 1,500 bleeders of turtles. The small fishnet is used to catch small fishes and young fishes. More than 60% is destroyed from the mouth of the river to the deep sea; this makes it impossible for young fishes to grow as well as disturb large aquatic animals, such as crocodile, Bryde's whale, Bottlenose dolphin and Irrawaddy dolphin.

The costal ecosystem of Thailand was disturbed from different activities both on land and on water. It can no longer bear impacts from the change of weather atmosphere. Therefore, plants and animals are risky to become extinct. When a temperature of sea water increases, a sea level will increase and storms are more common. These affects Thai economy, which relies largely with fishery and ecotourism.

## Impact to Health and Well-being

The spread of alien plants invades important ecologies, such as rivers, canals, and rice field. The budget is needed to establish to solve an issue, including manpower and machine. The chemicals can solve the problem, but it needs a budget for that and is risky for health as well as is costly.

Water hyacinth spreads quickly in water resources and rivers. It expands and covers water surface and grows from 2 tons to 30 tons within 20 days. It blocks water ways during the flood in 2011. The floodgate blocked by water hyacinth needs a lot of manpower to eliminate. In addition, it needs to excavate more often because the water hyacinth slows down water flow for 40%, blocks water transportation, and damage scenery. Moreover, it leads to a decrease of aquatic animals and a source of disease carriers, such as a mosquito. It is very costly to destroy water hyacinth in one year. For example, it needs a marsh dragline; one dragline is 2 million baht plus an expense for its operation for 2,000 baht per rai. The invented boat to destroy water hyacinth is worth 13 million baht. If it uses a chemical, the water hyacinth harvester is needed to import from abroad. The chemicals like Chlorophenoxy glyphosate: N- (phosphonomethyl glycine) and Bipyridyl need to be imported but it is dangerous to other plants in the same water source, such as lotus, rice, morning glory, and water mimosa as well as to aquatic animals.

## The spread of golden apple snail in rice field

The spread has been occurring since 1988 till the present. The apple snails come with water pumped by farmers into a rice field when rice starts to sprout. The apple snails are more found more than during transplanting period. It found that 12,800 snails can eat one rai of rice in only one night; this lowers half of paddy production. The apple snails also exploit other local species of snails, such as freshwater snails, big apple snail, etc. Farmers prevent golden apple snails by using a cloth to filter water, or collecting with their own hand; some apple snails are cooked and sold, some are used as animal feed. Some farmers release ducks into a rice farm to eat apple snails. In fact, *Anastomus oscitans* – Asian openbilled stork is a natural enemy of apple snails, however, after a large number of *Anastomus oscitans* – Asian openbilled stork dies from flu during 2004 - 2005, a population of *Anastomus oscitans* – Asian openbilled stork in Thailand dramatically decreases.

The apple snails can be destroyed with chemicals, but those chemicals need to be imported from abroad and affect other aquatic animals, frogs, small green frogs and snakes as well as other plants. The chemicals also remain to contaminate in earth and are dangerous with a health of consumers. Even if Endofan is prohibited from importing, farmers still continue using other types of chemicals to destroy apple snails.

# Chapter 3

## ***Review of Success of the National Policy, Strategies and Action Plan on the Conservation and Sustainable Use of Biodiversity 2008 – 2012***

According to Article 16 of the Convention on Biological Diversity (CBD), Thailand has developed the national strategies and action plan on the conservation and sustainable use of Biodiversity since 1998. Such policies and action plan, namely, the National Policies, Strategies and Action Plan on the Conservation and Sustainable Use of Biodiversity (NBSAP), has been developed for three periods which are NBSAP 1 for years 1998 – 2002, NBSAP 2 for years 2003 – 2007, and this recent NBSAP 3 for years 2008 – 2012. Thailand has shown its commitment to implement the policies, measures and various plans even before becoming the Convention's contracting party.

### ■ **Vision, Objectives and Main Targets**

The vision of the NBSAP is, Thailand, becomes one of the world's leaders in the conservation and sustainable use of biological diversity, in addition to developing progress in education and research on biological diversity. The objectives are to strengthen biological integrity such that it becomes the secured base for the living of Thai people, in parallel to support research on sustainable biodiversity economic value. The objective also includes development of mechanism on fair and equal access and benefit sharing of biodiversity.

The main target of the Plan is to significant decrease biological diversity losses; while ecosystems, species and genetic resources can be maintained and concerned biological diversity components are sustainably protected.

### ■ **Strategies, Action Plans and Measures**

#### **Strategy 1 – Protection of Biological Diversity Components**

Its 4 action plans and 12 measures are the following.

##### ***Action Plan on Ecosystem Conservation***

- Conserve marine, coastal and island ecosystems.
- Protect wetlands ecosystem and promote its sustainable use.
- Strengthen protected areas.
- Rehabilitate ecosystems to return nature to the nation.
- Conserve, protect and prevent forest ecosystem.
- Conserve and rehabilitate watersheds.
- Conserve mangrove forests and restore aquatic animals abundance.

##### ***Action Plan on Species Protection and Restoration***

- Protect and restore endemic species and threatened species.
- Conserve and restore rare and threatened wildlife population in the protected areas.

##### ***Action Plan on Species/Germplasm Conservation***

- Conserve diversity of germplasm, microorganisms, insect and mite pests.
- Decrease losses of biological diversity related to livestock.

##### ***Action Plan on Global Strategy for Plant Conservation***

- Implement the Global Strategy for Plant Conservation (GSPC).

#### **Strategy 2 – Encourage Sustainable Use of Biological Diversity**

Its 3 action plans and 5 measures are the following.

##### ***Action Plan on Development and Sustainable Use of Biological Diversity***

- Promote the development of biological resources of commercial use.
- Create incentives for conservation and sustainable use of biodiversity.
- Develop forest resources for economic use and alternative energy.

##### ***Action Plan on Preservation of Traditional Knowledge Associated with Biological Diversity***

- Protect and preserve traditional knowledge associated with the conservation and sustainable use of biological diversity.

***Action Plan on Access and Benefit Sharing***

- Facilitate access and fair and equitable sharing of benefits of the use of biological resources.

**Strategy 3 – Minimize Threat to Biological Diversity**

Its 4 action plans and 5 measures are the following.

***Action Plan on Minimizing Impacts on Biological Diversity***

- Minimize losses of ecosystem and natural habitat as the result of developmental projects.
- Control and minimize impact on biological diversity from tourism activities.

***Action Plan on Climate Change Impact Mitigation***

- Study the changes in biological diversity components resulting from climate change and develop measures on climate change mitigation.

***Action Plan on Invasive Alien Species***

- Control threats from invasive alien species.

***Action Plan on Biosafety***

- Control and prevent impacts from modern biotechnology to biological diversity.

**Strategy 4 – Promote Research, Training, Education and Public Awareness and Network on Biological Diversity**

Its 3 action plans and 11 measures are the following.

***Action Plan on Research and Inventory of Biological Diversity in Thailand***

- Develop national policy and guidelines or workplans on biological diversity researches.
- Allocate fund for continuous biological diversity researches and training.
- Place first priority to biological diversity study and inventory.
- Survey, research and compile data on living organisms genetic.

***Action Plan on Global Taxonomy Initiative (GTI)***

- Implement the Global Taxonomy Initiative.

***Action Plan on Promotion of Knowledge and Public Awareness on Biological Diversity***

- Develop and implement formal and/or informal education curriculum to promote learning process and knowledge on biological diversity.
- Create partnership with business sector to implement on-going activities in awareness raising campaign and promote their participation in conservation and sustainable use biological diversity.
- Promote collaboration between government and NGOs in biological diversity educating and awareness raising to local communities.
- Manage the forest to facilitate recreational activities and education on nature.
- Allocate fund to support NGOs, local institutions and communities in implementing education and awareness campaign on biological diversity.
- Promote ecosystem assessment to support local communities and NGOs in the conservation and sustainable use planning.

**Strategy 5 – Strengthen National Capacity for Implementing Biological Diversity-related International Agreements**

Its 3 action plans and 6 measures are the following.

***Action Plan on Capacity Building for the Implementation on CBD***

- Establish a committee on biological diversity in concerned agencies to ensure its relevant implementation complies with those of the national committee.
- Promote implementation on biological diversity and unity among conventions related to biological diversity.

***Action Plan on Implementation Toward 2010 Targets***

- Implement activities toward 2010 biodiversity targets.

***Action Plan on Biological Diversity Information Dissemination***

- Establish the Clearing House Mechanism on biological diversity and maintain biological diversity information networks.
- Establish and maintain the Biosafety Clearing House (BCH).
- Promote technology transfer and cooperation.

## Implementation Result Indicators

Information on the implementation results are gathered from concerned agencies, covers 21 indicator listed in the NBSAP 2008 – 2012. Other information are from related documents. The results can be summarized, indicator by indicator, as follow.

● **Forest areas cover at least 33 percent of the country's total areas, which at least 18 percent are conserved forests.**

This indicator reflects the effectiveness of efforts to protect biological diversity with regards to ecosystem conservation. This indicator is achieved, that is, the area of forest 33.56 percent, which out of that, 20.02 percent is the protected areas.

**Forest areas** of Thailand in 2006 is 158,652.59 square kilometer or 30.92 percent of the nation total area. In 2009 it is reported that the forest area is 172,184.29 square kilometer or 33.56 percent. The area in 2012 is being investigated by the Royal Forest Department.

The reason the forest area slightly increased is because of various projects/activities are implemented on reforestation and forest rehabilitation, while there are activities on conservation and protection of forest ecosystem such as awareness raising and promotion of public participation, and establishment of forest protection networks through the Volunteer to Protect Forests Project. The continuous project implementation has been resulted in public awareness on forest value, and create ownership mind of the people. The result also included a better attitude on forest resource conservation and protection. In addition, strict monitoring and arrest and punishment have been enforced on forest encroachment cases, both in the preserved and protected forest areas.

The Royal Forest Department has annually implemented forest rehabilitation projects during the period of 2008 – 2010. The average rehabilitated forest area is approximately 100,000 rai compared to 22,225 rai in 2007. There is also projects on promotion of reforestation among the public agencies and the public.

The Department of National Parks, Wildlife and Plant Conservation does not only implement projects and activities on forest conservation and rehabilitation, and protection of protected forest encroachment. Other projects involved distributing seedlings to the public so they can plant them in the protected areas nationwide.

Other government agencies, private sector, educational institutes, and local communities also play important role in forest conservation. For example, the Project on Love Water for The Royal Mother of the Nation Phase 1 (2008 – 2011) implemented by the Ministry of Agriculture and Cooperatives, the Commemorative Project on Plant Seedling to Support Watershed for the Royal Father by the Electricity Generating Authority of Thailand, the Project on Love Forest to Strengthen Residents Capacity in 84 sub-districts by the PTT Public Company Limited., various projects to create awareness among youths on environmental conservation by private sector such as the Project on Youth Camp on Environmental Awareness implemented by the Siam Cement Group Public Company, and Reforestation activities of Toyota Motors Thailand with the goal of 1 million trees planted by 2012.

In addition there are reforestation activities on the nation's important days by the government agencies, educational institutes, public companies, networks and communities.

**Protected Area** Means the conserved areas under the responsibility of the National Parks, Wildlife and Plant Conservation Department. Seven categories of the protected areas are national park, forest park, wildlife sanctuary, non-hunting area, botanical garden and arboretum.

In 2007 there were 400 protected forests in Thailand with the total area of 96,031.94 square kilometers, or 18.72 percent of the total area. In 2008 – 2011, 21 more areas are put the list. The information on 2011 indicate Thailand has 421 protected areas, with the total area of 102,719.90 square kilometers or 20.02 percent of the total country areas. Approximately 6,687.96 square kilometers increased from year 2007.

In addition, the National Parks, Wildlife and Plant Conservation Department has carried out a project on ecosystem rehabilitation and a project on conservation and reforestation to restore the watersheds in the protected areas nationwide.



**Table 9: Forest and protected areas, 2006 - 2011**

Year	Forest area <sup>1</sup>		Protected area <sup>2</sup>	
	Square kilometer	% of total land area	Square kilometer	% of total land area
2006	158,652.59	30.92	94,256.05	18.37
2008	171,585.65	33.44	98,268.00	19.15
2009	172,184.29	33.56	102,636.30	20.00
2010	n.a.*	n.a.*	103,809.92	20.23
2011	n.a.*	n.a.*	102,719.90	20.02

**Source :** *The Royal Forest Department, the National Parks, Wildlife and Plant Conservation Department*

**Note :** 1 *Forest information on 2006 and 2008 compiled by the Royal Forest Department forest information on 2009 compiled by the National Parks, Wildlife and Plant Conservation Department*

2 *Information on protected area, compiled by the National Parks, Wildlife and Plant Conservation Department*

\* *n.a. means no data*

● **At least 20 percent of marines and coastal areas in Thai waters have been designated as protected areas.**

This indicator reflects the efforts to protect of biological diversity components in the marine and coastal ecosystem aspects. The achievement is not clearly identified since current information cannot be compiled while there are problems of overlapped areas. It is however projected that more protected areas will be declared.

The marine and coastal protected areas include aquatic animal and plants protected area, wildlife non-hunting area, marine national park, mangrove forest, coral reefs, seagrass beds, area where fishery measures is enacted and environmental protection area.

The Department of Fisheries has declared, by the power of the Fishery Act 1947, 11 Ministry of Agriculture and Cooperatives notifications on areas where fishery measures is enacted, cover areas in 14 provinces i.e. Rayong, Narathiwat, Pattani, Satun, Phetchaburi, Phuket, Phang-Nga, Krabi, Trang, Nakon Si Thammarat, Samut Sakhon, Chantaburi, Chumphon and Prachuap Khiri Khan.

The National Parks, Wildlife and Plant Conservation Department has declared areas as national park since 1966 and up to 2007, Thailand has 21 marine national parks with a total area of 5,810.23 square kilometers. During 2008 – 2012 only one more national park was declared in 2009, that is Ranong Islands National Park with an area of 356.70 square kilometers. The total number of national park is then 22 with total area of 6,166.93 square kilometer. Three areas with the combined area of 419.97 square kilometers will be declared as national parks, i.e. Tan Sadej – Pangan Island in Surat Thani province, Had Kanom – South Sea Islands in Surat Thani and Nakon Si Thammarat provinces, and Ao Manao – Khao Tanyong in Narathiwat province.

Under Articles 43 and 45 of the Enhancement and Conservation of National Environmental Quality Act B.E.2535 (1992), the Office of Natural Resources and Environmental Policy and Planning has declared environmental protection areas in various parts of the country. In 2008 – 2012 nine environmental protection areas were declared in coastal provinces of the country, i.e. 1) Pattaya, Chonburi province (areas of Koh Sak, Kho Lan, Koh Krok and 3-kilometers waters around those islands), 2) Phuket province (areas of Phuket island and other islands of Phuket province, and 3-kilometers waters around the islands), 3) Krabi province (areas of Yoong, Mai Pai, Pi Pi Don, Pi Pi Le and Bida islands and 3 kilometers waters around the islands), 4) coastal areas from Bang Ta Boon sub-district, Ban Laem district, Phetchaburi province to Pak Nam Pran sub-district, Pranburi district, Prachuap Khiri Khan province (including areas of 3,000-meters from the coastal line), 5) Bang Lamung district, Sattahip district, Chonburi province, 6) disaster areas of Krabi, Trang, Phang-Nga, Phuket, Ranong

and Satun provinces (including sub-districts on the coastal zones of 6 provinces and areas of islands), 7) areas of Ao Luk, Nua Khlong, Khlong Tom and Lanta districts of Krabi province, 8) areas of Kuraburi, Takuapa, Tai Muang, Tab Pood, Muang Phang-Nga, Takuatung and Yao districts of Phang-Nga province (including coastal zones and islands within 3-kilometers of each district) and 9) Krabi province (some areas of Ao Nang, Nong Tale and Pak Nam sub-districts of Muang Krabi district).

In addition, the Office of Natural Resources and Environmental Policy and Planning has renewed the expired environmental protection areas by issuing three 5-years term notifications in 2010 on the following areas 1) areas of Bang Lamung and Sattahip districts of Chonburi province, 2) area in Phuket province, 3) Ban Laem, Muang Petchburi, Tha Yang, and Cha-am districts of Phetchaburi province, and Hua Hin and Pranburi districts of Prachuab Khiri Khan province. The total number of the environmental protection areas is then increased.

At present there are 5 areas being reviewed for declaring as the environmental protection areas, i.e. 1) Koh Samui and Koh Phangan districts, Surat Thani province, 2) Ao Luk, Muang Krabi, Nua Khlong, Khlong Tom and Koh Lanta districts, Krabi province, 3) Kuraburi, Takuapa, Taimuang, Tub Pood, Muang Phang-Nga, Takuatung, and Koh Yao districts, Phang-Nga province, 4) coastal area of Patiew district, Chumphon province and 5) Don Hoi Lod wetland, Samut Songkhram province.

**Table 10:** Number and area of notified marine and coastal zones and protected areas

Type of areas	2012	
	Number	Area (sq. km.)
Aquatic animal and plants protected area	223	n.a.
non-hunting area	9	777.47
national park	26	6,927.75
mangrove (number of provinces)	24 <sup>3</sup>	3,680
coral reefs	-	205.21 <sup>1</sup>
seagrass beds	-	189.86 <sup>1</sup>
areas where fishery measures is enacted	25	50,814.94
environmental protection area	6	9,499.27
total	313	72,094.5

- **At least one site of seagrass beds and dugong habitats has been designated as protected area.**

This indicator reflects efforts on protection of biological diversity components. The targets of conservation of marine and coastal, and island ecosystems have not been achieved yet. One of the reason is because during 2008 – 2012, no area has been notified as the protected areas for seagrass beds and dugong.

Seagrass beds can be found in 19 coastal provinces of Thailand. The total area is 160.582 square kilometers. The areas of the provinces on the Gulf of Thailand is 53.151 square kilometers, in Chonburi, Rayong, Chantaburi, Phetchaburi, Prachuap Khiri Khan, Chumphon, Surat Thani, Nakon Si Thammarat, Phattalung, Songkhla, Pattani and Narathiwat. The areas of 107.431 square kilometers are found in 6 provinces on the Andaman Sea, which are Ranong, Phang-Nga, Phuket, Krabi, Trang and Satun. The largest seagrass beds is in Trang province.

Seagrass beds is the habitat of dugong, the critically endangered species listed in the Thailand Red Data (2005). Dugong is also the reserved animal as stated in the Preserved Animal Act 1992. It is also listed in the Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

In 1992, five seagrass beds in Trang province was notified by Article 32 of the Fishery Act 1947 as the protected area. It is one of the efforts to protect seagrass beds and dugong.

As the result of enactment of the National Parks Act 1961 with the establishment of the marine national parks, the seagrass beds and dugong within the national parks are also protected. During 2008 – 2012, the National Parks, Wildlife and Plant Conservation Department has notified one more marine park, that is, the Ranong Islands National Park, with the area of 356.70 square kilometers. The number of marine national parks is then totaled 22 with the area of 6,166.93 square kilometers.

In 2008 – 2012, there are nine environmental protection areas in the coastal provinces, therefore seagrass beds and dugong in those areas are also protected under the measures specified for each province.

Even though the Department of Marine and Coastal Resources has developed a Strategic and Action Plans on Seagrass Beds and Dugong Management in 2008, Thailand, under the Bonn Convention on Conservation of Migratory Species of Wild Animal, has signed on 30 June 2011, the Memorandum of Understanding on The Conservation and Management of Dugongs (*Dugong dugon*) and Their Habitats Through Their Range, with the United Nations Environment Programme (UNEP). However, during the period of 2008 - 2012 there is no additional notifications issued for seagrass beds and dugong.

- **At least five sites of wetlands of international importance have been designated as Ramsar site.**

This indicator reflects the efforts in the conservation of biological diversity component, the ecosystem. The indicator is not fully achieved since during 2008 - 2012 not five but only two wetlands, wetlands of Khao Sam Roi Yot National Park in Prachuab Khiri Khan province and wetlands of Kud Ting in Bueng Kan province have been included in the List of Wetlands of International Importance or Ramsar Site No. 1734 on 14 January 2008 and No. 1926 on 19 June 2009, respectively.

Since 1998 – 2007, ten Thailand's wetlands have been included in the List of Wetlands of International Importance, or Ramsar site). They are 1) Phru Kuhan Khi Sian in Thale Noi non-hunting area, Phattalung province, 2) wetlands of Bung Khong Long non-hunting area, Nong Khai province, 3) Don Hoi Lot wetlands, Samut Songkhram province, 4) Wetlands of Krabi River Estuary, Krabi province, 5) wetlands of Nong Bong kari non-hunting area, Chiang Rai province, 6) wetlands of the Princess Sirindhorn wildlife sanctuary (Phru To Daeng), Narathiwat province, 7) wetlands of Had Chao Mai National Park – Libong islands non-hunting area – Trang river estuary, Trang province, 8) wetlands of Larm Son National Park – Kapoe estuary – Kra Buri river estuary, Ranong province, 9) wetlands of Ang Thong islands National Park, Surat Thani province and 10) wetlands of Phang-Nga National Park, Phang-Nga province.

During 2008 - 2012 two more wetlands, wetlands of Khao Sam Roi Yot National Park in Prachuab Khiri Khan province and wetlands of Kud Ting in Bueng Kan province have been listed as the Ramsar Site.

The Cabinet on 3 November 2009 endorsed Thailand proposal to nominate two wetlands as the Ramsar Site. They are wetland of Koh Kra in Nakon Si Thammarat province and wetlands of Koh Ra – Koh Phrathong in Phang-Nga province. The process of nomination took quite a long period of time since in practice, the provincial administration needed to approve the nomination and hold a public hearing, in addition to study, survey and draft the details of the nominated areas as indicated in the Ramsar Information Sheet (RIS). Those two sites however have been successfully included on August, 2013 in the List of Wetlands of International Importance No. 2152 and 2153, respectively.

- **Increase of 50,000 rai (approx. 19,768 acres) of mangrove forest areas.**

This indicator shows effort in the protection of biological diversity components – ecosystem conservation. The indicator has been achieved. The most recent information on 2009 shows 66,886.02 rai of mangrove forest area increases, comparing to the area in 2004.

Mangrove forest can be found in 24 coastal provinces, i.e. Bangkok, Prachuab Khiri Khan, Phetchaburi, Samut Prakan, Samut Songkhram, Samut Sakhon, Chantaburi, Chachoengsao, Chonburi, Trat, Rayong, Krabi, Chumphon, Trang, Nakon Si Thammarat, Narathiwat, Pattani, Phang-Nga, Phattalung, Phuket, Ranong, Songkhla, Satun, and Surat Thani. In 2009, the country's forest area is 1,525,060.56 rai which is 66,886.02 rai increases from 2004.

The Department of Marine and Coastal Resources has developed the National Strategy on Mangrove Resources Management 2008. The Strategy has identified measures on the prevention of forest encroachment, rehabilitation of the forest and its biological diversity, and promotion and support of private sector to carry out reforestation activity.

In addition, there are projects/activities on sustainable management of mangrove forest with public participation, such as establishment of mangrove forest conservation networks, and marine and coastal zone conservation networks.

Training on marine and coastal resources conservation for the people of 24 coastal provinces was also carried out. The training programs include that on volunteer to protect marine and coastal zone, promotion and conservation of mangrove forest, and volunteer youth program on marine and coastal resources protection. The awareness on mangrove forest restoration and conservation and rehabilitation of mangrove and marine and coastal resources are created in respective areas.

Moreover, there are projects/activities on reforestation on important holidays and occasions carried out by various agencies. Examples are cooperative project during 2004 – 2010 on mangrove reforestation by Toyota Motors Thailand, the Royal Thai Army Supply Department and World Wildlife Fund –Thailand; and the reforestation activities of the Tourism Authority of Thailand. In addition, local authorities such as local administrative agencies, institutions, NGOs, volunteer networks and communities located on the coastal zone have activities on marine and coastal resources conservation and restoration, and public awareness. Other activities include those on mangrove forest conservation to restore habitat and nursery ground for aquatic animals, and to create education site for youth, school children and student, and establish aesthetic site for the residents and tourists.

Cooperation among the government and private sectors, NGOs, academic institutions, local authorities and communities on mangrove forest conservation and rehabilitation, including reforestation activities, has resulted in continuously increase of forest areas, from 1,458,174.54 rai in 2004 to 1,525,060.56 rai in 2009.

**Table 11: Mangrove areas in 2004 - 2012**

Year	Mangrove area (rai)	Change (rai)
2004	1,458,174.54	-
2008	n.a.	-
2009	1,525,060.56	+66,886.02
2010	n.a.	-
2011	n.a.	-
2012	n.a.	-

**Source :** The Department of Marine and Coastal Resources

**Note :** The Department of Marine and Coastal Resources, the most recent survey on 2009

● **At least ten species of endangered/endemic species have increasing population, and have been protected and restored in situ.**

This indicator support Strategy 1 – Ecosystem components protection in the Action Plan on Protection and Rehabilitation of Species. The target for this indicator is achieved. In 2008 – 2012, 12 endangered/endemic species increases in population number.

The mentioned endangered species means species listed in the Thailand Red Data (2005), which composes of Extinct: EX, extinct in the wild: EW, critically endangered: CR, endangered: EN and vulnerable: VU.

The Botanical Garden Organization has studied, carried out research, bred rare, endemic and vulnerable plants with various techniques, for the purpose of conservation and introduction back to the nature. Some of the Department's projects are on conservation and increase of population in areas that prone to extinction. Some of the mentioned species are rare orchids such as *Vanda coerulea* and *Cycas circinalis*. In addition, database on Thai plant species are developed as the information center on plants and plant species. The database can be divided into five sub-databases, include those on living plants, plants specimen, local botany, threatened plants and plants in Thai literature.

The Zoological Park Organization has continuously carried out researches on Thai preserved and rare wildlife. Finally, artificial breed is successful on Sarus Crane. At Nakhon Rachasima zoo, 10-20 artificial-bred and naturally-bred birds were borned. The project to return Sarus Crane to nature has been carried out at wetlands of Huay Jorakey Mak reservoir, Muang district, Buriram province. In 2011 and 2012 twenty six birds are introduced back and at present they can survive in the nature. One of the female has already laid one egg.

In addition, artificial breeding of Eld's deer is also successful. The very first bred was borned on 17 October 2011. The baby Eld's deer was given to His Majesty King Bhumibol on His 7<sup>th</sup> cycle birthday on 5 December 2012. His Majesty names the baby "Rohisrat".

The Department of Marine and Coastal Resources has each year surveyed, studied and monitored the distribution and changes of rare marine animals in the Thai waters. They are Green turtle, Dolphins, Dugong, Whale and Whale shark. Breeding and nursing are also carried out by the Department. A network to monitor, conserve and protect the animals is established. The population number of these rare animals are still low and tends to decrease every year due to threats from fishery gears and environmental degradation. In contrary the data collected for years 2008 – 2010 indicates that the number of Hump-backed dolphin, Irrawaddy dolphin and Dugong increases while in 2012 a dugong was reported to ground ashore.

The Department of Fisheries has carried out study, research and surveyed and cultured rare and endangered aquatic animals, including various economic species such as Clownfish, Saddleback clownfish, Barbel sheatfish, Giant clam, Mekong giant catfish, Siamese giant carp, Günther's walking catfish, *Cirrhina microlepis*, Sultan fish and Julian's golden carp. The Department also releases rare species into the natural waters.

The National Parks, Wildlife and Plant Conservation Department has missions to conserve, preserve, protect, rehabilitate and maintain forest resources, wildlife and plants. The Department has notified conservation areas such as national park, wildlife sanctuary, and wildlife non-hunting areas such that wildlife can be conserved, protected and preserved. The rare and threatened wildlife are also live safely and exist in the wild. Activities of the Department also includes solving problem of wild and peddle elephants, and conservation and protection of rare birds. In addition, there are surveillance and culture of rare and endangered orchids in the wildlife non-hunting areas, and establishment of Thailand wildlife database.

The data collected during 2008 - 2012 indicate the population of 12 endangered/endemic species have been increased in number. They include one species of plant, i.e. *Vanda coerulea*, and 11 animal species, which are Hump-backed dolphin, Irrawaddy dolphin, dugong, Sarus crane, Chao Phraya Giant Catfish, Clownfish, *Cirrhina microlepis*, Sultan fish, Julian's golden carp and Giant clam, and wild elephant in Kuiburi National Park.

It is noted that certain species including the cultured ones, cannot be identified whether their population have been increased from the year 2007, due to fluctuation of their number and unidentified annual and cumulative data.

**Table 12:** Endangered/endemic species that increase in population

Name	Number of population					
	2007	2008	2009	2010	2011	2012
<b>Endangered species</b>						
plants						
Vanda coerulea (EN)	-	-	-	increase 297	-	-
animals						
Hump-backed dolphin <sup>1</sup> (VU)	-	174	188	198	-	-
Irrawaddy dolphin <sup>1</sup> (CR)	-	204	231	231	-	-
dugong <sup>1</sup> (CR)	-	120	135	149	-	-
Sarus crane (EW)	-	-	-	10	10	14
Chao Phraya Giant Catfish <sup>4</sup> (EN)	-	30,000	50	-	21,274	227,280
Clownfish <sup>4</sup> (EW)	-	-	1,054	-	3,000	-
Cirrhina microlepis <sup>4</sup> (VU)	-	38,120	181,160	157,221	425,000	298,000
Sultan fish (VU)	-	39,987,849	43,229,533	42,232,253	48,354,499	52,031,930
Julian's golden carp <sup>4</sup> (VU)	-	747,500	1,287,700	1,541,218	1,252,077	1,066,041
Saltwater giant clam <sup>4</sup> (EN)	-	2,500	9,400	4,110	10,908	4,691
Wild elephant (only in Kuiburi National Park) <sup>5</sup>	150	150	-	230	200 - 500	200 - 500

**Source :** 1 The Department of Marine and Coastal Resources  
2 The Botanical Garden Organization  
3 The Zoological Park Organization  
4 The Department of Fisheries  
5 The National Parks, Wildlife and Plant Conservation Department

**Note :** Data are both those collect in that certain year and cumulative data

● **At least ten biological resources have been promoted/restored for further use as raw materials, source of alternative energy, and commercial use.**

This indicator reflects success in supporting sustainable use of biological diversity. The target of this indicator is achieved. During 2008 – 2012 various agencies carried out projects to promote and rehabilitate biological diversity. In total twenty one projects/activities in 13 areas on rehabilitation of biological diversity resources are implemented to use as raw materials and source of energy and use in economic purposes.

Biological resources have been used as raw materials for production and service. Some of them are those carried out by Chiang Mai University such as fertilizer production from leaves and grass, compost production from leaves and organic liquid fertilizer from food waste, biological diversity management, use of plants in Arabica coffee plantation, and

training on knowledge related to Thai traditional medicine and Lanna herbs conservation. The National Science and Technology Development Agency also has a project on the study of guidelines to sustainably manage Razor clam in addition to a project to lay buoy for marine zoning to conserve dolphins and coral reefs to attract tourist.

Example of use of biological diversity as energy source are projects carried out by Kasetsart University such as projects on Physic nut plantation as alternative energy source, promotion of fast growing plant for use as alternative energy for community.

The commercial use of biological resources include training on Bamboo Caterpillar breeding for the farmers, introduction of mushroom and fungi variety to improve the community economy and algar culture for commercial purpose carried out by Chiangmai University; a project to promote business related to biological resources (Pheasant, Parrot, Deer, Fishes) carried out by the Biodiversity-Based Economy Development Office ; a project on tissue culture at Fah Mui village, Mae Rim district, Chiangmai province and another project to reproduce *Oberonia longirachis* at Ban Rom Klao, Chat Trakarn district, Phitsanulok province, both projects with the selling purpose and implemented by the Botanical Garden Organization.

● **National inventory on traditional knowledge and/or local wisdom related to the conservation and sustainable use of biological diversity completed, by the year 2012**

This indicator reflects the effectiveness of supporting sustainable use of biological diversity. This target has been achieved. The list has been developed for plants in Thai culture and tradition which are related to conservation and sustainable use of biological diversity. Information on culture and tradition with regards to biological resources and the community way of living regarding to biological diversity has also been recorded.

The Office of Natural Resources and Environmental Policy and Planning has developed a list of plants in Thai culture and tradition, in addition to recording information on culture, tradition, biological resources and the community way of living with regards to biological diversity. Such list is treated as the national list and has been disseminated through the Office's clearing-house mechanism. According to the information compiled, there are at least 25 traditions and 40 cultural believes, which are related to use of at least 200 plant species.

Concern agencies such as the Biodiversity-Based Economy Development Office, has developed a list of biological assets and exchange information on biological resources and local wisdom through community participation and encyclopedia on local Thai wisdom. In addition, the Botanical Garden Organization has studied and compiled knowledge on conservation and sustainable use of biological diversity which was transferred from generations to generations. The Department of Agricultural Extension has compiled information on local knowledge in planting tree to achieve biological diversity. Such information and holistic knowledge are related to culture, tradition and local wisdom and can be used for the conservation and sustainable use of biological diversity.

● **At least one mechanism, practical guidelines, criteria or regulation to facilitate sustainable use, access and benefit sharing from the use of biological diversity.**

This indicator is listed under the NBSAP Strategy to support sustainable use of biological diversity. The target is achieved. There are mechanism, guidelines, criteria or laws to support use, access and benefit sharing of biological diversity. Twelve success stories can be identified.

During the period before 2008, there were mechanism, guidelines, criteria and laws related to use, access and benefit sharing of biological diversity which are still in effective. Examples are the National Park Act 1961, the Royal Forest Department Notification on Permission to Collect Bird Nest 1989, Wildlife Preservation and Protection Act 1992, Plant Protection Act 1999, Thai Traditional Medicine Protection and Promotion Act 1999, the Department of Agriculture Criteria on Exchanging Plant Parts with other Countries 2003, Regulation of the Committee on Protection of Local and Wild Plant Species for Education, Experiment, or Research and not for Commercial Purpose 2004, the Royal Forest Department notification on Permission of Activities for Education or Research in the National Forest Reserve 2005, the National Research Council notification on Permission of Foreigners to Carry out Research in Thailand 2007, etc.

Since 2008 – 2012, various agencies have developed guidelines, criteria and laws to support use, access and benefit sharing of biological diversity. Some of them are regulation on entering the national park 2009 issued by National Parks, Wildlife and Plant Conservation Department; ministerial regulations of the Ministry of Agriculture and Cooperatives on criteria, methodology and condition for the permit to collect, provide or gather local or wild plant species for the purpose of species improvement, study, experiment, research for trading and benefit sharing criteria 2010 issued by the Department of Agriculture; or criteria to select area as habitat of herb plants which lead to surveillance, study, research, including

guidelines and steps of herb plant and habitat conservation and protection, issued by the Department for Development of Thai Traditional and Alternative Medicine, etc. In addition, the Department for Development of Thai Traditional and Alternative Medicine has also developed a management plan to protect herb plants in the conservation zone years 2012 – 2014 (short-term plan) which was approved by the Cabinet on 15 November 2010 and published in the national gazette on 21 March 2011.

The Office of Natural Resources and Environmental Policy and Planning by the National Committee on Conservation and Use of Biological Diversity has developed the regulations on principle and methodology of biological resource access and benefit 2011, to be used as criteria and methodology to access and share benefit gained from biological resources. The regulations comply with the control principle to access and of benefit sharing which is listed as one of the three objectives of the CBD. It is declared in the national gazette no. 128, part 26 ngor, on 4 April 2011.

**Table 13:** Mechanism, practical guidelines, criteria or laws that facilitate biological diversity sustainable use, access and benefit sharing

Indicator	Year					Total
	2008	2009	2010	2011	2012	
Number of mechanism, guidelines, criteria or laws that support biological diversity	-	5	2	3	2	12

**Source :** *The Royal Forest Department, the National Parks, Wildlife and Plant Conservation Department, Thailand Institute of Scientific and Technological Research , the Biodiversity-Based Economy Development Office, the Office of Natural Resources and Environmental Policy and Planning, the Department for Development of Thai Traditional and Alternative Medicine, the Department of Marine and Coastal Resources, the National Science and Technology Development Agency.*

- **Practical guidelines on biological diversity impact assessment.**

This indicator reflects the efforts to reduce threats to biological diversity. The indicator is achieved, however, details of guidelines developed are being revised before informing and allowing concerned agencies to use as their framework or for developing appropriate projects.

Increase in population and economic development has resulted in natural resources and environmental degradation, especially losses of biological diversity. Guidelines to prevent impacts on biological diversity caused by various kinds of development are needed. The Office of Natural Resources and Environmental Policy and Planning therefore has established criteria, methodology, practical code and guidelines for impact assessment in area with biological diversity importance. Those establishment are used for drafting the preliminary guidelines on impact assessment in area with biological diversity importance. The highlight of the guidelines includes a system to categorize biological diversity, principle of assessment of impacts on biological diversity, types of ecosystem, important sub-ecosystem that needs conservation, impacts in area with biological diversity importance and project screening.

The Office of Natural Resources and Environmental Policy and Planning is reviewing the details of such guidelines. After finalization, the guidelines will be forwarded to concerned agencies and consulting firms working on environmental impact assessment. The guidelines will be used during project or activity implementation and for environmental impact assessment.

- **Long-term policy at the national level regarding climate change adaptation and mitigation to biological diversity**

This indicator reflects efforts to reduce threats to biological diversity. Unfortunately this indicator has not been achieved since the development of national long-term policy on climate change adaptation and mitigation toward biological diversity has not been finished yet.



During the past, there was no agencies developed the direct long-term policy related to climate change adaptation and mitigation and biological diversity. Only the mid-term policy exists such as the Strategy on Climate Change 2008 – 2012 which was developed by the Office of Natural Resources and Environmental Policy and Planning. Under this mid-term policy, there is a strategy on impact assessment on key issues related to climate change such as drought, higher temperature, coastal erosion, changes of forest ecosystem, spread and culture of disease and vector. Strategy on capacity building to adapt to climate change impact has also been highlighted. The guidelines to prevent and mitigate impact on natural resources, ecosystem and biological diversity are also listed.

Many agencies has developed plans related to adaptation and cope with impact caused by climate change. The National Parks, Wildlife and Plant Conservation Department has developed a Master Plan on Climate Change Year 1999. The key issue of the plan is on climate change impact on biological diversity and its mitigation measures.

The Ministry of Agriculture and Cooperatives has developed a Plan to Mitigate Global Warming: Agricultural Aspects 2008-2010. The Plan was approved by the Cabinet on 24 July 1997. The key responsible agency is the Land Development Department, while other eight responsible agencies are the Department of Agriculture, the Rice Department, the Department of Fisheries, the Department of Livestock Development, the Royal Irrigation Department, the Department of Royal Rainmaking and Agricultural Aviation, the Office of Agricultural Economic, and the Agricultural Land Reform Office. Five work plans include those on plants, soil, water, livestock and fishery, and climate change and agriculture.

Under the National Energy Strategy, the Ministry of Energy has developed an Energy Conservation Plan 2008 – 2010. With regard to greenhouse gas reduction from the energy and industrial sectors, the promotion of alternative energy including biogas production from tapioca factory and agricultural solid waste/unused materials is highlighted. This approach reflects use of biological diversity for climate change adaptation.

The National Science and Technology Development Agency has developed a National Research Strategy “Development of Biological Diversity Value 2013 – 2016”. The study on climate change and its impacts on fragile biological diversity and ecosystem for the purpose of conservation and rehabilitation is among the research strategy on biological diversity.

In addition, many agencies has studied and carried researches on climate change impacts on biological diversity. The Department of Marine and Coastal Resources has carried out a study on climate change impact on coral reefs in various areas while Ramkhamhang University has a study on impact on coral reef ecosystem and measures to rehabilitate coral reefs in Thai waters.

At present, the Office of Natural Resources and Environmental Policy and Planning are in the process of developing a Master Plan on Climate Change 2013 – 2050. The Plan was approved by the Technical Sub-committee on Climate Change and is being submitted to the National Committee on Climate Change Policy and then to be approved by the Cabinet. After then the Plan will be implemented. The Plan includes six strategies on climate change adaptation i.e. 1) Water, flood and drought management, 2) agriculture and food security, 3) tourism, 4) sanitation, 5) natural resources management and 6) human settlement and security.

Under the Master Plan, the guidelines and measures on climate change adaptation and mitigation for biological diversity are those on climate change impact assessment on ecosystem and natural resources, such as forest distribution, species distribution and biological diversity pattern, especially of rare and endangered species. The outcome will lead to the ability to identify areas with risk on ecosystem and natural resources degradation or change; protect and preserve sustainable wetlands; in situ conservation and ex situ conservation; promote study and research on breeding of rare or endangered species; develop laws and regulations and measures on biological diversity conservation and protection in various ecosystems; declare marine and coastal protection areas in important ecosystem and river estuaries; rehabilitate marine and coastal resources; and lastly, develop standard database on natural resources and biological diversity which can also be networked with regional and international databases.

- **Mechanisms, criteria and regulations to control, oversee, eradicate and monitor invasive alien species.**

This indicator reflects accomplishment on effort to cope with losses of biological diversity. The indicator shows that the result meets the target. Mechanism, criteria and regulations to control, oversee, eradicate and monitor invasive alien species have been developed by various agencies such as the Department of Fisheries, the National Parks, Wildlife and Plant Conservation Department, and the Office of Natural Resources and Environmental Policy and Planning.

Examples of invasive alien species in Thailand are water hyacinth and the golden apple snail. Even though there are efforts to use water hyacinth in the handicraft business and the golden apple snail as animal feeds and liquid bio-fertilizer, they still can not be totally eradicated.

During 2008 – 2012, various agencies have developed mechanism, criteria and regulations to control, oversee, eradicate and monitor invasive alien species. Some of them are the following.

The Department of Fisheries issues a notification on guidelines to prevent and control distribution of aquatic alien species 2011. The Department also has measures to monitor and oversee import of aquatic alien species into the Kingdom, in addition to culture for exporting purpose. Other activities include carrying out studies to identify guidelines to control the quantity of alien species and educate the public on dangers and impacts of alien species on the environment and on local aquatic animals. The public were also invited to trade their alien species for the Thai endemic fish species.

The National Parks, Wildlife and Plant Conservation Department has surveyed invasive plant alien species in the protected area and registered the possession or import of alien species listed in the CITES appendix. The Department also issued measures to prevent, control and eradicate invasive alien species in the protected areas, in addition to develop guidelines for officers and the public on the prevention, control and eradication of invasive alien species in the protected areas. This will reduce impacts of the invasive alien species on forest ecosystem diversity.

The Office of Natural Resources and Environmental Policy and Planning has developed four measures to prevent, control and eradicate alien species; i.e. 1) management of alien species, 2) prevention and monitoring of alien species, 3) supporting study and research on alien species and 4) disseminate information and knowledge and raising public awareness on alien species. The Cabinet has approved the measures on 28 April, 1999. In addition, the Office has established a database on alien species and disseminate the information through its clearing house mechanism (<http://chm-thai.onep.go.th>).

- **National biosafety framework, which facilitate the use and regulation of LMOs**

This indicator reflects success in reducing losses of biological diversity. The effort is successful. Concern agencies such as the National Science and Technology Development Agency and the Safety, Occupational Health and Environmental Administration Center of Mahidol University, have develop guidelines on Biosafety which facilitate the use and regulation of LMOs.

The Office of Natural Resources and Environmental Policy and Planning has developed the national framework on biosafety in 2007 and has implemented the framework since 2008. Major activities under the framework includes the development of Biosafety for Modern Biotechnology Act, which was endorsed by the Cabinet on 22 January 2008. At present the draft Act is being considered by the Office of the Council of State. In addition, the Information Center on Biosafety in the form of website (<http://bch-thai.onep.go.th>) was established, while various agencies are initiated to work under the framework. Such agencies are the Department of Agriculture, the Department of Fisheries, the Department of Livestock Development, the Food and Drug Administration, the National Center for Genetic Engineering and Biotechnology, etc.

The National Science and Technology Development Agency by the Technical Committee on Biosafety and the National Center for Genetic Engineering and Biotechnology have also developed guidelines on biosafety to be used by researcher to protect and control dangers and hazards related to LMOs, which may cause impacts on human being, plant, animal and environment. Some of the activities under the guidelines are development of practical code in assessing biosafety of plant modified product and guidelines on biosafety for modified microorganism under the controlled environment to be used in the prototype factory and industry. In 2009 the guidelines on biosafety for modern biotechnology practice or genetic engineering was developed. In addition, the minimum requirement for requesting an assessment of food biosafety and manual for the construction of experimental nursery house for genetic modified plants were also developed.

The Safety, Occupational Health and Environmental Administration Center of Mahidol University has developed the Biosafety Guidelines in 2011. This guidelines was revised from the one previously developed in 2006. The main contents of the guidelines includes biosafety guidelines for tasks related to infectious agents, genetic-modified organisms, and arthropod vectors, both in the laboratory and in the field. This guidelines is to be used for researchers to reduce risk associates with infectious agents, genetic-modified organisms, and arthropod vectors, which may be released to the environment.

- **Quantitative guidelines on the effective national biological diversity research**

This indicator reflects efforts to promote research, training, education, awareness raising, and promotion of networking on biological diversity. The indicator has been achieved. The National Research Policy and Strategy No. 8 (2012-2016) has been developed. The Strategy cover those on conservation, promotion, and development of scholarship on natural resources and environment. The concentration is on the management of natural resources and environment, biological diversity, and conservation and sustainable use of natural resources. The Strategy also includes the strategy on Thai researches "Development of biological diversity value 2012-2016", that concerned agencies can be used as their framework on biological diversity researches.

The National Economic and Social Development Plan No.10 (2007 - 2011) has indicated biological diversity as one of the major strategies for national development. The Office of The National Research Council of Thailand who is responsible for developing national research policy and strategy and identify the budget for researches, has identified research on biological diversity as one of the five major strategies under the National Research Policy and Strategy (2008 – 2010). Later on the period of the Strategy was changed to 2008 - 2011. The Eighth National Research 2012-2016 developed to concentrate on researches that complies with the Eighth National Research Policy and Strategy 2012-2016, which indicates that conservation, promotion and development of natural resources and environmental capitals is one of the national research strategy. The researches will concentrate on natural resources and environmental management, biological diversity, and conservation and sustainable use of natural resources. In addition, biological diversity is classified as one of the 13 aspects of the National Research Policy and Strategy 2012-2016, and is considered as the priority research work plan for receiving budget.

The National Science and Technology Development Agency has developed the National Research Strategy "Development of biological diversity value 2012-2016". It composes of six strategies i.e. 1) assessment of national biological diversity, 2) study on impact of climate change on biological diversity and vulnerable ecosystem for conservation and rehabilitation, 3) rehabilitation of degraded ecosystem to improve quality of life and the environment, 4) increase of value and use of biological diversity for community and industry, 5) development of database on biological diversity, management of knowledge synthesis and 6) policy on management of biological diversity.

The Office of Natural Resources and Environmental Policy and Planning has developed the guidelines on necessary researches on biological diversity that support the target of the Strategic Plan for Biodiversity 2011 – 2020, such that researches will support the implementation of the Strategic Plan for Biodiversity 2011 – 2020 and the Aichi Targets. The Plan covers 296 approaches and the Cabinet has already approved the Plan and the Ministry of Natural Resources and Environment is requested to submit the progress report to the 11<sup>th</sup> CBD Conference of the Parties held at India on 8 – 16 October 2012.

In addition, other agencies such as the National Parks, Wildlife and Plant Conservation Department has carried out research related to biological diversity such as the research on ecosystem management, plants, wildlife, insects, and microorganism.

The Department of Marine and Coastal Resources has researches on assessment of biological diversity along the coastal zone of the Gulf of Thailand and the Andaman Sea, planktons, juvenile aquatic animal, benthos, coral reefs, seagrass beds, and rare marine animals such as dugong, dolphin, whale, sea turtle and saltwater giant clams. Other researches are on other aquatic animals such as jelly fish and sea urchin, aquatic animals of the coral reef and seagrass geds ecosystem, biological resources of the island ecosystem, mangrove and biological diversity in the mangrove forest. The Department of Fisheries has 32 projects/activities on biological diversity and eight on rare animals.

● **Establish and use of formal and informal educational curriculum to promote learning process and to establish awareness on conservation and sustainable use of biological diversity**

This indicator reflects the success of training, education, and awareness raising on biological diversity. There are a number of activites/projects implemented both in the internal and external educational curriculum.

The use of internal and external educational curriculum to promote learning process on conservation and sustainable use of biological diversity is an important approach to raise awareness on its value and importance, and to promote its knowledge and understanding. In 2008 – 2012 a large number of concerned agencies have implemented projects/activities to promote awareness raising on conservation and use of biological diversity.

For internal educational system, various universities around the country, including the Office of the Non-formal and Informal Education, have incorporated issues on biological diversity into the curriculum. In addition, activites, exhibitions, conference and training to promote awareness and knowledge on biological diversity for community and youth, and researches, are widely implemented.

For the external education system, many agencies have carried activities and projects to raise awareness. The Department of Environmental Quality Promotion has developed environmental educational media on biological diversity such as the Green Path journal, manual on Knowing the Biological Diversity, etc. The Department also implemented a Mahingsa project to promote youth to survey and oversee their local natural areas.

The Botanical Garden Organization has organized various training courses such as those for local botanists. The Organization also implemented activities with community leaders to conserve natural resources. The Department of Marine and Coastal Resources hold exhibition to promote learning on biological diversity, marine animal, and benthos in the mangrove forest. The National Parks, Wildlife and Plant Conservation Department has annually carried out studies on natural resources conservation. Other agencies such as the National Science and Technology Development Agency by the National Center for Genetic Engineering and Biotechnology has organized a youth camp to strengthen knowledge and understanding on natural resources in the research area, and held research project on local biological resources at the school level.

- **Databases on biological diversity research to facilitate management of projects on biological diversity conservation and sustainable use by the year 2010.**

This indicator shows efforts to allow research findings to support policy development. Various concerned agencies have developed their own database on biological diversity researches and apply their database to support their activities in conservation and use of biological diversity.

In 2008 – 2012 many agencies have developed and applied their database on biological diversity to support their activities on conservation and use of biological diversity. For example, the database on National Research Project Management (NRPM) of the National Research Council of Thailand, the database on biological diversity in some certain areas under the responsibility of the National Parks, Wildlife and Plant Conservation Department, the management system of the biological diversity knowledge and of the information on forest biological resources of the Royal Forest Department, the research findings of the National Science Museum, etc. Other concerned agencies can get access at certain level to the said information and database.

The development of database on research on biological diversity in Thailand is still facing limitation on budget and experts in certain field. The dissemination and use of information is also limited. During the past it is found that most of the information on research are not disseminated to the area of biological diversity resources. However, it is a good sign that biological diversity is highlighted in the National Research Policy Framework and Strategy 2012-2016, which considers biological diversity as one of the immediate research plan, and there is a development on research strategy of Thailand: Development of biological diversity value 2012-2016. With those developments, the opportunity on research and development of database on biological diversity is increased which has a positive impact on activities on national conservation and use of biological diversity.

- **At least two networks of database on biological diversity and taxonomy.**

This indicator, which is achieved, reflects the effort to network existing database on biological diversity. Six systems of database and taxonomic information are linked.

In 2008 – 2012, there are a number of agencies that developed their database on taxonomy. Examples are Chiang Mai University who developed the taxonomy information of Lejeuneaceae, Ptychanthoideae (Bryophyta, Hepaticae) in Thailand, the Department of Marine and Coastal Resources who developed database on marine animals and plants, and the Department of Fisheries developed database on aquatic animals in the Department's aquatic animal museum.

In addition, the National Science Museum has linked its database on reference plants, invertebrates, insects, fishes, reptiles, amphibians, birds and mammals to the network of the Biodiversity-Based Economy Development Office, while the Department of Marine and Coastal Resources has linked its museum information system on marine animal and plant with the fishery museum of the Faculty of Fisheries of Kasetsart University. The National Parks, Wildlife and Plant Conservation Department also has linked its database on flora specimen with Sirindhorn Museum and the Department of Agriculture.

- **At least ten projects of awareness raising campaign through various activities and media.**

This indicator shows the accomplishment of Thailand on biological diversity awareness raising. There are more than 100 projects related to raising public awareness.

During 2008 – 2012, various agencies have carried out projects to raise awareness on biological diversity. Different activities and media are involved. There are more than 100 projects implemented. Examples are publishing and distributing printed matters on biological diversity and knowledge on plant, animal and ecosystem; holding exhibition on the International Day of Biodiversity and Wetlands Day, and other activities on conservation of natural resources and environment; holding youth camp on forest, marine and coastal conservation; training to strengthen capacity of community organizations on biological diversity; and seminar/conference/workshop to disseminate research findings on biological diversity to various target groups.

- **Establishment of committee on biological diversity in all biological diversity-related institutions/ organizations.**

This indicator aims to strengthen the capacity of local agencies to be able to work toward the international commitment on biological diversity. This target has not been fully achieved yet. Twelve out of 14 agencies have established their committees on biological diversity.

The resolution of the Committee on Conservation and Use of Biological Diversity on 22 July 2009 agrees with the Sub-committee on Convention on Biological Diversity, that, all concern agencies must establish their own committee on biological diversity, in addition to holding the committee meeting for at least twice a year. The Office of Natural Resources and Environmental Policy and Planning as the secretariat of the Committee on Conservation and Use of Biological Diversity has informed such resolution to 14 agencies on 11 September 2009. The said agencies are the Rice Department, the Department for Development of Thai Traditional and Alternative Medicine, the Department of Marine and Coastal Resources, the Department of Fisheries the Royal Forest Department, the Department of Livestock Development, the Department of Agriculture, the Department of Medical Science, the National Parks, Wildlife and Plant Conservation Department, Ministry of Education, the National Center for Genetic Engineering and Biotechnology, the National Science Museum, the Botanical Garden Organization, and the Zoological Park Organization.

Until 2012, there are 12 agencies that establish their own committee on biological diversity. They are the Department of Agriculture, the Department of Livestock Development, the Royal Forest Department, the National Science and Technology Development Agency (the National Center for Genetic Engineering and Biotechnology), the Rice Department, the Department of Marine and Coastal Resources, the Department of Fisheries, the National Parks, Wildlife and Plant Conservation Department, the Zoological Park Organization, the National Science Museum, the Botanical Garden Organization, and Thailand Institute of Scientific and Technological Research. Only the Department of Medical Science and the Ministry of Education have not established their own committee on biological diversity yet.

In addition it is found that committee and sub-committee related to biological diversity are also established. For example the committee on protection and promotion of Thai traditional medicine wisdom, a sub-committee on herbs and their habitat conservation, a sub-committee on herbs protection, of the Department for Development of Thai Traditional and Alternative Medicine; in addition to Ramkhamhaeng University's committee on plant genetic conservation project under Princess Siridhorn initiatives, etc. Establishment of committee or sub-committee on biological diversity at the agency level is another mechanism that ensures the clear, complimentary and continuous implementation on biological diversity among concern agencies.

- **National report on Thailand's achievement toward 2010 targets.**

This indicator which reflects the implementation results with regards to international commitment on biological diversity, has been achieved. Thailand has developed a National Report which shows the national achievements toward 2010 targets. The Report has already been submitted to the CBD Secretariat.

At the 6<sup>th</sup> Meeting of the parties to the CBD held in April 2002 at Hague, the Netherland, the parties endorsed the Strategic Plan for Biodiversity 2011 – 2020, with the target to achieve by 2010, a significant reduction of the current rate of biological diversity loss. The United Nations therefore declares year 2010 as the International Year of Biodiversity (IYB). For Thailand, the Cabinet has approved on 22 December 2009 that year 2010 is the Thai-International Year of Biological Diversity.

The Office of Natural Resources and Environmental Policy and Planning as the national CBD Focal Point held a number of activities to celebrate the annual 22 May – International Day for Biological Diversity and 2010 International Year of Biological Diversity. Such activities include holding academic seminars and public relations activities to promote awareness and public participation on conservation and sustainable use of biological diversity.

During 2008 – 2010 various agencies such as the Department of Marine and Coastal Resources, the Royal Forest Department, the National Parks, Wildlife and Plant Conservation Department, the Department of Agriculture, the Department of Fisheries, have implemented activities on conservation and sustainable use of biological diversity. Other agencies such as the Rice Department the Royal Forest Department and the National Science Museum developed an achievement reports toward 2010 targets. The Office of Natural Resources and Environmental Policy and Planning has already reported to the CBD Secretariat on achievements on reduction of biological diversity towards 2010 targets.

### ● **Biological diversity clearing house mechanism (CHM) and Biosafety clearing house (BCH) and link among networks.**

This target indicator is achieved as a number of agencies have developed the biological diversity clearing house mechanism and biosafety clearing house mechanism. Networks among agencies are also established.

For Thailand, the Office of Natural Resources and Environmental Policy and Planning has established both the biological diversity and biosafety clearing house mechanisms. They can be online on <http://chm-thai.onep.go.th/index.aspx> and <http://bch-thai.onep.go.th/index2.html>, respectively. Their establishment objectives are to facilitate access to information on Biological Diversity Convention and the Cartagena Protocol on Biosafety to the CBD, in addition to support establishment of information dissemination and exchange among Thai agencies and the Information Center of the CBD Secretariat.

During 1998 – 2012 a number of concerned agencies such as the Department of Fisheries, the Department of Livestock Development and the Royal Forest Department, and various universities such as Burapha University, Khon Kaen University, Chiang Mai University, Prince of Songkhla University and Walailak University, have established database and disseminated information related to biological diversity, and established networking system with the Office of Natural Resources and Environmental Policy and Planning.

It is recommended that the clearing house mechanism should be promoted among other agencies that have active role in biological diversity and biosafety. Networking is also needed.

### ● **Implementation Summary**

With respect to the monitoring during the half plan period, and at the end of the NBSAP implementation, by comparing to its objectives, the following is found.

The implementation of Thailand covers efforts to create biodiversity integrity as the base of Thai's way of living. In addition, there were studies and researches to utilize biological diversity in different ways, including using its raw material and uses with for economic purposes. Efforts also include establishment and development of mechanism to get access to and benefit sharing from the use of biological diversity.

Comparing to the targets listed in NBSAP, it was found that there are cooperations among different agencies to increase the number of rare and endangered plant and animal species, to control habitats and ecosystems destruction, in addition to efforts to decrease loss of biological diversity, especially those originated from human activities such as changes of land use, deforestation, spread of invasive alien species, pollution and ecosystem and environmental deterioration caused by careless use of natural resources and ecosystem. However, it is found that decrease of biological diversity losses in Thailand are not significantly realized. Many species are still classified as threatened and vulnerable. Ecosystems and genetic resources are in high risk to be easily impacted by various developmental activities.

In overall, Thailand is a country that seriously and long continuously implement activities on biological diversity. This is reflected by the successful development of three NBSAPs. The very first one was developed in 1998 while at that time Thailand has not become contracting party yet. The country strong implementation was impressed by the CBD Secretariat. However, with limitation on budget, personnels, among others, the major goal of NBSAP 2008 – 2012 to significantly reduce loss of biological diversity has not been realized. However, with NBSAP as the framework on biological diversity, it reflects that Thailand gives high priority on this issue which is internationally recognized. It also reflects Thailand determination to maintain her rich biological diversity and sustainable uses.

The evaluation base on indicators listed in the NBSAP 2008 – 2012 indicates that most of the indicators, that is 16 out of 21 indicators, have achieved the target. There are four non-achieved indicators and one undetermined indicator. Details are shown in the Table.

**Table 14:** Evaluation results of the indicators of the NBSAP 2008 - 2012 (End of Plan evaluation)

Strategy/Indicator	Evaluation results		
	Target achieved	Target not achieved	Unable to evaluate
<b>Strategy 1 – Protect the Components of Biodiversity (6 indicators)</b>			
Forest areas cover at least 33% of the country's total area, which at least 18% are conserved forest	✓		
At least 20% of marines and coastal areas in Thai waters have been designated as protected areas			✓
At least one site of seagrass beds and dugong habitats has been designated as protected area		✓	
At least five sites of wetlands of international importance have been designated as Ramsar Site		✓	
19,768 acres of mangrove forests increase	✓		
Population of at least 10 endangered/endemic species increases, and have been protected and restored in situ	✓		
<b>Strategy 2 – Encourage Sustainable Use of Biodiversity (3 indicators)</b>			
At least 10 biological resources have been promoted/restored for further use as raw materials, source of alternative energy, and commercial use	✓		
National inventory on traditional knowledge and/or local wisdom related to the conservation and sustainable use of biological diversity completed, by the the year 2012	✓		
At least one mechanism, guidelines, criteria or laws to facilitate sustainable use, access and benefit sharing from the use of biological diversity	✓		
<b>Strategy 3 – Minimize Threats to Biodiversity (4 indicators)</b>			
Guidelines on biological diversity impact assessment	✓		
Long-term policy at the national level regarding climate change adaptation and mitigation to biological diversity		✓	
Mechanism, criteria and regulation to control, oversee, eradicate and monitor invasive alien species	✓		
National biosafety framework, which facilitate the use and regulation of LMOs	✓		

Strategy/Indicator	Evaluation results		
	Target achieved	Target not achieved	Unable to evaluate
<b>Strategy 4 – Promote Research, Training, Education and Public Awareness and Network on Biodiversity (5 indicators)</b>			
Quantitative guidelines on the effective national biological diversity research	✓		
Formal and/or informal education curriculum to promote learning process and knowledge on biological diversity conservation	✓		
Databases on biological diversity research to facilitate biological diversity conservation and sustainable use programs/projects completed by 2010	✓		
At least 2 networks of database on biological diversity and taxonomy	✓		
At least 10 projects of awareness raising campaign through various activities and media	✓		
<b>Strategy 5 – Strengthen National Capacity for Implementing Biodiversity-Related International Agreements (3 indicators)</b>			
Committee on biological diversity in all biological diversity-related institutions/organizations		✓	
National report on Thailand's achievement toward 2010 target	✓		
Biodiversity Clearing House Mechanism and Biosafety Clearing-House fully operated and linked together	✓		
<b>Total</b>	16	4	1



# Chapter 4

## ***Review of Implementation to Achieve Aichi Targets***

The Convention on Biological Diversity had developed Strategic Plan for Biodiversity, including the Aichi Biodiversity Targets, for the 2011-2020 period. This plan provides an overarching framework on biodiversity, not only for the biodiversity-related conventions, but for the entire United Nations system and all other partners engaged in biodiversity management and policy development.

Parties agreed to translate this overarching international framework into revised and updated national biodiversity strategies and action plans within two years. Additionally, the Conference of the Parties decided that the fifth national reports, should focus on the implementation of the 2011-2020 Strategic Plan and progress achieved towards the Aichi Biodiversity Targets.

The Aichi Biodiversity Targets are the Convention's significant tools to encourage parties strengthen awareness and understanding on biodiversity to all stakeholders, including public, government and private sectors, encouraging implementation to address threats to biodiversity resources, promoting the value of ecosystems service and sustainable use, and raising awareness and mainstreaming on the conservation and sustainable utilization of biodiversity resources in their country.

Thailand has long dependent on its fertile and abundant biodiversity resources on their livelihoods, including socio-economics, cultural aspect, and as main sources of National income, in particular the export and tourism. In general, biological resources in Thailand tend to be decreased from many factors and threats. However, the country has implements various efforts, measures and mechanisms to address problems occurred, and to achieve the Convention's Strategic Plan, and the Aichi Targets. The outcome of the implementation was successful in some aspects, for example, the total areas of forests and mangrove forests in many areas have been gradually increased.

### **■ Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity a cross government and society**

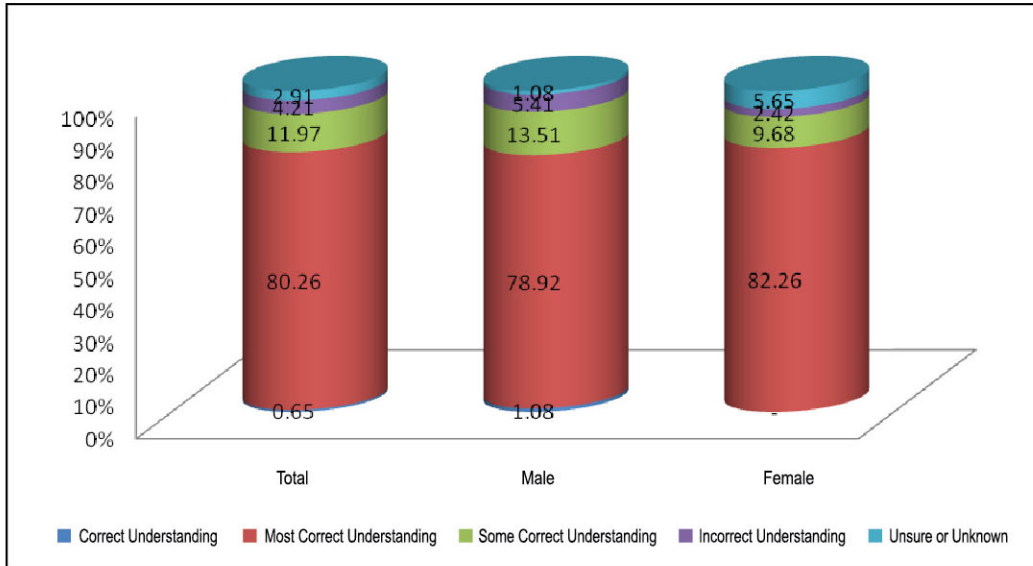
#### ***Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably***

Thailand has well recognized the importance of public awareness on biodiversity, and many initiatives and programmes have been implemented to raise awareness and mainstream biodiversity in all related sectors, as follows

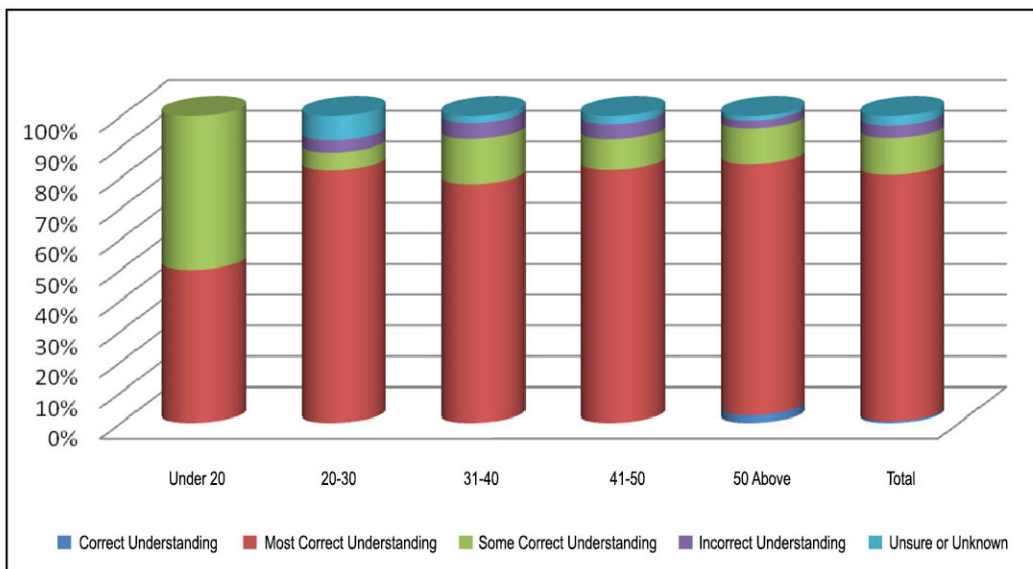
The Office of Natural Resources and Environmental Policy and Planning, as Thailand's national focal point to the CBD has organized various activities to enhance knowledge and raise public awareness including: the annual meeting on the international day of biodiversity, which the documents, proceedings and information of the meeting can be access at website <http://chm-thai.onep.go.th/>; campaigns and activities cooperated with relevant conservation organizations, institutions and communities, including the establishment of the Biodiversity Learning Center at Khao Khiew Open Zoo, Chonburi Province, in 2010; the publicize of knowledge on biodiversity through related organizations, including the Zoological Park Organization, The Botanical Garden Organization and the National Science Museum; and integrate biodiversity into formal education curriculum, at secondary and high school level.

To honor Her Majesty the Queen Sirikit and her long time contribution towards the conservation and sustainable use of biodiversity, in particular forest conservation and sustainable use of biological resources by local communities. In the year 2010, The Office of Natural Resources and Environmental Policy and Planning, by The national Committee on the Conservation and Sustainable Utilization of Biodiversity, had proposed, and the Cabinet had approved, to give the designation "Mother of Biodiversity Protection" to H.M. the Queen, and held exhibitions and documentations to publicize H.M. the Queen' initiatives and projects to conserve and sustainable use of biodiversity at national and international level.

The Office of Natural Resources and Environmental Policy and Planning had surveyed the attitudes and understanding of the public regarding biodiversity, from 309 persons in 40 provinces (59.87% male and 40.13% female). The result from the survey shows that only 0.65% of the representative samples have the correct understanding of the term “biodiversity”, while 80.26 % of them had most correct understanding of “biodiversity”, 11.97 % had some correct understanding of “biodiversity”, and 4.21% do not had sufficient understanding of “biodiversity”, as shown in the figure below.

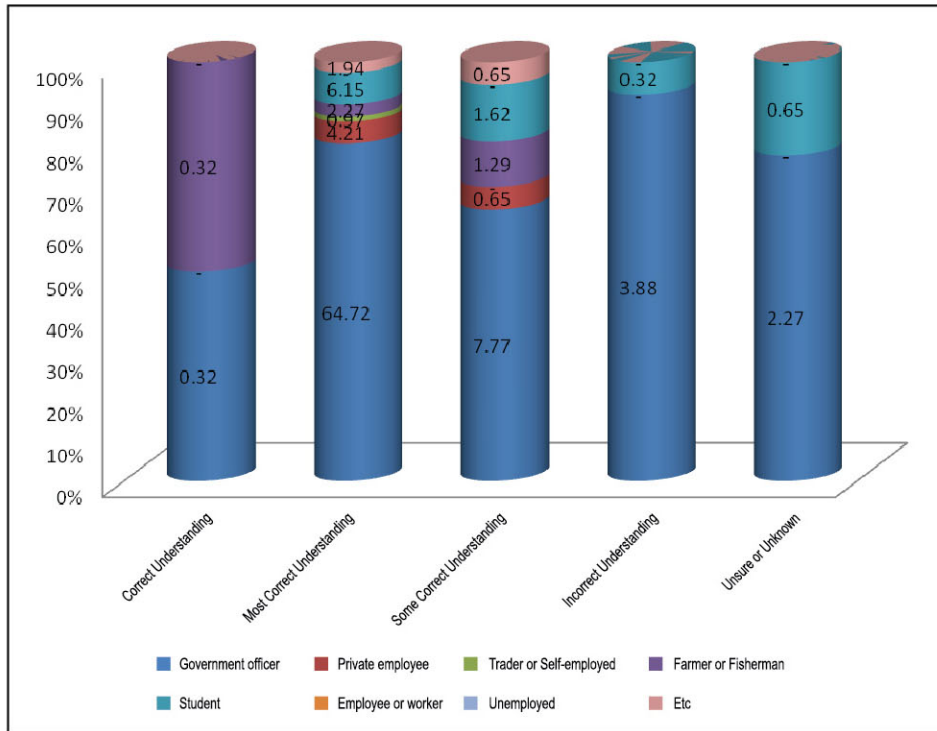


**Figure 18: Percentage of understanding of the term “biodiversity”**



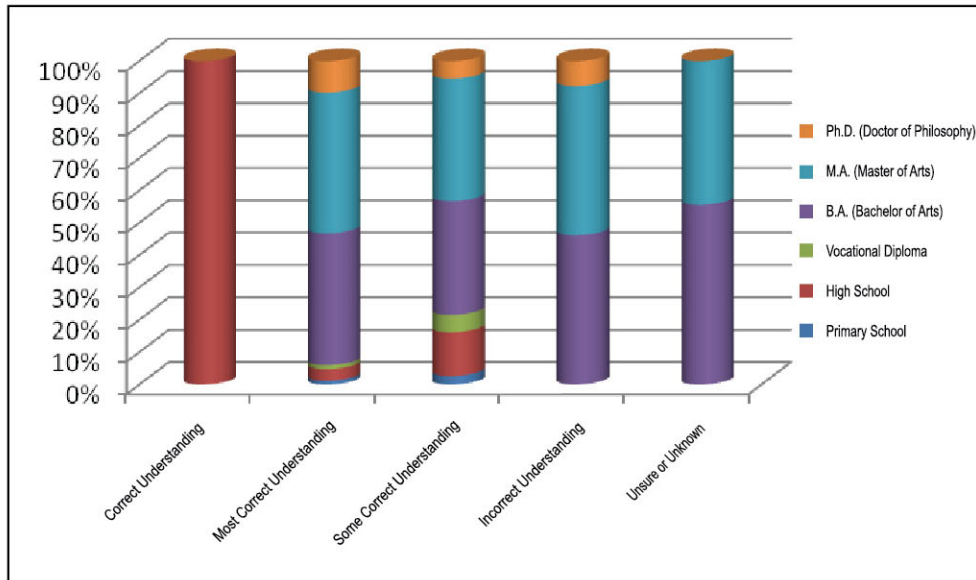
**Figure 19: Percentage of understanding of the term “biodiversity” , classified by age group**

Classified by occupation, the government officer and public servant (83.12% of officials in the central and the provincial offices, 76.32 % of local administrative organization officials, and 81.48% of teachers) have the most comprehensive knowledge and understanding of biodiversity (64.72%), followed by students (6.15%), the people who are self employed or private practice tend to have least knowledge and need to be urgently strengthen (0.97%)



**Figure 20:** Percentage of understanding of the term "biodiversity", classified by occupation

Classified by education degree, the post-graduate people have the most comprehensive knowledge and understanding of biodiversity, followed by the graduate, and elementary and diploma level need to be urgently strengthened and integrate biodiversity in related curriculum.



**Figure 21:** Percentage of understanding of the term "biodiversity", classified by education

Source of knowledge and understanding on biodiversity mostly come from work experiences (37.54%), followed by documents and web sites (35.60%), direct learning and study (31.39%), and from the meetings/seminars and experts (29.13%)

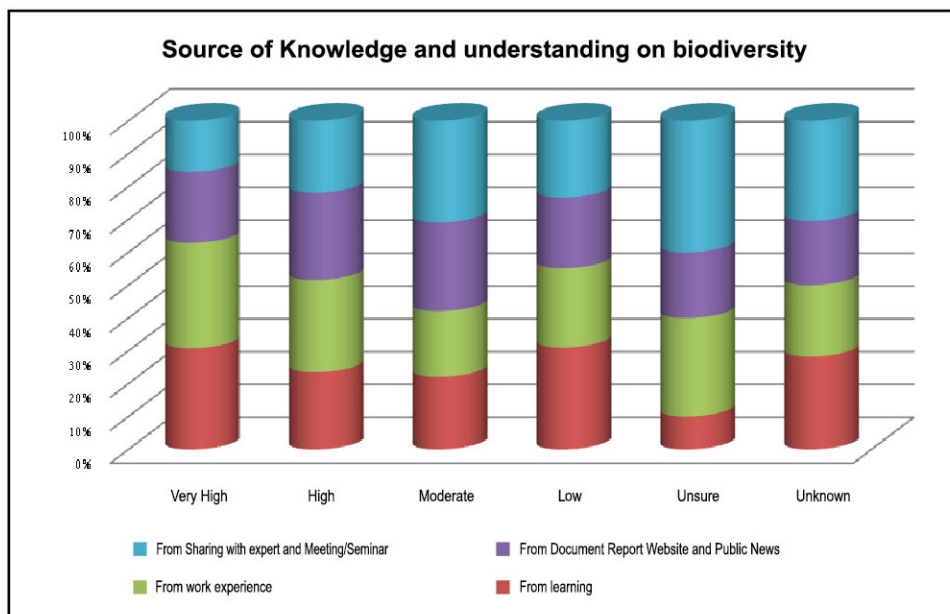


Figure 22: Percentage of understanding of the term “biodiversity”, source of knowledge and under standing

Regarding types of usage, people have used biodiversity resources mostly for basic needs (food, habitat, clothings and medicines) (40.78%), for maintenance of ecosystem resilience (27.83%), for tourist and recreation (25.57%), for maintenance of Green Areas (24.92%), for traditional knowledge and related culture (9.39%)

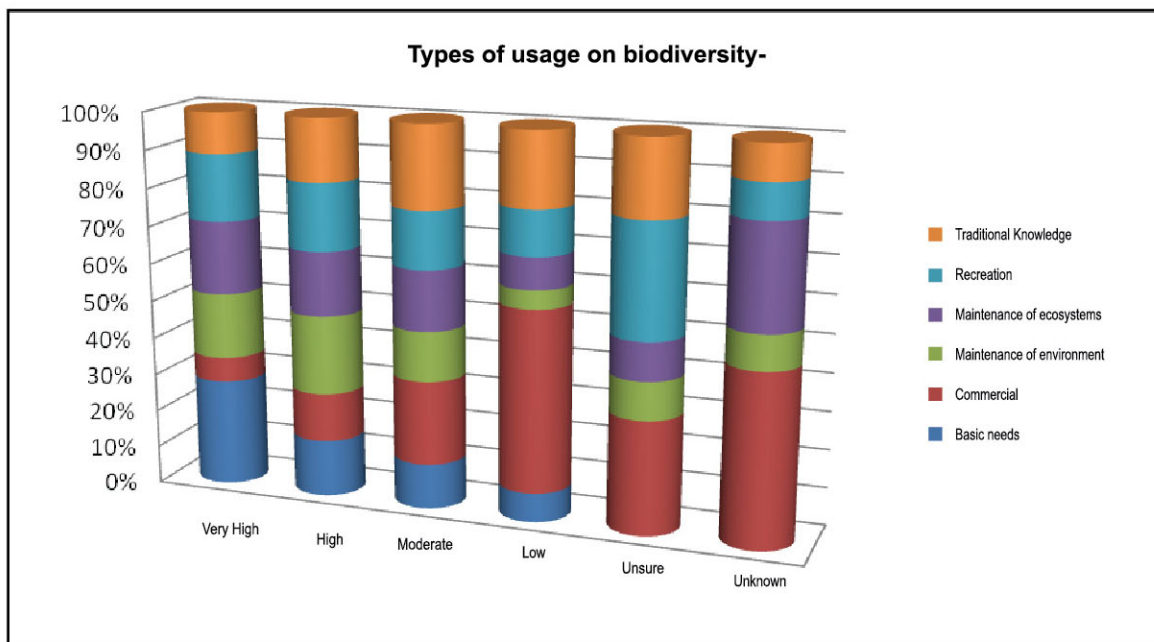
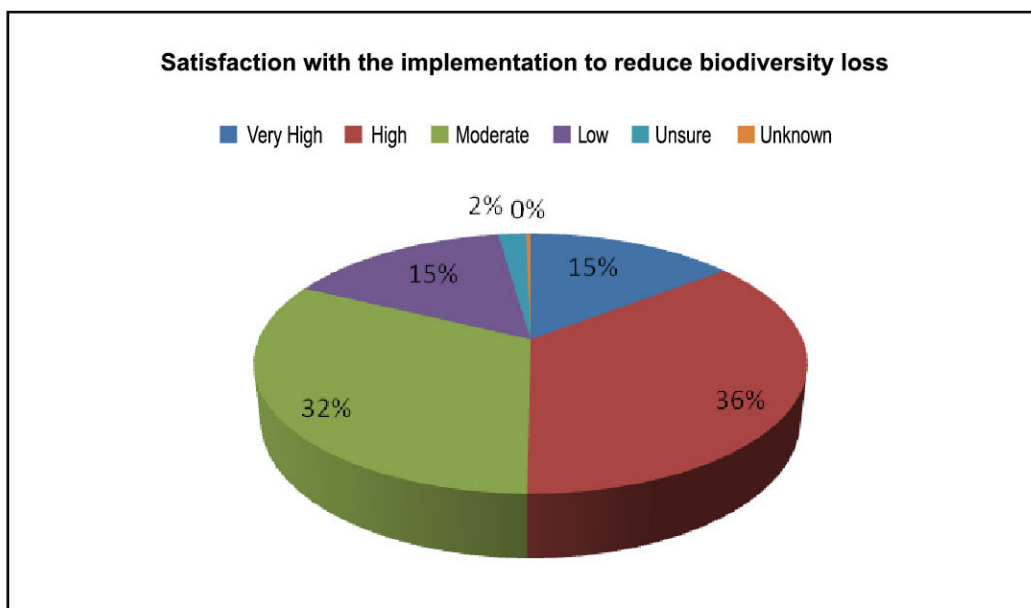


Figure 23: Percentage of understanding of the term “biodiversity”, by types of usage

In their perspective, the the representative samples have very satisfied with the implementation to reduce biodiversity loss (35.60%), moderate satisfied (32.04%) less satisfied (15.53%) and not known (14.56%)

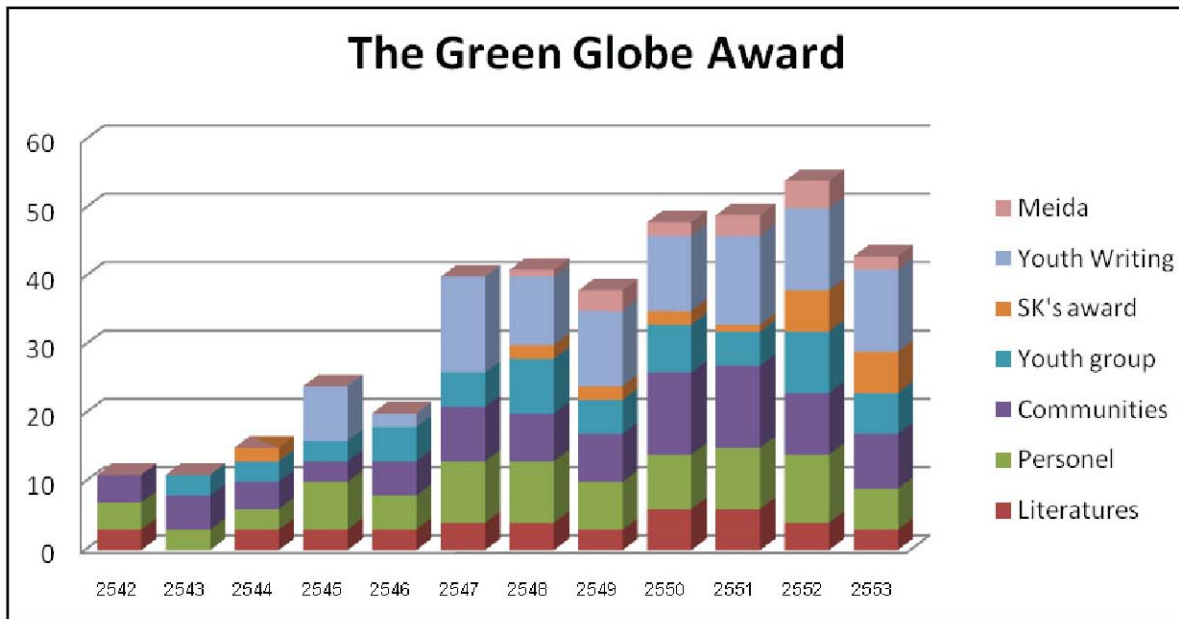


**Figure 24:** Percentage of satisfaction with the implementation to reduce biodiversity loss

**Guidelines on Communication, Education and Public awareness:** The Office of Natural Resources and Environmental Policy and Planning, has developed Guidelines on Communication, Education and Public awareness on Biodiversity, to facilitate implementation under UN Decade on Biodiversity, 2011-2020, which has been approved by the Cabinet on April 11<sup>th</sup>, 2012.

<b>Strategy 1</b> Strategy	Promote and encourage works to communicate biodiversity to the public Mainstream biodiversity into all relevant sectors
<b>Strategy 2</b> Strategy	Educate and enhance public knowledge and understanding on biodiversity through formal and informal education <ul style="list-style-type: none"> <li>- Include and integrate biodiversity through formal and informal</li> <li>- Create positive incentives for academic institutions and education personnels which worked related to biodiversity</li> <li>- Integrate knowledge on biodiversity through self learning</li> </ul>
<b>Strategy 3</b> Strategy	Enhancing knowledge, understanding and awareness on biodiversity <ul style="list-style-type: none"> <li>- Enhancing knowledge , understanding and awareness on value and importance of biodiversity to the public at all levels</li> <li>- Raising awareness on the conservation and safeguard of biodiversity to the public</li> <li>- Create positive incentives for organizations and personnels which worked related to the conservation, restoration and sustainable use of biodiversity</li> </ul>

Some major private sectors, for example, Petroleum Authority of Thailand (PTT), has promoted conservation efforts by presenting the annual “Green Globe Award” to communities, personnels, the press and the youth with outstanding works/implementation on the conservation of biodiversity and environment since the year 1999.



**Figure 25:** Percentage of “Green Globe Award” Winners classified by occupation

**Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.**

The issue of biodiversity has been integrated in the national and local plan and policy, and in the private business sector. Most of concerned sectors place priority on conservation and rehabilitation of forest, and marine and coastal ecosystems. Conservation and rehabilitation of freshwater ecosystem for irrigation purpose and for preventing floods and drought have not been the issued push forward by the country. In addition, there is only one plan that supports the Aichi Target 9.

- **The National Economic and Social Development Plan** has identified the issue on biodiversity in since its eighth Plan during the period of 2010-2024. There are only two Plans that concentrate mainly on forest, however still pay a little attention on wetlands ecosystem.

- **The National Economic and Social Development Plan No. 10, 2007-2011**, on its Strategy 4, indicates that the development be base on biodiversity and security of resources and environment. The target on forest area has been set at not less than 33 percent of the protected forest and not less than 18 percent of the country total area, while rehabilitation of protected area is set at 2,900,000 rai. In addition, the target also includes the complete national database and the development of mechanism to control access, use and benefit sharing.

- **The National Economic and Social Development Plan No. 11, 2012-2016**, on its Strategy 3, establishment of foods and energy balance and security, has indicated that in order to adapt to climate change, the guidelines be developed to promote research and support the development of plants and animals species and aquatic animals that can be grown successfully.

- To promote the production that conserve plant and animal diversity, and suite with the climate and the environment.
- To support community production and service such that value can be added to the agricultural, food and energy products, by developing the potentiality from biodiversity resources and local wisdom bases.
- To promote research and development on energy plant species which are suitable for the country and provide high yield.

The Strategy 6 on sustainable management of natural resources and environment has set a target to increase integrity of natural resource and biodiversity bases by maintaining the protected areas to not less than 19 percent, increase forest area to be 40 percent of the country total area, and increase 5,000 rai of mangrove area annually.

- To protect, prevent, maintain, rehabilitate the forest and protect areas by conserving vulnerable area with ecological importance, by establishing corridor between forests.
- To develop biodiversity database.
- To promote conservation, use and fair benefit sharing of biological resources.
- To strengthen the community and to promote the community right in the balance and sustainable access and use of natural resources.
- To create income from the conservation of natural resources and biodiversity.

● **Government Policy (2011-2011)** The Strategy 5 on land, natural resources and environmental policy states the conservation and rehabilitation of forest and wildlife resources, immediate surveillance and land use zoning, promotion of forest management including implementation of community and group of forest, forest rehabilitation, promotion the conservation and use of forest biological resource and fair benefit sharing.

In addition, the policy includes conservation and rehabilitation of marine and coastal resources by rehabilitation of Thai waters, artificial reefs installation with public participation, increase of mangrove forest area, improvement of marine protected area and national park management through eco-base and public participation, declaration the marine and coastal protected zone in area of ecosystem importance, maintaining marine biodiversity, improvement and extension of coastal fishery zone and limiting and discard certain destructive fishing gears.

The above policy gives priority to marine and coastal ecosystem, and forest ecosystem, however, there is no policy on freshwater ecosystem.

About the specific plans, it is found that agricultural development plan does not pay attention on local species biodiversity and the word biodiversity is not found in any plans. The guidelines on fishery resources do reflect the awareness on and value of biodiversity, as the phrase "maintain the national biodiversity" is seen. To conserve the biodiversity, the Master Plan on Thai Fishery Management also contains the strategy on ecosystem rehabilitation and development of marine fishery sites.

■ **Agricultural Development Plan** Strategy 2 of the 11<sup>th</sup> National Economic and Social Development Plan 2012-2016 states to develop the production capacity, and to manage agricultural product and food security. The guidelines of the Strategy stress the development of new species that tolerate the climate change and alternate energy plants. However the issue on conservation and rehabilitation of local species is not mentioned

Strategy 3 states that effective, balance and sustainable agricultural resources be developed. The introduction of the Strategy reflects that loss of biodiversity is caused by improper agricultural management. The target does not mention the issue on biodiversity. Regarding to guidelines on strengthening effectiveness of fishery resource management and competitiveness with international countries, rehabilitation of degraded fishery resources and research on aquaculture of rare and endangered species are stated in order to maintain the national biodiversity.

■ **The Master Plan on Thai Fishery Management 2009-2018** has identified five strategies. Strategy 4 states that ecosystem be restored while marine fishery sites be developed to conserve biodiversity and marine environmental quality. Activities includes zoning of area and season for marine and coastal resources conservation by participation of the community and fishery organizations, monitoring and promoting at the local level to restore the ecosystem, ecosystem rehabilitating and developing the fishery sites to strengthen the national economic.

The Strategic Plan on New Diseases is a modern plan which incorporates the Aichi targets. Strategies and measures are set up toward of Aichi Target 9 on invasive alien species.

■ **National Strategic Plan to Prepare, Prevent and Solve New Disease (2013-2016)** has identified five strategies. The Strategy 2 concentrates on management of domestic animal system and animal and wildlife health. The Strategy 8 indicates a study on security and genetic diversity of wildlife.

- To integrate researches in biodiversity, and respond to the targets of the Strategic Plan for Biodiversity 2011-2020, whose Target 9 involves research on invasive alien species and its pathway, control and eradication of high priority species and implement measures to manage the invasive species pathway.
- To manage wildlife health and to study its genetic diversity

In addition, the Strategy of the Agricultural Promotion Fund has integrated concerns on ecosystem and identified needs of the farmers and their framework guidelines to promote ecosystem and the environment. One of the strategies is to stop deforestation and preserve trees on the river/stream banks, which is a part of biodiversity integration.

■ **The sixth Enterprise Plan 2012-2016** developed by the Office of the Rubber Replanting Aid Fund has identified strategies to increase the production efficiency. The strategies include increasing production capacity by promoting the ecosystem and the environment through planting of soil-covered and complimentary plant in the rubber plantation. This approach will each year reduce use of chemicals and promote combination use of organic and chemical fertilizer. The Plan also supports planting other plants with rubber. The fifth Enterprise Plan 2012-2016 indicates strategy on sustainable rubber management for the environment, promotion of synthetic plots to establish soil erosion plan by planting soil-covered plants, prohibition of tree or other natural plant cutting on the river banks, and no encroachment of forest with high conservative value.

At the local level, Thailand has developed a cluster province plan and provincial development plan. Many of those plans reflect the understanding of forest value, ecological balance and sustainable use of biodiversity. However, many of them as well concentrate on economic plantation, large-scale projects and tourism promotion. Most of the municipality development plans also aim to be “low-carbon city” while only Chiang Rai municipality aims at biodiversity conservation.

■ **Northern cluster provinces development plan:** Chiang Mai, Lampang, Lamphun, and Mae Hong Son have realized about the problem of forest encroachment for the purpose of planting corn and rubber, problems of forest burning for agricultural purposes, soil degradation due to an increasing use of chemicals/pesticides, mono-crop plantation, unattended natural water sources, degraded river water quality due to domestic and industrial wastewater discharge. The Plan states that biodiversity is an immunity and capital that is needed to be restored to its original richness, in order to maintain the ecological balance that support the quality of life, and social and economic development in the long run. Therefore, Strategy 1 of the Plan promotes holistic restoration and conservation to create charm and beautiful atmosphere, by indicating in its goals that the natural resources and environment be rich and without pollution.

■ **Phrae Development Plan 2010-2013** realizes the values of forest and water sources. Its Strategy 5 states the sustainable natural resources and environmental conservation. The goal of the Strategy is to rehabilitate 5,000 rai of forest each year, in addition to identify strategies to support plantation of economic plants, forest and soil-covered plants; to raise awareness for the protection of forest; and to promote public to participate in natural resources and environmental protection. Moreover, the Strategy also covers an issue on water source management for the prevention and mitigation of floods and drought, and mud slide.

■ **Sukhothai Developmental Strategic Plan 2015-2018** has a vision that “Sukhothai the world heritage city and impressive tourist attraction”. Its third goal is to restore natural resources and environment for the well quality of life. Its Strategy 3 also promotes security and balance among the social and environment; identifies guidelines to develop biodiversity value by stressing on management of knowledge and local wisdom, such as promoting knowledge on traditional herb plants towards production and health product; and supports use of local biodiversity as the base for sustainable development.

■ **Chiang Rai Municipality Developmental Strategic Plan 2013-2017** states the strategy on the development of natural resources and environment such that Chiang Rai has good and serene environment, and green area. The goals are to establish more breathing sites of the city, to raise public awareness on natural resources and environmental conservation and biodiversity, to become a low-carbon city, and to prepare for climate change adaptation.

Corporate social responsibility (CSR) In Thailand there are at least 400 companies that have CSR in place. At present 40 percent has activities related to the environment, and out of that 37 percent is the activities related to biodiversity and ecosystem services, such as maintaining livestock species, forest rehabilitation, dike construction, community forest conservation, crab bank, etc. Half of the companies have integrated the responsibility on biodiversity as the company policy in addition to reporting in their annual report. Those companies also have continuous activities on biodiversity in their CSR project for a period of time. The purpose of organizing such activity is not for public relations or corporate image purpose, but the companies truly have concerns and see needs to operate the company with the international standards on protecting the global environment. Examples are the following.

■ **The Siam Cement Group (SCG)** has well aware of the activities that cause impact on the ecosystem or biodiversity, such as mining or promotion of forestation for paper pulp. The company therefore develops clear guidelines on business and impact mitigation as follow.



- Set up clear policy on biodiversity to be used by all company's business sector for ensuring the ecosystem integrity in areas with risks, and prevent possible impacts on biodiversity.
- Develop projects to study, survey, and compile information on biodiversity in all possible impact areas such as limestone mine, in order to be used for setting up guidelines and format to develop biodiversity restoration plan and mine rehabilitation plan. The clear indicators on ecosystem integrity and biodiversity will be identified.
- Create cooperative networks with outside agencies, especially experts on biodiversity, with the purpose to develop work plan to rehabilitate the project areas.
- Monitor and report progress on rehabilitation work plan of area with impacts on biodiversity.
- Disseminate lesson learnt and information of project biodiversity to outside agencies and stakeholders.

The Office of Natural Resources and Environmental Policy and Planning has identified that insufficient information causes the business sector not to fully understand how to support to the biodiversity. The business sector who has good model on biodiversity conservation should be identified and receive appreciation award. This will allow other business units to participate in biodiversity conservation activity. In 2010 therefore, a Sub-committee on promotion of conservation and sustainable use of biodiversity of the business sector is established. With the Sub-committee, the framework and direction of the CBD can then be implemented among the business sector. Consultation on conservation and sustainable use of biodiversity can also be initiated. Later on in 2011 the Working Group on best practice on conservation and sustainable use of biodiversity by the business sector is also established. Identification of success business units will be a tool to support and promote appropriate management and conservation of natural resources and biodiversity. As well it can be used as a framework for cooperation and participation of the business sector in promoting and supporting conservation of ecosystem, species and genetic diversity. The business sector will also take part in supporting researches on biodiversity, and has an opportunity to attend various CBD and international forum and negotiation, while the government takes part in supporting technical information and researches on biodiversity and other related services.

During the past, the Thai business sector has been participating in various international conference and exhibition. In 2010, the CP Group has presented the output of its project on livestock genetic conservation by the community, in one of the side events of COP 10 in Nagoya, Japan. In 2012, CP Group and PTT presented the role of business sector and biodiversity conservation: from Mountain to Sea, at COP 11 in India. In the same year, 2012, PTT also presented the exhibition on Learning Center of the Sirinat Rajini Mangrove Ecosystem at the Ramsar COP 11 in Bucharest, Romania.

*Activities on business and biodiversity carried out by the Office of Natural Resources and Environmental Policy and Planning*

**Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.**

Thailand is trying to solve the problem of incentives for agricultural strategy, which has been existed for many decades, mainly due to severe forest cutting and wetlands encroachment.

The agricultural area of Thailand is approximately 150 million rai or 53.4 percent of the country total area. There are six important plant agricultural products with high export quantity and play major role in farmer life, i.e. rice, rubber, tapioca, oil palm, sugar cane for industry and animal corn. They are responsible for 54.7 percent gross national product GDP, or the export value of 842,490 million Baht annually. However, there always is problem of unbalance between supply and demand. The farmers tend to plant more high-price product. Together with the government policies that support crop price guarantee, crop guarantee, farmer revenue subsidy, and price compensation; more forest areas are destroyed and encroached. In 2014 more than 10 million rai land area was encroached to plant economic plants, corn, tapioca, sugar cane and oil palm. This also creates over production and reduces agricultural product price. It is a cyclic problem and become threats to biodiversity.

During 2013-2014 Thailand has been facing with problems of rubber and rice price subsidy. The existing mechanism does not work as planned and caused other agricultural products to be unattended. The National Council for Peace and Order therefore set up a preliminary policy to eradicate incentives and subsidy by concentrating on production cost reduction. Various enterprises are consulted on a variety of production factors such as fertilizer, chemicals, pesticide. Subsidy is revoked such that the marketing mechanism can be fully operated and burden on government finance lifted. The other benefit is creating a self-sustainability base on farmer foundation.

In addition in 2012 the Ministry of Agriculture and Cooperatives tried to solve the problem in the long-term. The Ministry has developed a Strategy of Economic Agricultural Zoning for major agricultural products during the six years period, from 2013-2018 with the budget of 61,857.37million Baht. The objective is to create balance between economic agricultural production quantity and demand. Examples of the 14 economic products are rice, tapioca, rubber, palm oil, sugar cane, marine prawn, cow. The Plan also includes production planning for such agricultural products in the production site and aim at suitable quantity, in order to minimize risks, reduce production cost, increase farmer income, promote efficient land use, and reduce expansion of agricultural areas into the forest.

■ The Ministry of Interior, Ministry of Agriculture and Cooperatives, and the Geo-Infomatics and Space Technology Development Agency (GISTDA) have developed a master map which indicates land use zone, and also developed maps that reflect suitable area to culture economic plants. The map is developed by evaluating and using information on land map, land use map and other factors such as forest illegal boundary, administrative boundary, irrigation project boundary, and other physical factors such as amount of rainfall, etc.

■ Evaluate information on production status to identify whether plantation on various suitable areas is beneficial, together with information on demand and supply, suitable market direction, potential of the areas, provincial strategic plan, and guidelines to increase production per rai.

■ Use measure on incentives to allow the farmers in the economic agricultural zone to produce as demand.

- For access or non-demanded agricultural products: Reduce access production in the less-potential and medium-potential agricultural areas, respectively. Incentives such as credit support, production factors, technology transfer, etc. will be applied so farmers turn to plants more demanded agricultural products.

- For demanded agricultural products

- Increase production base on the potential of the areas, in couple with establish guidelines and measures to increase production, such as support production factors, provide technology transfer, on the high-potential and medium-potential agricultural areas.
- Increase agricultural areas for products that do not meet demands, in areas not suitable to develop any other plants.

- In case the farmers wish to plant on the same original area, suitable technology transfer and self-sufficiency agriculture must be promoted to avoid problem associated with marketing.

The promotion of positive incentives for the conservation and sustainable use of biological diversity is considered as one of the tools.

- A Model Community Forest Award. Since 2008 the Royal Forest Department together with the Ratchaburi Electricity Generating Holding PCL. has annually organized a competition on a model community forest. The selected community forests as the national winner will receive a Princess Sirindhorn trophy, honorary plaque, and a cash prize of 200,000 Baht. In addition, there are prizes for 3 runner ups and a prize for the distinct community on "Best application of local wisdom on and use of community forest". Each prize is 100,000 Baht in cash. During the years 2008-2013 the winners have been awarded to Khao Wong community forest in Nong Bua Rahew district, Chaiyaphum province; Ban Ta Papao community forest in Mae Ta district, Lamphun province; Ban Rai Burapha community forest in Wua Sor district, Udon Thani province; Ban Klang community forest in Muang district, Phang-Nga province and Ban Huay Sapan Samakki community forest in Phanom Tuan district, Kanchanaburi province.

- The Green Globe Award. The project has been implemented since 1999. It is the continued project of the forestation project to commemorate His Majesty the King, carried out by PTT. The goals of this awarding project are to support and compliment projects on natural resources and environmental conservation, implemented by individual or group of individual, to be a good role model to others. The awards include cash awards of 250,000 Baht for community project, 100,000 Baht for individual, 50,000 Baht for youth group, 50,000 Baht for best written document, 10,000 Baht for youth written document, 100,000 for press and media, etc.

***Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.***

At present the industry and business sectors of Thailand have sufficient knowledge, understanding, interest and responsibility on sustainable production and consumption. This has been the consequence of the principle and vision of the Earth Summit since 1992. The Ministry of Industry has changed its role from "steering" to "preventing pollution" and introduced new knowledge and technology to the industrial and business sectors. It is understood that environmental care is not solely the responsibility of the government but the responsibility of both the industrial and business sectors, which will facilitate their business competitiveness as well. In addition, both sectors have learned more from international organizations and forum that the word environment does not only mean pollution, but also has linkage to natural resources which are the production capital. The production process that aims at the product quality which creates minimum impact on the environment is therefore a priority. This has positive impact on the global market competition and positive impact on the environment.

- The Strategy on Sustainable Production and Consumption has been highlighted in tenth National Economic and Social Development Plan (2007-2011). Before that, Thailand has promoted product with eco-label that is environmental-friendly. Consumers are promoted to choose green products. This will initiate the producer to use environmental-friendly production process. However, green market has not been successfully implemented in Thailand. The Pollution Control Department later on developed in 2007-2011 a plan for the government agencies to purchase environmental-friendly products and services. This plan complies with the green paper on integrated product policy (IPP). Concerned agencies have strictly applied this policy which creates positive impact on the green product market.

- The Industrial Standards Institute has continued on with the Green Label project initiated earlier in 1993 by the Thailand Business Council for Sustainable Development (TBCSD). The project has been widely accepted and well known among producers and consumers. The green label aims at preventing the nature from being destroyed by setting up pollution control and mitigation measures, in addition to promoting efficient resource management, and waste reuse and recycling.

- Thailand by the Department of Primary Industries and Mines also promotes the development of Eco-Town, in addition to promote industrial community by revising the town plan toward pollution controlled eco-town. The activities are also on promotion of knowledge and awareness, and initiation of public participation in environmental sustainable industrial zone management.

The target has been set that by 2018 there will be 11 eco-industrial town in the existing industrial areas of Samut Prakan and Samut Sakhon provinces, and of Map Ta Put industrial estate, including the new industrial areas in Chacheongsao and Prachin Buri provinces. Originally the eco-industrial town project has already been implemented in Rayong, Prachin Buri, Patum Thani, Chonburi, Phra Nakhon Si Ayutthaya and Saraburi provinces. At those sites, the public has been participating in the project and strict environmental management, industrial waste disposal, energy efficiency, and sustainable use of natural resources are enforced.

The promotion of clean production technology is another important measure implemented by the Industrial Works Department. The Department has policy and plan on clean production technology. The Industrial Environment Institute and the Federation of Thai Industries have promoted use of clean technology to the industrial sector, such that they are able to solve environmental problem through their point source pollution abatement while at the same time the production cost can be reduced. Such approach of sustainable development allows the industry to be able to compete at the global level. In addition, the principle of “environmental-friendly factory” is initiated in Thailand by the Thai Productivity Institute. Demonstration in the factory, seminar, training and result dissemination are organized for the industrial sector.

Other measures include development of environmental management system suitable for the industrial production sector, minimization of raw materials and production process waste, energy efficiency in the factory, promotion of efficient electrical equipments used in industrial production.

■ **Sustainable tourism** The sustainable environment principle has been introduced into Thailand tourism industry after the Earth Summit in 1992. Before that Thailand saw tourism was just a tool to promote the national economy. Therefore the use of ecosystem as the long-term tourism resources has been neglected. In 1998 – 1999 the Amazing Thailand year was announced and the committee on promotion and development of eco-tourism has been established. The local authority has been promoted to sustainably develop and oversee its tourist attraction sites. At present the sustainable tourism management is in place in the national parks. The number of tourist is limited base on the site carrying capacity. The project on green national park has also been implemented to aim at sustainably rehabilitating and developing the natural ecosystem. In addition, campaign on tourism to mitigate global warming has been implemented base on the national tourism guidelines “7-Green Project”, which with public participation and entrepreneur awareness on environmental quality, aims at rehabilitating and maintaining the environment. Besides, the green leave standards have been implemented by the Green Leave Foundation. Evaluation on water and air quality, purchasing procedure, energy efficiency status, and control of impact on the ecosystem is carried out for hotel that applies for the standards. At present there are more than 700 hotels certified with green leave standards.

■ **Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use**

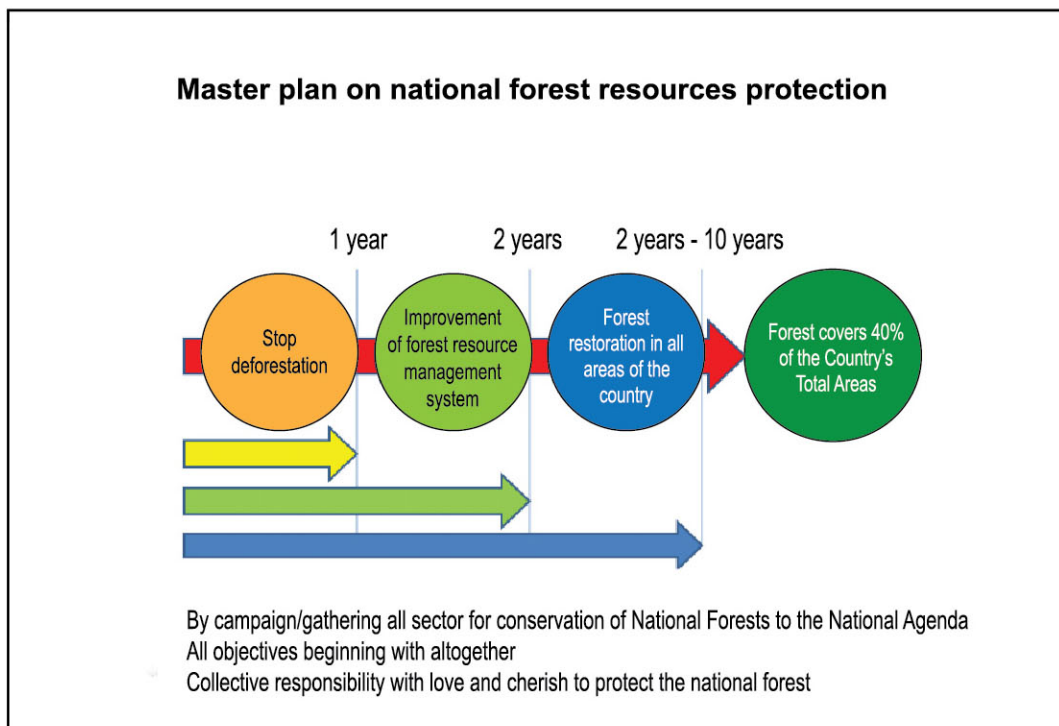
***Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero and degradation and fragmentation is significantly reduced.***

Thailand put a lot of efforts to reduce illegal forest tree cutting. Various approaches have been implemented for a long time by the Royal Forest Department and the National Parks, Wildlife and Plant Conservation Department. Recently even with support from and cooperation with the Royal Thai Army and the Royal Thai Police, the country still loses the forest area continuously. Encroachment during the past five years, from 2009-2013, has been shown in the aerial photographs that the 107 million rai forest area was reduced to 102 million rai in 2013. Each year one million rai is lost, with the total number of 370,000 cases arrested.

In 2014 the National Council for Peace and Order is aware that continuous loss of forest area is a severe problem for the national security. The Council therefore has issued an Order No. 64/2014 to declare the mission to eradicate and seize forest resources encroachment, by concentrating on suppression and arrest people who encroach, possess or degrade the forest; including intercepting illegal cutting of value or prohibited trees, illegal woods import and export along the borderline, and eradicate tree cutting networks in all villages and communities around the country. Cooperation among the Ministry of Defense, Ministry of Interior, Ministry of Natural Resources and Environment and the Internal Security Operations Command will be more stringent and strict. The Royal Forest Department aims to reduce the forest loss rate from one million rai per year to 200,000-300,000 rai per year. Activities to be implemented with the Community Organizations Development Institute and the National Farmers Council are revising aerial photograph information and set up guidelines to solve national preserved forests encroachment. Ground surveillance and database development will be implemented. Four types of encroacher can be categorized as follow.

- Those who have occupied the land prior to 30 June 1998 and complied with the criteria approved by the Cabinet, will be issued with a document to show their right to earn their living on the land.
- The poor who is eligible and complied with the criteria approved by the National Council for Peace and Order, is allowed to continue to live on the land.
- Investors, will be negotiated to return the land, otherwise will be prosecuted.
- The not-rich and not-poor group, and have been living in the preserved forest for 1-10 years, the community society will judge whether their eligibility to continue staying on the land or not. For investors who encroach the forest and build a resort, after the judge sentence, the properties must be dismantled and will be prosecuted for a fine of 70,000-150,000 Baht/rai.

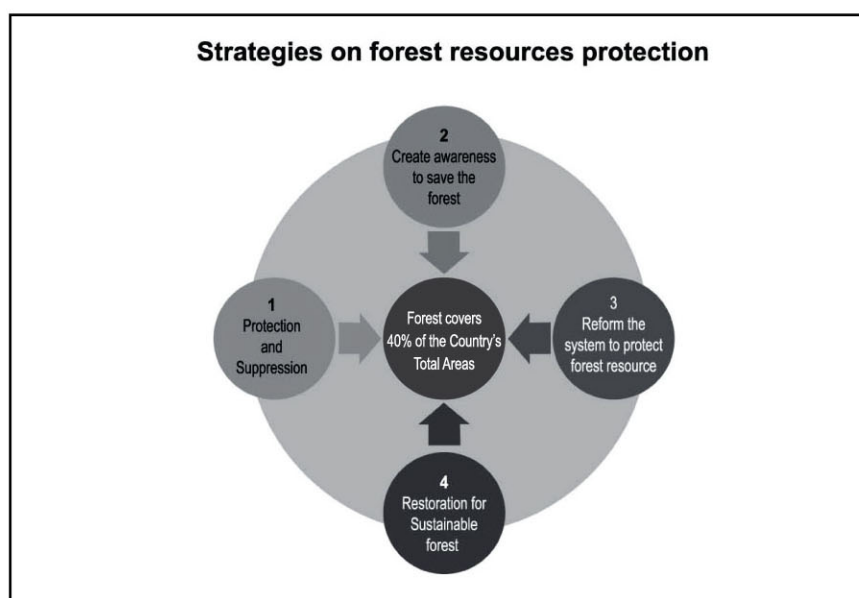
Later on 1 August 2014 the National Council for Peace and Order has approved the Master Plan on National Forest Resources Protection. The goal of the plan is to maintain by the at least 40 percent of the country total area as rich forests by the next 10 years. The visions of the plan which is the base for secured and sustainable national development are as follow.



**Figure 26:** Master Plan on National Forest Resources Protection

**Table 15:** The strategies on forest resources protection covers 4 aspects and 17 strategies.

<b>Strategies to Unite to Project and Control Forest Resource Destruction</b>	
Strategy 1	Stop forest resource destruction
Strategy 2	Establish Ad Hoc unit to protect and control forest resource destruction
Strategy 3	Promote public participation in protecting and controlling forest tree cutting
Strategy 4	Reclaim encroached forest, stop forest encroachment and solve problem of forest and man by using aerial photography and others as evidences
<b>Strategic on Awareness Raising on Forest of the Nation</b>	
Strategy 5	Set deforestation, tree cutting and encroachment as the national agenda
Strategy 6	Establish the public sector united front to raise awareness
Strategy 7	Raise awareness among officer to create pride
<b>Strategic on Reforming Forest Resource Protection System</b>	
Strategy 8	Improve forest resource protection system
Strategy 9	Establish forest management unit at the provincial and district levels
Strategy 10	Establish clear and uniform boundary of all types of forest
Strategy 11	Zone the forest resources and forest land use
Strategy 12	Revise laws and regulations that obstruct forest resource protection
<b>Strategic on Sustainable Forest Rehabilitation and Conservation</b>	
Strategy 13	Establish sustainable forest resource monitoring system with participation of the public
Strategy 14	Establish the national economic plantation system to substitute needs and reduce forest encroachment and tree cutting
Strategy 15	Happily co-living, man and forest
Strategy 16	Promote international cooperation on sustainable forest restoration and conservation
Strategy 17	Promote and support research on development of forest resource management



**Figure 27:** Strategies on Forest Resources Protection

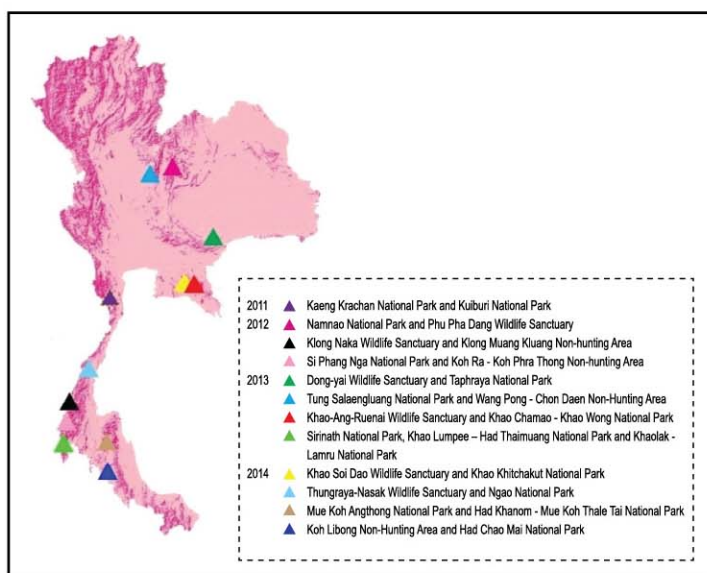
Thailand has tried to minimize ecosystem scattering. The protected areas have been divided into large and small pieces for agricultural purpose and for road development. Since the land is no more connected therefore the problem of elephant feeding on agricultural plots and elephant and other animals get hit by cars are common. The problem of genetic loss also reduces their chance of survival.

■ **Corridor forest of Khao Yai – Tab Lan Forest** Regarding to the 29<sup>th</sup> World Heritage Committee meeting in 2005, complying with Criteria 10 on important and significant natural habitats for in-site conservation of biological diversity, the Phaya Yen – Khao Yai is listed as the world heritage site. The area of 3.8 million rai covers Khao Yai, Tab Lan, Pang Sida and Ta Phraya national parks, and Dong Yai wildlife sanctuary.

■ The World Heritage Committee recommends that Thailand establishes a corridor to connect Khao Yai and Tab Lan forests since highway 304 has separated these two forests. It is necessary to establish a wildlife corridor to increase biodiversity and prevent wildlife from car accidents. From various researches the National Parks, Wildlife and Plant Conservation Department has developed a preliminary plan to construct a bridge at kilometer 24<sup>th</sup>. The length and height of the bridge are 330 and six meters, respectively, and consists of elevated road and tunnel to serve as animal walkway between the forests. Guided platforms will be installed to direct animals to the right way. Noise barrier will also be installed to avoid animal disturbance. The Department of Highways is responsible for constructing this bridge.

■ In addition, the third Greater Mekong Sub-region ministers' meeting in August 2011 has approved the project to develop corridor for biodiversity conservation among the Greater Mekong Sub-region (GMS BCI) Phase 2 with a project period of 5 years from 2012-2016. The 18<sup>th</sup> meeting of the Working Group on Environment of GMS held in China, has approved the project on development of corridor for biodiversity conservation of the GMS Phase 2. This Project consists of the development of the countries' and between the countries' corridors for biodiversity conservation.

Thailand will establish the forest corridor in two areas, at the western forest in Tanaosi mountain range and Kaeng Krachan forest. The goal is to use information obtained through this project for the establishment of another 19 forests. The information will also be the database for the project on the management of trans-boundary protected areas and countries of the GMS. The major goal of connecting the forests is to maintain the forest richness and integrity of the ecosystem, in addition to allow cross-breeding (to avoid in-breeding). At present the Kuiburi forest in Tanaosi mountain range with the area of 80,000 rai is very rich and is the source of various waters such as Huay Sua Hok, Huay Suan Kanun where water runs all year round. The forest should be declared as a part of the Kuiburi national park, or non-hunting area, so laws to protect the forest can be enforced and officers can be assigned to oversee the forest. There are much poaching and tree cutting now while the forest area has been continuously decreasing. From the study it is found that there are 16 animal species that are important for the forest ecosystem. Among them are tiger which is considered as an ecosystem regulator. Three preserve animals are found namely tapir, serow and. There is a link between the notification of 80,000 rai forest corridor and the notification declaring that Kaeng Krachan is a World Heritage Site.



In addition, there is a project on feasibility study of a development of ecosystem corridor of major forest of Thailand, the project to study and survey forest and wildlife biodiversity at the ecosystem corridor of Pa Klong Naka and Klong Muang Kluang wildlife sanctuaries in the forest of Klong Sang Khao Sok, a project to survey and develop a management plan for an ecosystem corridor of mountains and Andaman coastal zone in the forest of Klong Sang Khao Sok (areas between Si Phang Nga and Koh Ra-Koh Phra Thong national parks).

**Figure 28:** Shows twelve forest corridor study sites, during 2011-2014

**Source:** National Parks and Protected Areas Innovation Institute; National Parks, Wildlife and Plant Conservation Department, 2014

## Solving problem of Irrawaddy dolphin in Songkhla Lake

Irrawaddy dolphin (*Orcaella brevirostris*) is listed as one of the preserved wildlife under the Wildlife Preservation and Conservation Act 1992. The dolphin is also classified by the Thailand Red Data as critically endangered species. At the 13<sup>th</sup> CITES meeting in 2003 Irrawaddy dolphin is listed under the Appendix I and is international protected. In addition, Her Majesty Queen Sirikit has accepted the Irrawaddy dolphin under Her royal patronage. The Irrawaddy dolphin in the 295, 625-rai northern Songkhla lake or so-called Tale Luang, is one of very few dolphin species that can live in freshwater. Irrawaddy dolphin can be found in the other four sites in the world. The flight survey of the Department of Marine and Coastal Resources on 22-26 April 2013 located the herd of 15-20 individuals in the area between Koh Yai, Krasaesin district, Songkhla province and Lampam sub-district, Muang district, Phattalung province. The death rate is high. During August 2006 – June 2013, 63 deaths are recorded. The major cause of death, 50 percent, is trapping in net for catching Mekong giant catfish. The net mesh is large and the length of the net is more than 1.5-3 kilometer. The fishery ground overlaps with the habitat of the dolphin. Other factors are degraded environmental quality, pollution, discharge of wastewater from community, industry, pig farm and prawn farm, and sediment from soil erosion entering the lake. Cooperation among all concerned parties is urgently needed to solve the problem.

The Office of Natural Resources and Environmental Policy and Planning therefore has signed an MOU on solving the problem of threatened Irrawaddy dolphin in Songkhla lake, with Songkhla province, the Department of Marine and Coastal Resources, the Department of Fisheries, and the National Parks, Wildlife and Plant Conservation Department, on 12 December 2012. Its activities will be carried out in corporation with the business sector and the public, fisherman, and academic institutions. Seven measures are the following.

- Measure 1 – strictly control fishing gears that are dangerous to Irrawaddy dolphin, by buying back the net used for catching Mekong giant catfish and replace with the non-dangerous gears, in addition to stringent patrol by volunteer group (at present there are more than 300 members).
- Measure 2 – promote alternate sustainable fishery profession by release fishes and other aquatic such as shrimp into the nature, in order to increase aquatic animal catch, in addition to promote tilapia cage-culture.
- Measure 3 – cooperate with the “Committee on Phattalung-Songkhla dolphin networks” to improve the ecosystem of the habitat and feeding ground of Irrawaddy dolphin in the Tale Luang non-hunting area, by using local wisdom to establish the dolphin home at Mu 6, Koh Yai sub-district, Krasaesin district, Songkhla province and Mu 10, Lampam su-district, Muang district, Phattalung province. Ten rai is assigned to be the habitat area. Buoy around the 100-kilometer area is also improved to be used as the preserved habitat area for the dolphin.
- Measure 4 – promote knowledge on importance of the last herd of Irrawaddy dolphin of Tale Luang, through various media and exhibition.
- Measure 5 – support the business and other sectors to participate in Irrawaddy dolphin conservation. PTT Exploration and Production Public Company has signed an agreement on 22 March 2013 with the National Parks, Wildlife and Plant Conservation Department and the Department of Marine and Coastal Resources to carry out a cooperative project on Irrawaddy dolphin in Songkhla lake. The project activities include long-term support of research on the dolphin population, monitoring, and workshops to create cooperation among the business, public and local community sectors on Irrawaddy dolphin conservation.
- Measure 6 – capacity strengthening for Irrawaddy dolphin conservation networks, establish Irrawaddy dolphin museum at Lampam beach, Phattalung province, establish learning system through website: [www.LOMAIRRADEE.org](http://www.LOMAIRRADEE.org), and establish Irrawaddy dolphin in Songkhla lake conservation group.
- Measure 7 – monitor the death rate of Irrawaddy dolphin caused by trapping in fishing gears in Songkhla lake.

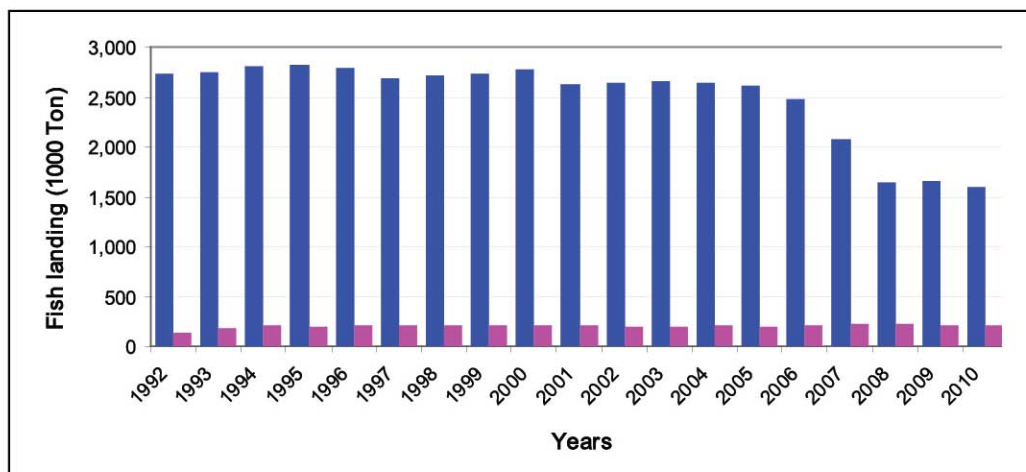


**Target 6: By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.**

Thailand by the Department of Fisheries has developed fishery control measures to avoid impact on the ecosystem, such as the following.

- Control and prohibit use of certain fishing gears in the spawning season of economic aquatic animals.
- Prohibit use of certain fishing gears such as trawlers at the 3,000 meters zone off the coast in order to preserve the small-scale fishery, and
- Declare preserved zone for aquatic animals in combination with release of economic aquatic animals and threatened species to restore their natural population. In 2013 millions of aquatic animals were released (freshwater animal - 1,384 million and coastal animals - 491million).

In addition, there is a study and research on new technology development for use to restore aquatic animals, including public participation in local fishery resource management. However, refers to the fishery statistical of the natural sites, the trend of marine catch has been decreased, while the freshwater catch is stable at 7 percent of the total catch or approximately 200,000 ton/year. This is due to the release back to the nature each year by various government agencies, and the measures to prohibit catching during the spawning season.



**Figure 29:** Catches of freshwater and marine animals from natural sites during 1992 – 2010 (SEAFDEC, 2011)

In 2010 the Department of Fisheries has developed a master plan for Thai fishery management 2009-2018. The fishery sector is very important to the Thai economy. There are more than 2.2 million labors hired in each year. The plan is developed with the goal to solve the problem sustainably, in addition to promote participation of fishery community and other communities on the coastal areas. The implementation results will be used to set up direction to solve problem and for developments since the Thai waters are degraded from overfishing and use of destructive fishery gears which drastically decrease the number of aquatic animal and has impact on way of life of the local fisherman.

Thailand ranks number eight of the world fishery exporter. The revenue is more than 300,000 million Baht annually. However the conservation and conservation of marine resources is neglected and has caused impact on local fishery. In addition, there is a problem of rapidly degraded coastal resources. It is therefore necessary to apply policies to promote sustainable coastal resources management, while maintaining the position as the world leader in fishery production technology and fishery product export. Some of the policies are on fishery resource restoration, regulate fishery in balance with natural production potential, reproduce aquatic animals, extend local fishery conservation area, develop safe and qualified fishery goods, restore Thai waters, improve and extend coastal fishery zone, and limit and prohibit use of destructive fishing methods such as trawler.

■ Since in 2012 Thailand has a problem of fishery product standards not accepted by competitive producers and decrease of fishery product (1995-2010 = 3.2-4.1 million tons and 2012= 1.9 million tons), therefore the Department of Fisheries and the Fishery Society of Thailand have signed the MOU to promote responsible and sustainable fishery and food cycle, towards safe and secured food production. The Fishery Society of Thailand, the Thai Grounded Fish Producer Society, the Thai Animal Food Producer Society, the Thai Frozen Food Society, the Processed Food Producer Society, the Thai Prawn Society, the Thai Tuna Industry Society and the non-Thai Waters Fishery Society, have signed the MOU which indicates the following measures.

- Measure to down size the small scale fishery. Enterprise, animal food factory, grounded fish factory, and process aquatic animal factory will not buy raw materials from fishing vessels for 3 months (1 April – 30 June, each year)
- Measure to support implementation of Market Mechanism Guidelines such as increasing the fishing net mesh size to 4 centimeter and employ legal labor, including support grounded fish factory towards good manufacturing practice (GMP).
- Measure to support and develop sustainable fishery, without ecosystem and environmental destruction.

The principle and justification of the MOU is to set up a basis to promote sustainable fishery, especially on continuously destroyed ecosystem. The goal is to push forward appropriate use of fishery resources, promote environmental-friendly fishery production system and product, develop secured and sustainable fishery production process and products. All parties will cooperate in drafting the legal harvesting rules, especially those to be used by approximately 1,000 Thai fishing vessels, and promote capacity building for concerned monitoring agencies, in addition to provide compensation for fisherman who bare high expenses. The whole action period will be around 2-3 years and will be implemented first on the Andaman coast.

Marine habitat restoration or installation of artificial reef. This activity has been implemented from 1987-2012 covered areas of 2,044.35 square kilometer or 0.49 percent of the country marine area. The installed artificial reef of the Department of Fisheries serves to restore coastal aquatic animal abundance, establishes new fishing ground for small-scale fishery and eliminates near-shore trawler and push-net fishery. There are many forms of artificial reefs, including the one developed through the local wisdom, which is made of bamboo woods and sand bags. These artificial reefs are installed by public participation at Ya Ring, Sai Buri, Mai Kan districts of Pattani province. The reefs made of concrete ring, concrete slab, tire and used container are installed at Rayong province.

***Target 7: By 2020, areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.***

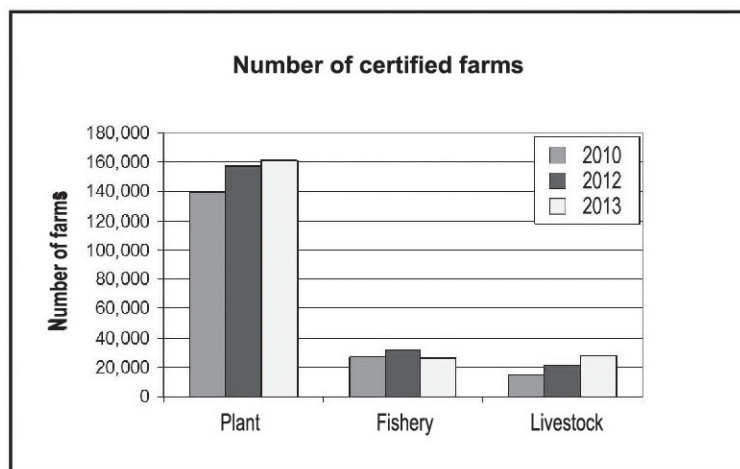
Thailand has a good progress on implementing standards on sustainable agriculture, aquaculture and forestry, ensuring conservation of the environment and biodiversity. This is the result of awareness among all parties, who apply international sustainable environmental standards to guarantee the origin of the products.

■ Thailand by the Ministry of Agriculture and Cooperatives has managed the crop, fishery and livestock areas. The government policy on quality promotion and development are used in the agricultural product standards, such that the product is accepted by the national and international consumer. Green economic is used to produce safe foods, while other activities are also implemented such as control of production process to be environmental-friendly, limit or stop use

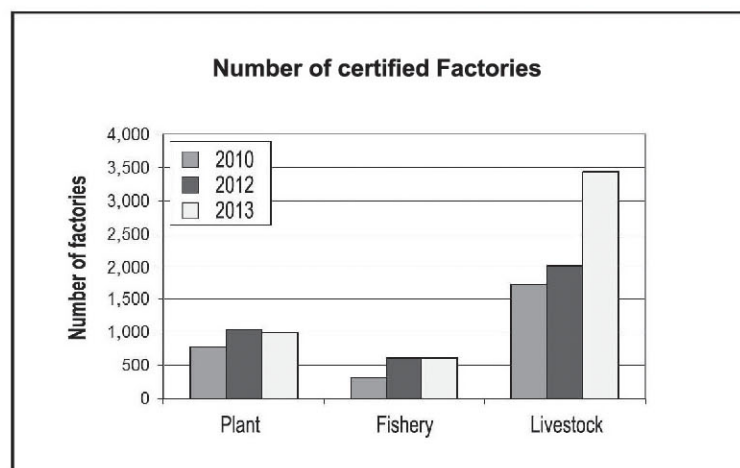
of chemical insecticide, identify legal farm site that does not encroach the forest, treatment of wastewater before discharging into natural courses, in addition to control and certify system for from-farm-to-table agricultural products, and increase of product inspection and certification efficiency.

- Farm and factory certification with Quality Management System, starting from plot/field to factory.
- Laboratory development to examine raw material used for production and issue of product standards that is free from chemical residue.
- Establishment of traceability system by using an electronic database system as the central system for use in controlling product quality, and to link with system of exporter, for a quick and accurate traceability.

The information on safe food and other agricultural product such as plant, fishery and livestock products during 2010-2013 indicate more and more number of certified farms, factories and agricultural products each year. This indicates more care has been place on the environment and biodiversity.



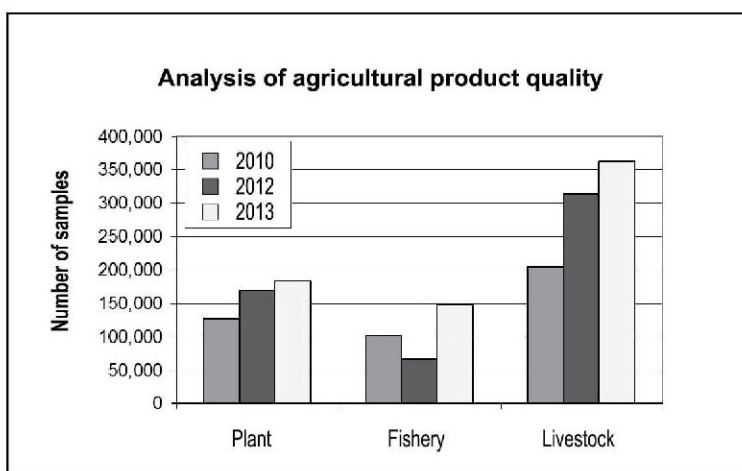
**Figure 30:** Numbers of farms had been certified and monitoring standard



**Figure 31:** Numbers of enterprises and factories had been certified

■ For sustainable forest management, the Forest Industry Organization plays major role in developing sustainable economic forest park, in addition to planting economic forest for almost one million rai. There is also a sustainable forest park management system in place by setting up standards on sustainable forest park management and implementing the Thai Industrial Standards Institute's standards on sustainable forest management system. Other standards are also implemented such as the FSC Principles and Criteria for Forest Stewardship (version 4.0), Revised ITTO Criteria and Indicators for Sustainable Management of Tropical Forests Including Reporting Format, and the Rainforest Alliance/Smart Wood Interim Standard for Assessing Forest management in Thailand. Such implementation respects the local community and indigenous people' right, that is, they have right to use and gain reasonable benefits from administrating sustainable forest park, under the specific criteria, rule and procedures. Moreover, there also are conservation and rehabilitation of biodiversity, protection and prevention of rare and/or endangered species, including their habitats, protection of ecosystem and landscape and vulnerable areas. The standards also states that the use of introduced species must be controlled, be cautious and monitored, to avoid environmental impacts.

Other companies include the Siam Forestry Co., Ltd. has a business on forest park and is certified under the FSC system.



**Figure 32:** Numbers of analysis of agricultural products quality

**Note:** No information available on 2011 due to heavy flood in Thailand

**Source:** Office of Agricultural Economic, 2014

In 2013 the Thai Chamber of Commerce and Board of Trade of Thailand saw the importance of sustainable environment, economic, and social related to the export of agricultural products. They have assigned the Sub-committee on Food Stability to seek for the food sustainability model, in order to solve problem of trade barrier. Rice is selected as the pilot product. Eight principles of the Roundtable for Sustainable Palm Oil standards are applied. They are 1) be transparency, 2) follow laws and regulations, 3) create economic stability in the long term, 4) follow good practice of palm oil handling, 5) protect the environment, 6) responsible for workers and community, 7) plant new palm with great responsibility and 8) continuous palm oil plantation development. The ten fair trade are also use in the Thai rice sustainability model (TRiSM) which are 1) create opportunity for less-opportune producer, 2) be transparency and describable, 3) develop to increase production potential and be environmental-friendly, 4) fair payment, 5) no child labor involved, 6) gender, race and religion equity, 7) good and safe working environment, 8) develop and increase production potential, 9) public relations on fair trading and 10) trade relationship.

TRiSM gives priority to rice safety (follow the good agricultural practice (GAP)), rice security, creation of new generation farmer, increase of production/rai, manual development (manual for member of the jasmine rice promotion project), increase of farmer income, labor laws, and equity. For the environment, carbon footprint, water footprint, use less water and reduce greenhouse gas (CO<sub>2</sub>, CH<sub>4</sub>) emission are the priority.

The next step will be the Sub-committee cooperates with the Land Development Department and the Rice Department, to use the map on soil development and to consult on GAP documents, respectively. In addition, the Sub-committee has applied the above eight principles of RSPO into its project on sustainable tapioca production.

**Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.**

Thailand made good progress on industrial pollution control. The industrial sector is aware of the impact of pollution on human health and ecosystem. In 2014, there is a trend the Financial Measures for the Environment will be approved by the legislative assembly and later on enforced. This ensures good control of pollution and its impact.

According to the Johannesburg Declaration on Sustainable Development of the World Summit on Sustainable Development in 2002 and the Manila Declaration on Green Industry in 2009, the Ministry of Industry realizes that the industrial sector is responsible for the greenhouse gas emission, and pollution discharge that has impacts on water and soil quality which are the feeding ground of plants and animals and consequently cause problem of food shortage. The change to production process that is environmental and ecosystem friendly will allow the industrial sector to sustainably exist in harmony with the community and the environment. The green industry project is then seriously initiated. The MOU is signed among concern agencies in the ministries, and network institutions, to unite to develop towards green industry. There are five levels of green industry as follow.

- Green Commitment – has policy to mitigate environmental impacts.
- Green Activity – successfully implemented activities to mitigate environmental impacts.
- Green System – has a systematic environmental management, monitoring system and environmental standards certified.
- Green Culture – all members of each agency participate in action that is environmental-friendly.
- Green Network – has network, partner and ally that also participate in the green industry certification process.

In 2004, more than 12,000 industrial units are certified at levels 1-4. The very first level 5 certification is granted to the Thai Cement (Lampang) Co., Ltd. in May 2014. The company takes part in supporting more than 450 companies to participate in the green industry project. In addition, the company has activities that are accepted by the community. Ninety-seven percent of the labor is hired from the local to work on community economy development and environmental conservation, including to work on the projects to conserve water for the future, to install dike, Do It Green project, etc.

The Ministry of Industry set a target that by 2018, 35,000 industries, of which mainly are SMEs, will participate in the system.

The Industrial Works Department, Ministry of Industry, in 2013 is aware and sees the importance of river conservation and sustainable industrial development. The Project on “United industry to protect river” has been implemented during 2013-2014. The objectives of the project are to prevent and solve water quality problem of major rivers, with pilot activities on six rivers where numerous factories are found, such as Chao Phraya, Ta Chin, Lam Takong, and Bang Pakong rivers.

Through this project, more strict laws will be enforced. In 2013, 641 factories are randomly inspected and 14 of them are found to discharge wastewater into the river. For three consecutive discharges, the factory will be fined and imprisoned for two years. In addition, the ministerial regulation on siting criteria for factory on the river bank is being drafted. The distance to the river will be change from 50 to 500-1,000 meter. Visual pollution will be one of the concerns. The law on transfer of hazard industrial chemicals are also being drafted.

■ In 2010, the Pollution Control Department has developed a manual of good practice to mitigate pollution from rice field. The goal is to reduce organic matters in the form of BOD, nitrogen and phosphorus, and reduce chemical pesticide in the water discharged from the rice field. The manual topics cover selection of rice species, selection of rice grain, selection of chemicals, use of herb as pesticides, and integrated agriculture.

■ In August, with the polluter pay principle, the Fiscal Policy Office of the Ministry of Finance has drafted the Financial Measures for the Environment Act. The Act will promote environmental management and create incentive to mitigate pollution, and change production and consumption behavior such that less pollutant will be discharged. Six economic tools are the following

- Environmental tax – a tax collected for discharging pollutant, and tax for natural resources and environmental conservation.
- Pollution management fee – a fee for waste disposal and treatment.
- Product tax and fee – money collected from producer or importer of product that may cause environmental impact.

- Deposit for environmental risk and damage – can be in the forms of bond or deposit agreement, to ensure there will be no environmental impact.
- Trade of right to use natural resources and to discharge pollutant – a legal sell of the right, to transfer the right to use natural resources and discharge pollutant to the environment to the buyer
- Measures to support and promote, including tax reduction, provision of subsidy or low-interest loan, for products, activities or any operation that are beneficial to environmental quality enhancement and conservation, and natural resources management.

The Act at present is being submitted to the Cabinet and the legislative council for approval. It will be used as an environmental management tool on top the existing measures that use control approach.

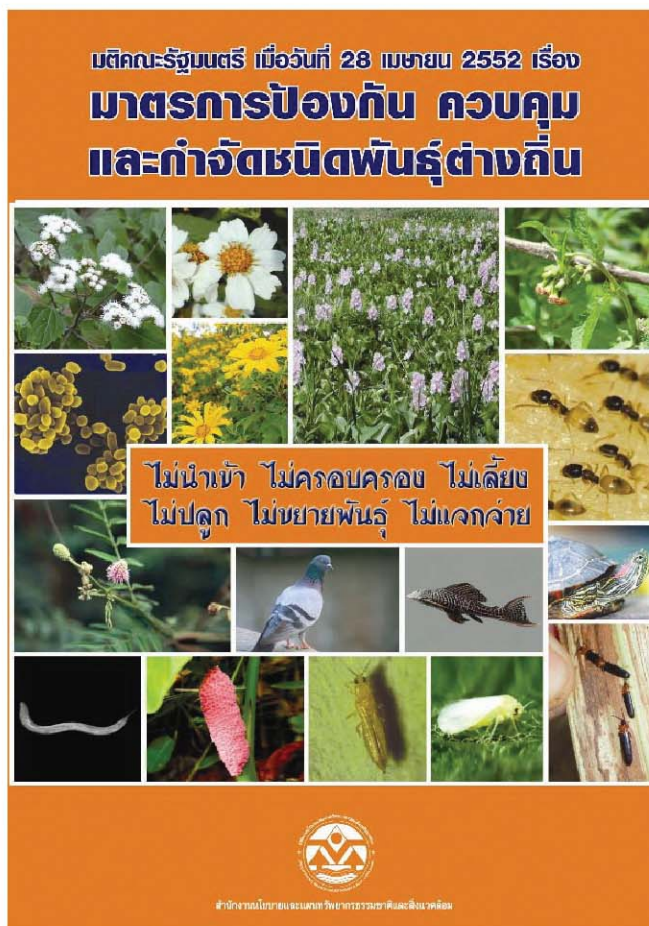
**Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment**

The Office of Natural Resources and Environmental Policy and Planning has implemented many ongoing initiatives and programmes regarding invasive alien species, both at policy level and implementing level, including encouraging related institutions and agencies to prevent, control and eradicate, by enhancing knowledge and understanding and establishing the Working Group on Invasive Alien Species under Sub-Committee on Convention on Biological Diversity to oversee and supervise works and implementation regarding invasive alien species. The eradication of alien species was the most implemented works, in particular the case of Water hyacinth (*Eichornia crassipes*), one of the most invasive species in the country.

The Cabinet Resolution on April 28, 2009, urges related agencies and institutions to adopt and implement Measures on the Prevention, Control and Eradication of Invasive Alien Species, which comprise of 4 operative measures according to the List of alien species in Thailand to be provided, control and eradicate. The above-mentioned list had classified alien species into 4 groups:

- List 1: Invasive Alien Species, with 81 species
- List 2: Potential Invasive Alien Species, with 52 species
- List 3: Invasive Alien Species in Other Countries but not in Thailand, with 49 species
- List 4: Invasive Alien Species not found in Thailand, with 91 species

The implementation on Measures on the Prevention, Control and Eradication of Invasive Alien Species has been monitored in every two year, the outcome shows that during 2009-2011, 14 out of 15 practical guidelines have been implemented, and 13 out of 24 agencies/institutions had implemented and cooperated in the guidelines. During 2012-2014, there were increasing number of government agencies/institutions implementing guidelines, including 5 organizations 9 academic institutions and 12 local organizations. All of the guidelines in each measure has been implemented, and related activities and works of local organizations, which are the pilot implementing agencies for alien species have been published and publicized to be role model for the others.



The Office of Natural Resources and Environmental Policy and Planning has coordinated and encouraged local organizations to implement Measures on the Prevention, Control and Eradication of Invasive Alien Species, and selected pilot areas in five provinces. The outcome of implementation in each province are as follows:

- Nakhon Pathom Province: has initiated campaign on enhancing knowledge and public awareness of Water hyacinth (*Eichornia crassipes*), in order to eradicate and make sustainable use of this invasive plant species. This initiative was included in the Annual Provincial Implementation Plan.

- Udon Thani Province: has initiated campaign on enhancing knowledge and public awareness of Golden apple snail (*Pomacea canaliculata*), and using Golden apple snails to make Bio Extract, by purchasing the snails from villagers at the price of 3 Baht per Kilogram, and trading 50 Kilograms of the snails for 10 Litre of Bio Extract.

- Phayao Province: has established the Committee on the Prevention, Control and Eradication of Alien Species, Phayao Province, chaired by the Provincial Governor and Provincial Office for Natural Resources and Environment served as Secretariat. Three major invasive species: Giant sensitive Plant (*Mimosa pigra*), Golden apple snail and Water hyacinth have been eradicated by local administrative organizations, in cooperation with relevant government agencies and local communities. In addition, Water hyacinth have also been used to produce organic fertilizer.

- Nakhon Ratchasima Province: the Provincial Office for Fishery has initiated “Snail for Fish: Get Rid of Rice Paddy Problems”, urging farmers to collect and trade Golden apple snail with Thai fishes. The other uses of Golden apple snail, such as making of Bio Extract and duck feed, have also been promoted and demonstrated to the public and communities.

- Nan Province: Nan Provincial Office for Natural Resources and Environment has published “Guidelines on Invasive Alien Species Management” and mobil exhibition regarding invasive alien species, to publicize and enhance knowledge and awareness on invasive alien species.

The Office of Natural Resources and Environmental Policy and Planning had published “Toolkits on List of alien species to be provident, control and eradicate” which contains description, photos, characteristics, places of origin and distribution of specific invasive alien species, including environmental-friendly eradication methods/techniques, to facilitate implementing officials and border control officers in identifying, controlling, preventing and eradicating invasive alien species effectively. Toolkits for alien species in Phylum Porifera, water flea, plants, mollusks, fishes, amphibians, reptiles, birds and mammals had been published.





- The Office of Natural Resources and Environmental Policy and Planning had also developed mobile exhibitions and publications, including booklets and brochures regarding invasive alien species, to enhance knowledge and better understanding of invasive alien species among the public of all ages.



● Regarding the identification and management of invasive alien species pathway, The Working Group on Invasive Alien Species had compiled related information and held a number of discussions/forums on these issues. In the year 2014-2015, the Working Group will implement ongoing works to develop measures on the control and management of invasive alien species introduction pathway, as well as to integrate The Cabinet Resolution on Invasive Alien Species into draft biodiversity law/regulation.

● The Department of Fisheries (DOF), recognized negative impacts from alien species to endemic species, had develop measures to address problems from invasive alien species, including :

- Measures to Control Introduction: Development of Royal Decree which prohibit the import of some animal species to the country, Estblishment of a Committee to consider and permit the import of aquatic animal species, Development of Guidelines to address problems from aquatic alien species, and strictly regulate/monitor the import/export of aquatic animals.
- Study/Research: Policy regarding Research on Biology, in order to develop comprehensive guidelines to control alien species population.



- Measures to prevent, mitigate and address problems: Publicize and inform the public of negative impacts from aquatic alien species to endemic animals and the environment. Campaign not to release alien species into natural waterbody has also been promoted. In particular the case of Sucker catfish (*Hypostomus plecostomus*), the DOF urges villagers and communities to release Common snakehead and Eel in stead of Sucker catfish, encourages every provinces to trade collected or raised aquatic alien species with endemic fishes, and held "Sucker catfish Free Day" to promote the eradication of Sucker catfish.

The Department of Agriculture Extension has promoted eradication of invasive alien species in agricultural ecosystems in various methods, including biological control. For example, during the spread season of Rice Hispa (*Dicladispa armigera*) and Coconut black-headed caterpillar (*Opisina arenosella*), Trichogramma Wasp (*Trichogramma spp.*) and Bracon hebetor (*Habrobracon hebetor*) were released to control eggs and pupa. In case of Pinkish cassava mealybug invasion, Green Lacewings (*Plesiochrysa ramburi*) were released to cassava field to control Pinkish cassava mealybug population. The Department of Agriculture Extension has also informed the public of severe impacts from Golden apple snail, encouraged the conservation of its natural enemy, including Open-billed stork, Coucal, rats and ducks, and held annual Golden apple snail eradication event.

- The Department of Agriculture, had provided *Salvinia cucullata* Roxb. as prohibited object according to the Plant Quarantine Act, and has continuously surveyed the spread and invasion of alien plant species in agricultural ecosystems.

- The Department of National Parks, Wildlife and Plants has continuously surveyed the spread and invasion of alien plant species in protected areas throughout the country, and had mandated relevant officials to implement the Cabinet Resolution of 28 April, 2009, to prevent, safeguard and monitor alien plant and animal species in national parks, wildlife sanctuaries and wildlife non-hunting areas.

- The National Biological Control Research Center has introduced Seed bruchids (*Cantheoscelides sp.*) for biological control of Giant sensitive plant, the outcome was about 15% successful. The Department Of Royal Highway has eradicated Giant sensitive plant occurred alongside the highways (not far other than 3-5 metres from the road), and The Royal Irrigation Department has eradicated Giant sensitive plant that had severe impacts in irrigation systems, which used high costs for implementation.

**Target 10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.**

Thailand has encountered the loss of coral reefs, since threats to coral reefs have occurred continuously. At present, the country still not have strategy to conserve and restore coral reefs specific to climate change impacts, but have only contingency plans for emergency situation, such as severe coral bleaching in the year 2010, and the situation of crude oil over 50,000 liters was leak from pipes in PTT Company refinery pipeline system, 20 Km offshore, and oil spills had landed at Prao bay, Samet Island on July 2013, which caused significant damages to coastal and marine ecosystems, including coral reefs in the area.

In the year 2010, sea temperature rised from 29 to 33 degrees Celsius between March-June, which caused widespread coral bleaching, covering both sides of Andaman Sea and Gulf of Thailand. Coral bleaching in Andaman Sea were more severe than in Gulf of Thailand, especially in Surin Islands, Similan Islands, Phi Phi Island, and islets of Phuket Island. Staghorn coral or branching coral and tabulate coral have died more than massive coral.

Scientists and experts had brainstormed to seek for solutions and proposed measures to rehabilitate coral reefs as follows:

- All marine national parks effected from coral bleaching closed, to avoid more damages that can occur from tourist activities, in particular diving.
- Surveillance and suppress illegal fishing, and overharvesting of coastal and marine resources.
- Encourage the prevent of waste water from ships and inland infrastructures released to the sea.
- Encourage the prevent of silt and/or alluvial soil from coastal development released to the sea.

Tourist entrepreneurs have agreed to address problems regarding wastewater released from hotels, resorts and tourist facilities to the sea, and trawlers that caused damages to coral reefs, as priority actions.

The Department of National Parks, Wildlife and Plants has closed some parts in many marine national parks, which means tourists are not allowed in the area. In order to support rehabilitation activities, which will take approximately five years. In addition, not more than 15 tourists were allowed to swim and dive in the sea per round. The Department of Marine and Coastal Resources has coordinated and informed 26 marine national parks, local administrative organizations and tourist entrepreneurs of coral bleaching status and trends, and seek for cooperation in the development of plans to minimize tourist activities that will likely to have negative impacts on coral reefs.

During the year 2012-2014, The Department of Marine and Coastal Resources has cooperated with the Royal Navy and relevant sectors to release wrecks of Royal Naval to seabed, in order to increase tourist attractions and diving spots, and to minimize impacts to coral reefs. The Department of Marine and Coastal Resources also has work plan to monitor climate change, in particular the rise of sea temperature, ocean acidification, diseases and endurance of corals to future changes in marine environment.

Thailand also has Master Plan on Fishery Management (2009-2018), which provides strategies to control fishing efforts according to available resources in a sustainable manner, and Action Plan on the Management of Wastewater from Fisherman's Wharf, Jetty and Fish Market (2013-2017). In addition, training courses on coral reef conservation were provided to teachers, students, guides, villagers and fishermen in thirteen coastal provinces where coral reefs exist, many coral and coastal resources conservation communities were established, such as Coral Guard Volunteer Group in Phuket Province.

Many tourism entrepreneurs and business sector has develop initiatives to minimize impacts from tourist activities, for example:

- Since 2008, Green Fins-Thailand and the Ocean Conservancy have cooperated with the Department of Marine and Coastal Resources and coastal provinces to held annual activity to "cleaning up the beaches" in celebration of World Ocean Day, 8 June, and develop networks and manual on how to eliminate garbage in the sea.
- Chevron Company had cooperated with Biodiversity Research Center of Excellence Prince of Songkhla University, placed mooring buoys in popular diving spots at Koh Tao, Surat Thani, to avoid damages caused by anchor to coral reefs.

- Regarding inland pollution, garbages, wastewater and greenhouse gases emission, which all are threats to coral reefs, Thailand has initiated the "Low Carbon Municipality" campaign in many coastal municipalities. Klang sub-district municipality, Rayong Province, has implemented outstanding environmental-friendly activities that help reduce greenhouse gases emission, and had been selected as "Outstanding Model for Low Carbon Municipality". From this regard, The Municipality Association of Thailand, in cooperation with Thailand Environmental Institution foundation, has extended the "Low Carbon Municipality" to 84 pilot coastal municipalities.

- Related researches indicated that one of the best ways to help conserving and restoring degraded coral reefs is to conserve fishes live in coral reefs which have much contributed to coral reefs protection, in particular parrotfish, which feed on seaweeds that compete corals in photosynthesis process and can help mitigate coral bleaching, in recent years parrotfish have been caught and sold in many supermarkets in Bangkok. In mid 2014, there was the campaign to stop selling, which received much supports from the public, finally, after 3 months of the campaign implemented, the awareness of the fish's important was well accepted and parrotfish were not sold anymore.

■ **Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity**

***Target 11: By 2020, at least 17 percent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes***

Terrestrial and inland protected areas in Thailand covers more than 17% of the country' total areas, and marine and coastal protected areas covers more than 10% of the country' marine areas. However, there still was some challenges regarding the protection of all threatened species and the comprehensive network to protect critically threatened ecosystems effectively. Therefore continuing efforts to protect habitats of those species have been implemented from relevant organizations, communities, business sectors and the public.

Legal protection of protected areas in Thailand are in the responsible of the following government agencies, according to the types of the areas and resources : The Department of National Parks, Wildlife and Plants, the Royal Forest Department, The Department of Marine and Coastal Resources, the Office of Natural Resources and Environmental Policy and Planning, the Department of Fisheries and the Department for Development of Thai Traditional and Alternative Medicine.

Strictly and legally protected areas in Thailand include: 127 national parks ( total areas of 62,198.86 sq.km.), 58 wildlife sanctuaries (total areas of 36,578.72sq.km.), 67 wildlife non-hunting areas (total areas of 5,233.04 sq.km.) covering 20.26% of the country' total areas. Furthermore, additional 25 conservation areas were prepared for the establishment as national parks, wildlife sanctuaries and wildlife non-hunting areas.

In addition, there are 111 forest parks, 71 arboretas and 1,221 national reserved forests (total areas of 230,280.65 sq.km.), various types of forests and mangrove forests, and 4,500 aquatic flora and fauna preserved areas (total areas of 800 sq.km.)

Most of protected areas in Thailand cover areas in high land and mountainous areas, which have high level of biodiversity. However, lowland forests which have unique biodiversity, have not receive sufficient protection, as well as floodplain forests, peatswamp forests, dry dipterocarp forests and beach forests, while mangrove forests was protected but utilization can be allowed.

Thailand has 21 established marine national parks, which 6 parks located in Gulf of Thailand and 15 parks located in Andaman Sea, covering total areas of 5,812 sq.km., or 1.8% of the country's total marine areas. However, most of the parks has the total less than 1,000 sq.km. which may not enough to allow effective protection of habitats of large marine mammals.

More than 50% of coral reefs in Thailand are protected under the above-mentioned marine national parks. 34.7% of seagrass beds, covering total areas of 52.09 sq.km., are protected under marine national parks, and only 7% of mangrove are protected under the above-mentioned marine national parks.

In 2010, the National Committee on the Conservation and Utilization of Biodiversity has established the National Multilateral Advisory Sub-Committee on Protected Areas, to give advice regarding protected areas management, facilitate implementation of Programme of Work on Protected Areas, and strengthen technical capacities to improve efficiency of protected areas. Later in 2011, the National Multilateral Advisory Sub-Committee on Protected Areas had decided to established the Technical Working Group, to analyze the gap of existing protected area systems in conserving critically and threaten species and ecosystems, and prioritized the areas that need urgent actions.

**Enhancing protected areas network:** many marine and coastal ecosystems including islands in Thailand are protected under existing protected area systems, including: 24 marine national parks, 7 wildlife non-hunting areas, and 6 environmental protection areas. Aquatic flora and fauna preserved areas and fis cover 40.3% of total coral reef areas, 35% of total seagrass areas and 7% of total mangrove forest areas. However, all of mangrove forests in the country has already classified as national reserved forests, according to the National Reserved Forests Act. 1964.

- The Office of Natural Resources and Environmental Policy and Planning, and the Department of Marine and Coastal Resources had seek to encourage the formulation of laws/regulations to protect the Inner Gulf of Thailand, and brackish water ecosystems in major estuaries, including Bang Pakong estuaries, Chao Phraya estuaries, Ta Chin estuaries, Mae Klong estuaries and Bang Taboon estuaries, which are habitats of marine mammals such as Irrawaddy dolphin (*Orcaella brevirostris*), finless porpoise (*Neophocaena phocaenoides*), Indo-Pacific humpbacked dolphin (*Sousa chinensis*) and Bryde's whale (*Balaenoptera edeni*). Furthermore, the Inner Gulf of Thailand is the breeding sites of more than of 50 species of migratory bird species, including critically endangered spoon – billed sandpiper (*Calidris pygmeus*). Khoke Kham Nature Conservation Community, supported by Bird Conservation of Thailand, has done ongoing efforts and outreach programmes to , encourage the nomination of wetlands in Inner Gulf of Thailand at Khoke Kham Sub-district to be designated as Ramsar Site. Meanwhile, the Office of Natural Resources and Environmental Policy and Planning has implemented to designate Don Hoi Lot Ramsar Site at Mae Klong estuaries, Samut Songkram Province, which its fertile mud beaches are habitats of various species, especially razor clam (*Solen regularis*) as environmental protected area.

- For the outer Gulf of Thailand areas, in June, 2014, The Office of Natural Resources and Environmental Policy and Planning had designated environmental protected areas at Koh Samui and Koh Phangan, Surat Thani Province, covering 42 islands and some parts of water bodies in Surat Thani, for 5 years period, in order to protect peatlands and mangrove forests, to prevent physical changes of the beaches, as well as forest and land clearing. These protected areas are habitats of coral reefs, sea turtles, whales and dolphins.

- Munnai Island, Rayong Province had been protected under H.M. the Queen Initiative, to be the center for the conservation and greeding of sea turtle. In addition, Kram Island, Chon Buri Province, has been protected by the Royal Navy, to serve as the spawning site of sea turtles, including hawksbill turtle (*Eretmochelys imbricata*) and green turtle (*Chelonia mydas*), and Kham Island, which the Royal Navy has develop the "Undersea Park", to rehabilitate coral reefs, and to be the tourist attraction and learning center of coastal ecosystems.

**Protected Areas in Mountain Ecosystems:** Many high mountains in Thailand have been protected as national parks, wildlife sanctuaries and wildlife non-hunting areas, such as Khao Kho National Park, Khao Sam Roi Yot National Park, Phu Kradung National Park, Doi Inthanon National Park, Doi Suthep-Pui National Park, Phu Hin Rongkla National Park, Phu Soi Dao National Park, Doi Luang National Park, Doi Phukha National Park, Doi Pha Hom Pok National Park, Doi Chiang Dao Wildlife Sanctuary, Doi Luang Wildlife Sanctuary, Doi Pha Muang Wildlife Sanctuary, Phu Khiew Wildlife Sanctuary.

- Limestone Mountains one of the biodiversity important areas with many endemic species, such as limestone rat (*Niviventer hinpoon*) and limestone wren babbler (*Napothera cripiifrons*), unfortunately some limestone mountains have not been protected, mostly from the concession to cement industry. In December, 2013, a serow (*Capricornis sumatrensis*) at limestone mountain in Sara Buri Province was beaten to death from workers in the cement factory located near the mountain, even though it was one of 15 species of reserved animals in Thailand, that has been legally protected. Serows were hunted from belief that its oil can cure wounds and broken bones. The Department of National Parks, Wildlife and Plants then has surveyed the area, and prepared to designate as wildlife non-hunting area, in order to protect serows.

**Protected Areas in Mountain Ecosystems:** 23 wildlife non-hunting areas has protected biodiversity in peatlands, marshes, bogs, canals, water reservoirs, etc., while many wildlife sanctuaries has protected biodiversity in rivers, canals, streams, and watersheds, such as Phachi River wildlife non-hunting area, Khlong Naka wildlife non-hunting area, Khlong Sang wildlife non-hunting area, Khlong Yun wildlife non-hunting area, Salween wildlife non-hunting area, Khlong Phraya wildlife non-hunting area, Thum Than Lod wildlife non-hunting area. Some rivers, canals, streams, and watersheds were protected under national park system, such as Kra Buri River national park, Mae Ngao national park, Kok River national park, and Thale Bun national park.

- Thailand has 33 inland water wetlands, according to the List of Wetlands of National and International Importance, that has been protected as national parks, wildlife non-hunting areas and wildlife sanctuaries. However, 14 Ramsar sites do not have specific laws/regulations to protect biodiversity in the areas and to facilitate ecosystem function.

- Some inland ecosystems are protected by local administrative organizations, such as Kabin Chalermratch Park, Prachin Buri Province, which is migratory sites for dabbling ducks during October to May, and was promoted as bird watching site and tourist attraction of the province.

Local communities in many areas have more involved in ecosystem protection, for example, Mae Rampeung Peat Swamp in Bang Saphan, Prachuap Khiri Khan Province, Mae Rampeung Conservation Group has protected the melaleuca peatswamp forest from smelter industry and harbors since the year 2005, to preserve biodiversity and ecosystem services in this peatswamp forest which are connected with coastal ecosystems, and had nominated Mae Rampeung Peat Swamp as wetland of national importance in 2009. At present, this peat swamp is in the process of Ramsar site nomination.

- Regarding threatened and endangered endemic species, the Office of Natural Resources and Environmental Policy and Planning has prepared the designation of "Onion plant Protected Area", since Onion plant (*Crinum thaianum*), rare and endemic species found in Ranong and Phang-Nga Province, which was threatened by development projects and overharvesting. In 2008, the Office of Natural Resources and Environmental Policy and Planning had included Onion plant in Thailand Red Data, then in 2010 had included Onion plant in the list of "10 endangered plants in Thailand". Later, in 2011, IUCN had included Onion plant in IUCN Red Data as globally endangered plant species, and then in 2012, the Office of Natural Resources and Environmental Policy and Planning has prepared the designation of "Environmental Protected Area" for Onion plant habitats, at present, the implementation is in the public hearing process.

**Target 12 : By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained**

Thailand has put all efforts to restore threatened and endangered species for a long time, including researches, breeding, study and assess to release the restored species into the wild, based on priorities identified in Thailand Red Data, and The Plan to Conserve and Restore 20 Animal Species and 10 Plant Species, which was developed in 2010.

● The Office of Natural Resources and Environmental Policy and Planning (ONEP) has continuously developed and updated **Thailand Red Data** since the year 1996, according to IUCN Red List Categories, through brainstorming related knowledges, suggestions and experiences from relevant experts, scientists and researchers. The ONEP has organized the meeting to identify the status of vertebrates in Thailand, including mammals, birds, reptiles, amphibians and fishes. Outcome of the meeting were the Red Data, or list of status of threatened and endangered invertebrates in Thailand, which has been updated every five years, according to IUCN criteria, and in 2005-2006, had compiled and published Thailand Red Data Series, as follows:

- ONEP Biodiversity Series Vol. 14 : Thailand Red Data : Mammals Reptiles and Amphibians
- ONEP Biodiversity Series Vol. 15 : Thailand Red Data : Birds
- ONEP Biodiversity Series Vol. 16 : Thailand Red Data : Fishes
- ONEP Biodiversity Series Vol. 17 : Thailand Red Data : Plants

In 2013 and 2014, The Office of Natural Resources and Environmental Policy and Planning (ONEP) has organized consecutive meetings to brainstorm related knowledges, suggestions and experiences from relevant experts, scientists and researchers, in order to update status of biological resources in Thailand, with cooperation from IUCN, to celebrate 50<sup>th</sup> anniversary of IUCN Red List . However, the status of invertebrates and bryophytes have not been identified.

● In the year 2010, the Office of Natural Resources and Environmental Policy and Planning (ONEP) has organized events and initiatives to celebrate the International Year of Biodiversity 2010, including the to conserve and restore 20 endangered animal species and 10 endangered plant species in Thailand, including Tiger (*Panthera tigris*), Asian elephant (*Elephas maximus*), Malayan Tapir (*Tapirus indicus*), Irrawaddy dolphin (*Orcaella brevirostris*), Dugong (*Dugong dugon*), Sarus Crane (*Grus antigone sharpii*), Eld's deer (*Cervus eldi*), Hornbill, Gurney's pitta (*Pitta gurneyi*), Black-necked Stork (*Ephippiorhynchus asiaticus*), Siamese Fireback Pheasant (*Lophura diardi*), Thai Giant Softshell (*Chitra chitra*), Sea turtle (Superfamily *Chelonioidea*), Gallus domesticus, Giant clams (*Tridacna crocea*), Giant mountain crab (*Potamon bhumibol*), Regal crab (*Thaiphusa sirikit*), Himalayan newt (*Tylototriton verrucosus*), Chaophraya Giant Carp (*Catlocarpio siamensis*) and Golden birdwing (*Troides spp.*), and 10 threatened plant species including Onion plant (*Crinum thaianum*), Vanda coerulea Griff., Trachycarpus oreophilus, Afgekia mahidolae, Paphiopedilum spp., Dendrobium friedericksianum and Dracaena loureiri.

**Sarus Crane** (*Grus antigone sharpii*) has been classified as extinct in the wild (EW) since have not been found in the wild for more than 50 years. Its habitats, mostly wetlands alongside paddy fields, have been threatened by community expansion, and the birds were hunted down since it was regarded as pest in the rice paddies. In 1997, The Zoological Park Organization had succeed in captive breeding of Sarus crane.

In 2008, The research on the release of Sarus crane to the wild had been conducted, through the assessment of potential wetlands in Thailand suitable to be the habitat of the crane. The result from the research suggested some water reservoirs and wetlands in Buriram Province, including Huay Jorakhe Mak Water Reservoir Non-hunting Area, Sanam bin Water Reservoir Non-hunting Area, and Huay Talad Water Reservoir Non-hunting Area to be the crane's habitat. The International Crane Foundation – ICF had cooperated and gave advice to related officials and communities, as well as provide staffs to facilitate the implementation, and with support from NGOs, Bird Conservation Society of Thailand, and conservation groups in Buriram Province.

In the year 2011-2013, 36 Sarus cranes have been released to wetlands in nature: 21 cranes have been released in Huay Jorakhe Mak Water Reservoir Non-hunting Area, and 15 cranes have been released in Sanam bin Water Reservoir Non-hunting Area. After the release of the cranes, the Zoological Park Organization and related organizations have regularly monitored the cranes and their habitats, with cooperation from local communities.

**Siamese crocodiles** (*Crocodylus siamensis*) have lived alongside rivers and canals, its population has continuously decreased since 1967, due to the hunting for skins and eggs, and the community expansion, at present there are only about 200 crocodiles live in natural ecosystems in Thailand. However, the breeding of crocodiles are significantly growing, there are more than 800 crocodile farms, which breed more than 200,000 crocodiles per year for commercial and tourism industry.

In 2013, the Department of Fisheries in cooperation with The Department of National Parks, Wildlife and Plants, Crocodiles Conservation and Breeding Association of Thailand, Crocodiles Cooperatives of Thailand, and Faculty of Veterinary, Mahidol University, have developed the “Crocodile Conservation in the Wild” Project, in continuation with the first stage project started in 2005, which monitored and surveillance crocodiles in major water bodies, such as Bung Boraphet, Kaeng Krachan National Park, Pang Sida National Park, Phu Khieo National Park and Khao Ang Rue Nai National Park. In the second phase, the project will release freshwater crocodiles which have been listed as protected animals with legal breeding permitted into their habitats. The Department of Fisheries has also coordinated in the DNA and genetic identification of the crocodiles to facilitate conservation of the crocodiles' unique genetic characteristics and to prevent

the spread of diseases and cross-breeding between freshwater crocodiles and salt water crocodiles, and promoted community's participation in crocodile conservation. Related communities in many provinces have well aware of the importance of crocodiles to natural ecosystems and biodiversity, and crocodiles were not heavily hunted anymore, conservation groups were established to facilitate the study, surveillance and conservation of crocodiles in natural ecosystems, with the assistance of local administrative organizations.

**Asian elephant (*Elephas maximus*),** In the past, there were more than ten thousand elephants lived in Thai forests. At present, the threats from habitat invasion and fragmentation, and hunting for ivory and tourism industry have caused the elephant population significantly decreased, Only about 3,000 elephants lived in 68 conservation areas, including 30 wildlife sanctuaries and 38 national parks. The important wild elephant conservation areas include: Kaeng Krachan Forest Complex, Dong Phrayayen-Khao Yai Forest Complex, Phu Khieo-Num Nao Forest Complex, Eastern Forest Complex, and Northern Forest Complex. The Human-elephant conflict occurs in some areas, especially in case of the elephants intruded and destroyed farm plants. The Department of National Parks, Wildlife and Plants has helped solving the problem by habitat improvement, including construction of water supplies and electric fences, planting elephant feeds, fund raising for elephant feeds etc.

His Majesty the King and Her Majesty the Queen have concerned of the current elephant situation, and encouraged relevant organizations and institutions to implement the "Thai Elephants under Royal Protection" Project, which comprises of 2 projects: The Elephant Habitat Restoration Project; and the Return of Elephants to the Wild Project. The two projects have supported 1,900 wild elephants, two-third of the entire population of wild elephants in the country. Regarding domesticated elephants, there are currently 4,000 elephants raised and in custody of private sectors (96%) and the Forest Industry Organization. The other problem is concerned with the elephants roaming in the city, especially Bangkok, the Department of National Parks, Wildlife and Plants had coordinate and request the Ministry of Interior to improve the Vehicle Act B.E.2482, to help identifying the elephants, and the Department of Livestock Development has developed database of domesticated elephants' health, and microchip planting to elephants.

**Eld's Deer (*Cervus eldi*)** have been continuously hunted and was critically endangered (CR) (IUCN 2012; ONEP. 2014), rarely found in nature for more than 50 years, only three Eld's deer were reported to be found at Huay Kha Khaeng Wildlife Sanctuary, Uthai Thani Province

In the past, there are two species in Thailand : *Rucervus eldii siamensis* and *Rucervus eldii thamin*. At present, there are only exist in captive breeding condition (approximately 50 *Rucervus eldii siamensis* and 1,000 *Rucervus eldii thamin*).

The Zoological Park Organization in cooperation with the Faculty of Veterinary, Mahidol University have done ongoing efforts to study and adopt artificial insemination technique to be used with Eld's deer, and have succeed in the year 2009, a female Eld's deer was born and named "Ung Pao", later in 2010, The Zoological Park Organization in cooperation with the Faculty of Veterinary, Mahidol University had released the Eld's deer and its mother into the wild at Salak Phra Wildlife Sanctuary, Kanchanaburi Province.

The Zoological Park Organization in cooperation with the Faculty of Veterinary, Chulalongkorn University, the Faculty of Veterinary, Kastsart University, Ag Research Institute, New Zealand, and Smithsonian Conservation Biology Institute , USA, had developed in vitro fertilization technique for Eld's deer, and successfully gave birth to the deer in October, 2011, the world's first in vitro Eld's deer was named given by H.M. the King as "Rohisratna", which means "glass deer"

**Chinese goral (*Naemorhedus giseus* – *Chinese goral*)** have lived in high mountains in Northern Region of Thailand, such as Thanon Thongchai Mountains in Tak, Mae Hong Son, and Chiang Mai Province, its population has continuously decreased due to the mountainous forest fragmentation, and the hunting for its oil to produce "Oil Of Chamois", which the main purpose to cure arthritis, so that it become critically endangered (CR) (ONEP, 2014), at present, there are only 300 Chinese gorals left in nature. Many organizations have put efforts to restore goral population ex situ, for example, Omkoy Wildlife Breeding Station has bred and reproduced Chinese gorals since 1994, then during the year 2012-2014, the Zoological Park Organization in cooperation with Chiang Mai Zoo and conservation networks, has prepared to reintroduce Chinese gorals to the wild.

**The Irrawaddy dolphin, (*Orcaella brevirostris*),** is listed as protected animals according to the Wildlife Preservation and Protecting since 1992. This species also classified as critically endangered in Thailand red data. Furthermore, in 2003, the Irrawaddy dolphin also reckon onto the Appendix I of CITES at the 13<sup>th</sup> meeting of the Conference of the Parties. And most of all, Her Majesty Queen Sirikit had adopted all Irrawaddy dolphin under her royal patronage. This peculiar

dolphin is considered endangered because it has restricted range of distribution which confined to small (ca. 473 Km<sup>2</sup>) freshwater part of the inner Songkla Lake where adjoined between Songkhla province and Pattalung province. A very small population of 15-20 dolphins was seen from aerial survey during April 2013.

Main problems that cause mortality in the Irrawaddy Dolphin is setting gill nets which aiming to hunt for the introduced Mekong Giant Catfish, (*Pangasianodon gigas*). Reports from the Department of the Marine and Coastal Resources, revealed that from 63 dolphins found dead during 2006-2013 and half of them die due to gill nets. Apart from gill nets, other point sources such as degradation of aquatic environments by discharged waste water from households, industrial plants, swine farms and shrimp ponds and also shallowness in dept of lake by accumulation of eroded sediments from highland would also suffering the dolphin population.

In order to ease this situation, the Office of Natural Resources and Environmental Policy and Planning as focal point agencies has launched the MOU with local government agencies, local business sectors, the Department of National Parks, Wildlife and Plant Conservation and also the Department of the Marine and Coastal Resources in 12 December 2012. The MOU is comprising of 7 measures which are

**Measure 1:** Control and regulated the fishing gear that might be violence to the local Irrawaddy dolphin population. Implementation of this measure is to buy the set gill nets for giant Mekong Catfish from local fishermen and change that gear into non-harmful fishing gear type and setting of surveillance volunteer group in order to monitoring the harmful fishing gear in targeted area.

**Measure 2:** Finding other economic important species for substitution of the Mekong Giant Catfish. The new fishing target species such as the giant freshwater shrimp (*Macrobrachium rosenbergii*) and the Nile Tilapia (*Oreochromis niloticus*) were selected. Seedling of native species including shrimp was released into the lake as well as culturing the Nile Tilapia in hapas was also promoted in order change the fishers main income.

**Measure 3:** Improvement of dolphin's living and feeding ground. Implementation for this measure was done by the Talelaung Wildlife non hunting sanctuary cooperated with local Dolphin save committee. By establishing of 2 Dolphin's house in the Songkhla and Pattalung province for permanent living area for dolphin and also setting or repairing of buoyancy mark as dolphin territory within 100 sq. km acreage.

**Measure 4:** Enhancing and promoting understanding on the last herd of the Irrawaddy dolphin of the inner of Songkhla Lake. To achieve this measure permanent exhibition, learning Medias both printed and electronically form was launched and disseminate to public.

**Measure 5:** Supporting the private sectors and other agencies to cooperate in the conservation of dolphins. On March 2013, the PTTEP had signed cooperation decree with the Department of National Parks, Wildlife and Plant Conservation and the Department of Marine and Coastal Resources in order to fund long term research grant on monitoring of change in population of the Irrawaddy Dolphin resided in the Songkhla lake. Furthermore, workshop on dissemination and cooperation in conservation of the Irrawaddy Dolphin was held for enhancing of cooperation between government agencies, business enterprises, and also local communities.

**Measure 6:** Enhancing and strengthening of the Conservation of Irrawaddy Dolphin Network. This measure was succeeded by establishing the dolphin museum in Lumpum district, Pattalung province and establishment of the Irrawaddy Dolphin learning center at website Website: [www.LOMAIRRAWADEE.org](http://www.LOMAIRRAWADEE.org) and establishing of the conservation of Lake Songkhla Irrawaddy Dolphin group.

**Measure 7:** Monitoring and Evaluating for diminish the mortality rate of the Irrawaddy Dolphin of Songkhla Lake caused by fishing gear.

**Returning of wild orchids into forest project**, the Department of National Parks, Wildlife and Plant Conservation had launched this project since 2011 to 2016. Some rare and endangered wild orchid species was selected and propagated by using of tissue culture technique. There were several species of wild orchid which succession on propagation by tissue culture since 2006 and these species were use as pioneer to be returned to their original habitats in conservation forests or at the area within responsibility of the Royal Development Project. In order to celebrate the 84<sup>th</sup> years of her majesty Queen Sirikit, the 84,000 stems or wild orchids was set to return to forest. Returning of propagated wild orchids to their own habitats was initiate at Khunjae Nation Parks, Chiang Rai Province on 2013. Five species of wild orchids included the silver dendrobium (*Dendrobium formosum*), blue foxtail (*Rhynchostylis coelestis*), Chang Kra (*Rhynchostylis gigantea* (Lindl.) Ridl.), vanda (*Vanda denisoniana* Bens.Rchb.f.) and aerides (*Aerides falcata* Lindl) were retruned.

Other species of wild orchids that has been restore into their own habitat by another agencies included;

**Lesser blue vanda**, (*Vanda coerulescens* Griff.) was classified as extinct in the wild by the office of national resources and environmental policy and planning (ONEP) and has been restore by the Department of Agriculture in 2011 onto hill evergreen forests in Northern of Thailand. By cooperating with the Queen Sirikit Botanical Garden, mature wild seed of this species was propagated on enriched seed culture media and keeping in horticulture hatcheries until restoration. Apart from re-habitation, keeping technique and tissue culture technology of lesser blue vanda was also transferred to commercial companies in order to promote this orchid as economic species. By cooperation with the National Parks, Department of Customs, the Royal Police office and Armory, the Department of Agriculture was established to monitoring and surveillance projects for prevent the illegal purchasing of wild orchids at every boarder markets.

**Mrs. Godfroyae lady slipper** (*Paphiopedilum godefroyae* (Godefr.-Lebeuf) Stein) is formerly common species in Souythern of Thailand. However, over-harvesting form natural habitats cause this species nearly extinct in wild. In 2012, the Agricultural Research Development Agency (Public organization) or ARDA was funded the Extension and Promotion of Agriculture station in Trang province to propagate 7 species of lady slippers found in Southern of Thailand by using tissue culture technique. The three years project aimed to produce at least 10,000 seedling of lady slippers (7 species) and restore seedling onto their habitats. This extension and promotion station was licensed to propagate these conserved species. Till now the thousands of lady slippers seedling was restore on the forests of the Southern Botanical Garden, Center of Science for Education and 2 local schools.

**Yellow Chantaboon dendrobium** (*Dendrobium fredericksianum*), this fascinated yellow dendrobium in native to eastern part of Thailand, especially the Chantaburi province. Local population of this species was extremely declined due to over harvesting and degradation of habitats. Aiming to restore this pretty wild orchid and honor to Her Majesty Queen Sirikit, the Chanthaburi Provincial Administrative Organization with cooperation from Khao Khitchakut National Park, Tamplaung Municipal and the Rajamangala University of Technology Tawan-ok (Chanthaburi campus) had launched the restoring of Yellow Chantaboon dendrobium to forest project. Project was initiated on 2002 by using tissue culture technique. Propagated seedling not only use for re-habitation purpose but also distribute to local government agencies as well as private firms for keeping in their gardens with hoping that this species will bloom everywhere as provincial symbolic.

**Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.**

As agricultural country, Thailand had realized about important on existence of native genetic of culturing plants, domestic animals and cattle and also wild varieties. Since new social popularity about selection of the local variety first as anxiety of extinction is considered. This popularity has induced activity for conservation and restoration of local varieties form many community networks around country. Examples of activities are;

- **National Center for collecting and operating of rice grain**, Rice Department had collected local variety of rice grains all over country at least 20,000 samples. Apart from specimens collection, the center also generate database on specific characteristics, evaluation value and classification for each local variety. This new database is hoping to stimulate member of country to re-consider on wild or local rice variety more.

- Since genes in wild variety of rice can be use to enhance diseases resistant and prevent insects attack. The Rice Department has launched long term project of research on genetic conservation of wild and local variety of rice during 2012-2016 and also perform the in situ conservation of rice at center of rice research in Prachinburi and Sakon Nakhon province.

With attention on extinct of wild and local rice variety, the Rice Department had attempt to select rice strain that can harvest with higher yield, drought resistance, resistant to brown plant hopper and high nutrition value roughly 100-300 strains annually.

Apart from breeding selection, the certification for pure breeding of local strain is important issue for conservation on local rice strains. In 2012, 3 strains of rice which are Leum Pua black sticky rice, Khao Banna rice, and flood resisting jasmine rice was certified and promote to public interests. To combat with un-harvest crop by flooding phenomena, the Rice Department had developed the deep water rice strain which can survive when flood occurs. Rice Department had aimed to certify 2-4 strains of local rice variety annually.



To prevent risk in loss of rice varieties by natural disaster such as flooding, the Rice Department is also setting the local rice collection network which acting as local rice genetic bank for each community. The local rice genetic bank would collect the certified local rice variety, or the local rice strains which suitable and in enough amount within their community. In this case the department would produce grain of the good strain and distribute to deposit in local genetic bank around country.

- Considering on extinction in local variety of fruits and vegetables, the Department of Agriculture had tried to conduct researches on value adding of local fruits and vegetable. The local fruits and vegetables meet the extinction situation due to give less benefits comparing to the selective breed or the commercial breed. Fruits such as the Garcenia fruit can be encapsulated as traditional medicine, or the local vegetable like the Garcinia leaves, the sour taste of leaves is good for making traditional style curry, if this curry was canned and being favored by consumer then this vegetable would be continue cultivated by gardeners.

- Local fruit and vegetable varieties can be revived by keeping in reserved area of specific research station or in a special genetic bank. Example of local variety of fruits such as varieties of Durian from Nonthaburi Province, the pomelo strains of Nakhon Pathom and Chainat province for example. Under activity of the Plant Genetic Conservation Project under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn, the department of Agriculture had successfully conserve numbers of local variety of fruits such as durian and pomelo. During mega-flooding in 2011, several places of good varieties such as Nonthaburi and Nakhon Pathom province were flooded and good variety plant had massive dead. After flooding, the DOA had extensively propagated reserve varieties and rehabilitate these variety to their original place. In 2012, DOA had returned 40 local durian varieties to Nonthaburi province.

- **Department of Livestock Development**, had gathered local breed of poultry from all over country since 1989. The stocking of local chicken varieties are used for genetic stock for improving of breed selection and development of new breed. Till now the local Thai chicken breed can be classified by using color plumage into 17 color shade.

- Thai wild horse is considered confronting of extinction, in the ancient time this horse variety was used in wars and transportation purpose. Now massive horse population is left in Lampang province for drawing buggies. DNA survey is revealed that this horse variety of closely related to the nearly extinct Mongolian Przewalski horse which only 150 individuals left in nature. Current situation for Thai wild horse is considering nearly extinct due to less favorable for Horse-drawn Carriages and this variety is replace by bigger size European horse. Thence, horses were sold for slaughtering. To alleviate wild horse population in Lampang province, the Lampang horse carriage association had survey and sampling the DNA of 50 suspected Thai horses and it was found that only 34 horses are real Thai variety. To purify Thai strain, the association had certified pure breed horses and preserved sperm of these horses in sperm bank. Furthermore, the association also tried to perform artificial insemination for Thai variety and 2 were succeeded.

**Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.**

#### **Wetlands**

- Awareness for scrutinize and preservation on forest ecosystem, headwater and stream ecosystems as food and water sources was commonly found in local communities rather than the policy maker and associated firms. Hence, considering on wetland ecosystem is less consideration than the forest ecosystem. At present, Thailand had lost more than 50 percent of wetlands area comparing to the past 60 years.

- As responding to obligation of the Ramsar Convention, after ratified on 1998, Thailand had declared 14 international important Ramsar sites which covered area about 4,011.34 sq. km., by resolution of the cabinet in 2000. In 2008, the revised resolution for specify the standard for protecting of wetlands, and improving of wetlands checklist which comprising of 69 sites for the international important wetlands, 47 sites of national important wetlands and also setting the conservation measure for general wetlands, especially the public wetlands which functioning as storage and support of water body.

- However, declining of wetlands still present due to illegal possesses, or by colossal construction projects, or invaded by invasive alien species. Even Thailand had a strong mechanism for monitoring, evaluating and problem determining by the wetland committee which will acting as technical consultants, considering and screening of management plans for wetlands and then pass for approval from National Board on Wetland Management and also the National Board on Environmental. However, lessons from past had indicated Thailand need a special act for wetland. This wetland act should



provide authority to related agencies in order to prevent, control the destruction of wetlands from illegal invaded, mega-land development project, and also controlling of invasive alien species. Hence, it is expected that the wetland act should be enforced among 2015-2020. It is also hoping that local communities still continue to implement and cooperate to conserve the ecological services of every wetland types with strong wishes.

### **Community forest**

Since 1999, the Royal Forest Department had established the community forests in order to conserve and restore local forests. Participating community will benefits the forest ecological service such as foods sources, herbs and herbal medicine, extra income, fire-woods, water reserve, and also reduction in releasing of carbon dioxide. Normally, the community forest had small area which small enough for community to prevent the illegal invasion, wildfire, prevent of take advantage till excess limitation of recovery by forest. Till now 9,000 community forests were registered with total area of 5901.3 sq. km.

The Ratchaburi Electricity Generating Holding Public Company Limited (Thailand) and the Royal Forest Department had cooperated to launched the project of "People conserve the forest, forest love the community" for promoting community participation on conserving of local forests. By supporting the 3 coordinators which are government, private sectors and local communities to create conservation network which aim to reinforce sustainable forests utilization by adjacent communities. Main activity has focused on "Sustainable forest can support community benefits". The project had awarded the best community forest at 3 levels which are province level, regional level and national level. Apart from funding supports, the project also established the learning center for community forest, knowledge transferring center in biodiversity, plants seedling hatcheries, and herbal garden for example. The project is evaluated as succession because the number of community forest was increasing comparing to before emerging of project.

The most example of community forests that wining the national reward are;

#### **Community forest of Ban Dong Huay Yen, Ban Hong District, Lampoon province.**

This community won 200,000 baht ( about 3450 US\$) award and trophy from Her Royal Highness Priness Maha Chakri Sirindhorn in 2012. This community forest used to be abandoned mine concession and forest was totally destroyed. Community has restore the forest, enforcement of own regulation for protecting forests and did several activities for forest restoration. At present community forest become pristine and fertile, re-occurring of wildlife till becoming source of water supplied and food to community. Another advantage from this community forest is for learning center and nature studying trails.

#### **Community forest of Ban Mae Kreet Laung, Mae Sot District, Tak province.**

This community won the best national award in 2013. With a very small area about 0.08 sq. km., the forest had surrounded with 6 villages. Communities had worked together to conserve their hill forest and headwater streams. Community also set the annual proceeding on forest destiny and reforestation, community tap water and nature trail for serving tourists.

- During 2009-2013, there were 70 communities won the green globed award. This award was really reflecting the role local communities on restoration and surveillance the head water of watershed forest, rainforest, freshwater swamp forest, coastal swamp forest, mangrove forests, sago forests, streams and rivers and seas for sustain communities source of food, water supplied, herbal medicine, and wood for example. Some example of global globe award winners were;

- The female unified group for sago forest, had initiate the project of conserving and restoration of 0.21 sq.Km. Sago forest in Trang province, Southern of Thailand. Establishing of group due to concerning of degradation and destruction of Sago forests by wetland development project. Sago is aquatic palm species that pack together like dense forest. Densing Sago plant become good habitat for fish especially juvenile fish. Other than that old Sago stem also accumulate edible starch which community can use this starch as carbohydrate source. Demolished sago forests would cause food shortage in community. Thence, the group had push several measures for managing and deforestation of Sago plants. Furthermore, the group also finding the way to get benefits from Sago forest as community enterprise such as making instant sago starch, sweepers, sleeping mat and learning center.

- **Ban Chao Lao local fishermen group, Tha Mai District, Chantaburi Province**

Group was assembled for against with threaten from commercial towing net, dragging net and pushing net. These harmful gears have destroyed mangrove forest, coral reef and seagrass bed until collapsing of aquatic community. With consultation from the Kung Kraben Royal Development Study Center, the group can restoring the beach forest,

mangrove forest, setting of artificial coral reef, established of blue swimming crab bank, conserve their seagrass bed. Other than that the group also held the education camp every 4 years for propagating and transplanting of seagrass, garbage cleaning out and exploring of forest biomass. Finally, the group can now transferring their knowledge to adjacent communities.

There are another communities that perform the activities related to conservation of water body such as rivers, lakes and pond with collaboration with private companies. The good example is River Mun Conservation Project. The project had started since 1966 at Nakhon Ratchasima province, Northeast of Thailand, by construction of the rubber barricade on river for storing of water until the community can grow rice twice crops per year. Apart from water storing, the project also tried to build small hydroelectric power plant for supporting their community desire. In 2007, the CPF company had support this project and provide some fish seedling as well as forest plant seedlings. The project decide to restored forest in area of upper barricade and announced fish sanctuary area 1.5 km downstream under the barricade. In 2014. Total 400,000 tails of fish were released and 1,900 trees were propagated on reforestation area. In order to sustained and giving education to young member, the project had organized the River detective which pertaining to using of aquatic organisms as water quality indicator in 2014 and 74 students from local school were trained by this program.

- Degradation of headwater watershed, and other related water body would also suffering the Metropolitan waterworks authority by increasing their cost in treatment chemical substances. To reduce this severe, the MWA with collaborating with UNDP and World Environmental Fund was grant the small communities living in headwater to engage the water conservation project under the Water for People' Partnership: Small Grants Program.

***Target 15 : By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 percent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification***

In recent years, Thailand has committed to restore and rehabilitate forest ecosystems, the implementation has been progressed in many aspects, with significant participation from concerned communities. However, it still cannot be evaluated that achieve the target of restoration of at least 15 percent of degraded ecosystems.

After the great flood crisis in 2011, which caused damages and losses worth of 1.44 million Baht, recognized that one of the major causes of flooding is the degraded forests that severely imbalanced ecosystem functions and resilience. The Cabinet had a resolution on 10 January, 2012 to develop the Master Plan on Water Resources Management, for 5 year period (2013-2017), which give priority to the restoration and conservation of watershed forests and ecosystems, as well as promoting of economic forests and community forests. The Ministry of Natural Resources and Environment, in cooperation with The Ministry of Interior, had done preliminary survey and found that there were degraded forests which have the potential for restoration, with the total areas of 18,560 sq.km., the main restoration activities are:

- Reforestation and restoration of degraded forests and ecosystems for the total areas of 1 million Rais, within five years, mandating The Department of National Parks, Wildlife and Plants to be responsible for conservation areas, the Royal Forest Department responsible for national park reserves, and The Department of Marine and Coastal Resources responsible for mangrove forests.
- Preparation to breed 800 million seedlings countrywide.
- Establishment of 116,051 Check dams and natural firebreaks with 4,800 kilometers length.

Thailand was aware of adverse impacts from the reduction of forest areas, and have done various efforts to restore forest ecosystems, and have initiate the Reforestation and Restoration Project, The Cabinet Resolution on 12 August, 2012, had mandated The Ministry of Interior and The Ministry of Natural Resources and Environment, implement reforestation throughout the country, developing workplans to restore and conserve forests and Chao Phraya River Basin in watershed areas of eight major river basins in the country, with total areas of 160,320 sq.km., and in areas of eight major river basins in the country, with total areas of 352,960 sq.km, through reforestation and restoration of watershed forests. The Department of National Parks, Wildlife and Plants, Royal Forest Department, and the Department of Marine and Coastal Resources:

- Reforestation and ecosystem restoration in conserved forests.
- Reforestation and ecosystem restoration in national reserved forests.
- Reforestation and ecosystem restoration in mangrove forests and coastal areas.
- In 2014, Thailand, by the Royal Thai Army, has initiate **the ASEAN Forest Project**, to reforest in the areas connected with neighboring countries in order to create healthy and fertile forest complexes for serving as "Lung of ASEAN". The project has three-years period from 2014-2017, by the Royal Thai Army Region 1-4, as leading implementing agencies,

coordinating with neighboring countries, organizing local and regional meetings, cooperating with all relevant governmental and private organizations, including villagers in the “Strong Villages Project” at the border areas towards cooperation in sustainable conservation of forest in bordering areas. At present, the Royal Thai Army Region 1-4 has surveyed the suitable 40 forest areas for the first phase of the project, at the Thai-Myanmar ASEAN Forest (Mae Sod-Meawwadi) which is the pilot ASEAN Forest, and has started the project in May 2014.

The Department of National Parks, Wildlife and Plants has initiated the “Return Wildlife to Heal the Forest” since 2011, to release 31 species of wild animals bred and raised in wildlife breeding stations into 29 conserved forests in three-year period (2011-2013). And in 2014, of wild animals bred and raised in wildlife breeding stations, such as Chinese goral, Eld's deer, Hog Deer, Sambar deer, Barking deer, Mouse deer, Peacock, Great argus, Grey Peacock-Pheasant, Pheasant and Spiny-breasted Giant Frog, have been released into 20 conserved forests. Local People in related communities and villages have participated in the releasing ceremony, and in natural resources conservation, including planting trees for use as animal feed, making artificial salt lick, monitoring and safeguarding released animals to maximize their survival.

Mangrove forests have been continuously decreased, from 3,680 sq.km. in 1961 to only 2,400 sq.km. at present. The Department of Marine and Coastal Resources, in cooperation with Chareon Phokaphand Food Co. Ltd. (CPF), has initiated the “Seed, Share, Save the Mangroves” Project, and developed the Mangrove Forest Strategic Plan: 2014-2018, to plant and restore mangrove forests in 5 provinces: Samut Sakhon, Rayong, Chumphon, Surat Thani and Krabi. This project gives priority to all stakeholders’ participation, established the committee to supervise mangrove forests protection, and developed specific work plan for each mangrove forest, In addition, works regarding knowledge and experiences sharing, reforestation, protecting existing mangrove forests and monitoring. CPF company has supported reforestation project since 1993, covering mangrove forests in 17 provinces and now has improved the ways and efficiency of the implementation, with focusing on local administrative organizations and communities.

Regarding biodiversity and urban areas, there is significantly increasing good trend since municipalities countrywide have more awareness of the importance and value of environment and biodiversity. The Municipality Association of Thailand has initiate the “Low Carbon Municipality” since 2012, with 16 pilot municipalities implemented under four main strategies: Green City; Pollution-Free City; Energy Saver City; and Sustainable City. The impressive outcomes: for example, Klang Municipality has planted trees along every roads and canals, established city parks, and introduced “Urban Agriculture” to communities; Chiang Rai Municipality has focused on ecosystem and biodiversity conservation, including Doi Sagen Forest, Doi Phrabaht Forest, and Nong Pung Wetland, and the survey and restoration of Inner Kok River and Mab Ummarit Municipality has continuously planted mangrove forests. At present, there are 171 municipalities participated in the project and it continues growing.

In this regards, The Office of Natural Resources and Environmental Policy and Planning has cooperating with municipalities participating in “Low Carbon City” and “Sustainable Environment City” project, to encourage the adoption of “Singapore’s Biodiversity Index” as guidelines for conservation and restoration of biodiversity in urban areas and municipalities, and had promoted Krabi Municipality and Nakhon Sawan Klang Municipality to participated in the ASEAN Regional Workshop on Urban Biodiversity Indicator, between 10-12 June 2014 at Singapore. In the next step, The Office of Natural Resources and Environmental Policy and Planning will develop the guidelines for conservation and restoration of biodiversity, based on Singapore’s Biodiversity Index, and provide to municipalities to used as guidelines for developing “Tree City” under The Low Carbon City Project.

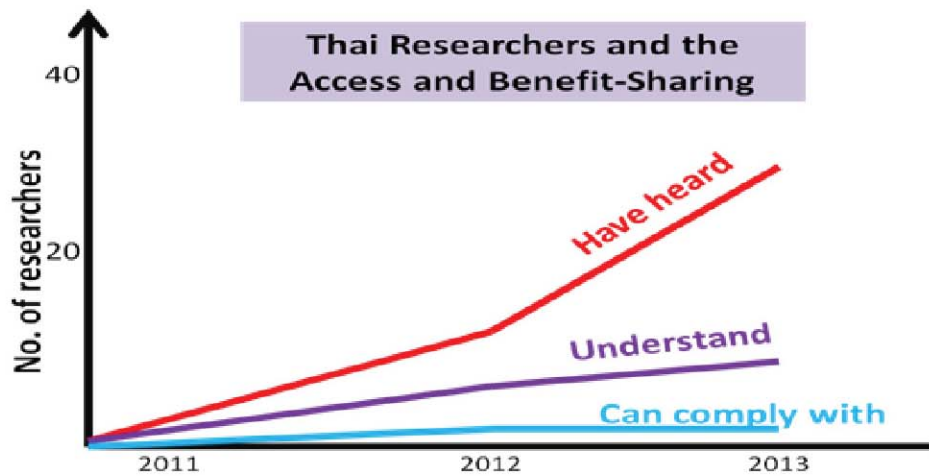
***Target 16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation***

Thailand still has not succeed in becoming the parties of Nagoya Protocol, but it was expected that the country will ratify the Protocol by 2015, However, there are related regulations at national level, and are in the process of drafting the Act.

The Office of Natural Resources and Environmental Policy and Planning has ongoing enhanced knowledge of the Protocol and access and benefit sharing from genetic resources, and Thailand had signed the Protocol on 31 January 2012.

Thailand has recognized the importance of the access to genetic resources, and the fair and equitable sharing of benefits arising from the utilization of such resources, has developed the Regulation of the National Committee on the Conservation and Sustainable Utilization of Biodiversity, on the Criteria and Means in the Access and Benefits of Biological Resources, 2011, which the Cabinet had approved on 11 January, 2011, and has been entered into force since 5 March,

2011. At present, 11 organizations have developed mechanisms to implement the above-mentioned regulation, the organizations which have already prepared to implement the works regarding access and benefit sharing are the Department of National Parks, Wildlife and Plants and the National Center for Genetic Engineering and Biotechnology.



**Strategic Goal D: Enhance implementation through participatory planning, knowledge management and capacity building**

**Target 17: By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan**

Thailand’s fourth national biodiversity strategies and action plans (NBSAPs) : The Office of Natural Resources and Environmental Policy and Planning, has developed the fourth national biodiversity strategies and action plans (NBSAPs), which covers a 7 year period between 2015 to 2021, which comprised of 4 main strategies to be implemented, which response to the Convention’s Strategic Plan (2011-2020) and the Aichi Biodiversity Targets, particularly in addressing the underlying causes of biodiversity loss through conservation, restoration and maintenance of as well as enhancing benefits from biodiversity and ecosystem services, and encouraging business sector engagement. This NBSAPs had been approved by the National Subcommittee on the Convention on Biological Diversity on 28 September, 2012, and are in the process of the Cabinet.

The Cabinet Resolution on September 4<sup>th</sup>, 2012, has mandated the Ministry of Natural Resources and Environment, the Bureau of the Budget, Office of the National Economic and Social Development Board, the Office of Natural Resources and Environmental Policy and Planning, and other relevant organizations, committees and sectors, to cooperate in

the review and integration of the development of the Strategic Plan on Biodiversity to be the most comprehensive plan to cover all aspects of access and utilization of biodiversity for all related stakeholders, including local communities's right and fair and equitable benefit sharing. The Office of Natural Resources and Environmental Policy and Planning, had prepared to develop the **Integrated Masterplan on Biodiversity Management 2013-2021**, which is the long-term plan to response to global targets in the Strategic Plan on Biodiversity 2011-2020 and Aichi Targets. This masterplan comprises of 4 strategies and 11 measures, as follows:

**Strategy 1: Integration of biodiversity values and management with participation from all levels**

Measure 1: Strengthening awareness and education on biodiversity.

Measure 2: Enhancing capacity in administration and management of biodiversity, and in the implementation of related international agreements.

Measure 3: Promoting community and relevant sectors participation in the conservation, restoration and sustainable utilization of biodiversity.

**Strategy 2: Conservation and restoration of biodiversity**

Measure 1: Conserving, restoring and protecting ecosystems, species and genetics.

Measure 2: Conserving and restoring biodiversity at provincial, local and community level.

Measure 3: Reducing the threats to biodiversity.

**Strategy 3: Building capacity for utilization and sharing of benefits derived from biodiversity in accordance to the principle of the green economy**

Measure 1: Promoting sustainable utilization of biodiversity.

Measure 2: Protecting and sharing of benefits derived from biological resources and genetic resources in fair and equitable manner.

Measure 3: Promoting researches and building capacities in development of bio-based economy.

**Strategy 4: Developing knowledge and database system on biodiversity, consistent with internationally recognized standards**

Measure 1: Promoting and developing management of knowledge on biodiversity.

Measure 2: Developing database system on biodiversity, consistent with internationally recognized standards.

This Master Plan had been presented to related sectors for opinion and suggestions, and had been approved in principle by the National Subcommittee on the Convention on Biological Diversity on 2 October, 2013, and are in the process of the development of action plan on biodiversity management.

***Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.***

According to Thai traditions, Thai people commonly have threat animals, plants, forests, rivers and other ecosystems with respect since ancient times. More than 90% of Thai traditions, beliefs and practices have connected with the sustainable use and safeguard biodiversity and resources, for example:

● **Forest Ordination:** Thai people have believed that "Forest Ordination" can contribute to the safeguard and protection of forests. This ritual is the good combination of Buddhist belief with conservation techniques to encourage the conservation of forests and natural resources. Communities will aware that forest which had done forest ordination is the sacred area that no one was not allowed to cut down the trees or catch juvenile aquatic animals, which result in fertility of ecosystems, and the sustainable sources of food and income for communities.

At present, forest ordination and the "River life extending ceremony" become more popular among the public, governmental organizations, private sector, NGOs, local administrative organizations and academic institutions. Many initiatives and activities have been implemented, for example, watershed forest ordination at Bumiphol Dam, Tak Province, Teak forest ordination and the Yom river life extending ceremony, Phrae Province, and the watershed forest ordination in honour of HM the king and the Queen at Huay Rak Mai Village Chumphon Province.



- Many local communities have shown interests and willingness to conserve and restore natural ecosystems in their local areas. The Office of Natural Resources and Environmental Policy and Planning, has developed Participatory Mechanism for communities in the process of nomination of wetlands of national and international importance, and Ramsar site, and in the annual meeting on World Wetland Day. The example of participating communities are:

- **Bang Pakong River Community**, Chachoengsao Province, in 2013 has initiated campaign to promote the nomination of Bang Pakong River as Ramsar site.

- **Mae Rumpheung Conservation Group**, Prachuap Khiri Khan Province, in 2009, has protested against the construction of Iron-steel making Plant near Mae Rumphung peat swamp, and proposed to nominate the peat swamp as Ramsar site, which had been approved by the Cabinet Resolution on 3 November, 2009. At present, the process is in the seeking of the Provincial Office' approval.

- The Department of Intellectual Property, Ministry of Commerce, has recognized traditional knowledge, innovation and practices of indigenous and local communities, and declared Geographic Indication to seven varieties of Thai endemic rice, and eight varieties of Thai fruits. The Department also has developed database on Thai traditional knowledge, which link to the network of related organizations

**Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.**

**Biodiversity Clearing-House Mechanism** The Office of Natural Resources and Environmental Policy and Planning, as the CBD national focal point, has developed and maintained clearing-house mechanism, (CHM) since 2004, which provides information on the Convention's thematic programmes and cross-cutting issues and other information/data on biodiversity in all aspects, via web site: <http://chm-thai.onep.go.th/>

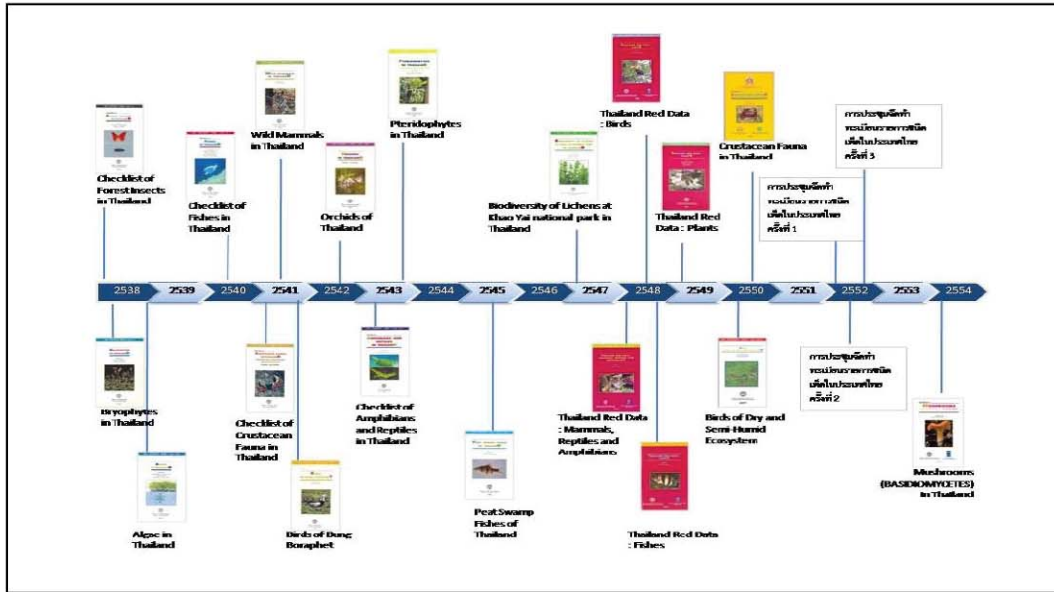


**The update of Biodiversity Clearing-House between 2010 and 2013**

- Thematic programmes  
Compiled and provide data on
  - Marine and Coastal Biodiversity
  - Island Biodiversity
  - Inland water Biodiversity
  - Biodiversity in Dry and Sub-humid land
- Cross-cutting issues  
Compiled and provide data on
  - Access and Benefit Sharing
  - Invasive Alien Species
  - Traditional Knowledge related to Biodiversity
  - Global Taxonomy Initiative
  - Protected Areas
  - Communication, Education and Public Awareness
  - Business Sector and Biodiversity
- Database of Biodiversity in each province, documents on biodiversity available in electronic format, list of biodiversity experts/researchers and committees/working groups, and Thailand Red Data  
Provincial Biodiversity Database includes data of biodiversity in Chiang Mai, Sukhothai, Phrae, Nan, Nakhon Sawan, Phetchaburi, Prachuap Khiri Khan, Chachoengsao, Chumphon, Ranong, Surat Thani and Phang-Nga

**Thailand's Taxonomy Database** The Office of Natural Resources and Environmental Policy and Planning, has established Thailand Taxonomy Working Group, under the national Sub-committee on the CBD, the working group has developed Guidelines on Taxonomic Capacity Building in Thailand, for the year 2011-2020, which accordance to Strategic Plan on biodiversity and Aichi Targets. The other taxonomic works of the Office include: Checklist of species in Thailand, or Biodiversity Series, since 1995 (Checklist of Forest Insects), the latest checklist is Checklist of Basidiomycetes in Thailand, published in 2011; booklets and brochures on biodiversity for kids; and the book "List of Plants in Thailand: Book 1" to be published this year.





*Biodiversity Series (List of Species in Thailand), published by The Office of Natural Resources and Environmental Policy and Planning*

Biodiversity Researches: The Office of Natural Resources and Environmental Policy and Planning, had discuss the issues regarding biodiversity researches with National Research Council of Thailand and related organizations, and concluded that biodiversity researches do not receive sufficient and ongoing financial support, do not manage data efficiently, no networking, no prioritization and public relation, and no work plan. The Office of Natural Resources and Environmental Policy and Planning, then, has develop Guidelines on Biodiversity Researches, which comprises of 5 goals 20 targets, and identify implementing agencies and funding agencies, including research unit in each institutions and universities.

**Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.**

Thailand has not fully initiate resources mobilization for effectively implementing the Strategic Plan, most of organizations implementing the NBSAPs still using the official national budget for implementation, however, there is increasing trend in financial support for researchers, communities, and NGOs regarding the conservation and restoration of biodiversity.

**Biodiversity Researches** has a good chance to receive more financial support, since the Strategies on Biodiversity Researches 2013-2016, developed by National Research Council of Thailand, had provide strategies focusing on:

- Researches on restoration, conservation and protection of biodiversity.
- Researches on the support of the utilization and value added to biodiversity.
- Researches on Behavioral Change of communities and all related organizations regarding biodiversity.
- Researches on Capacity Building for implementation regarding biodiversity at regional and global level.

In 2014, 145 projects (3.25% of overall projects) have been supported , for the budget of 91 million baht, (2.00% of overall budget).

Beside the government budget, **Global Environment Facility (GEF)** is another important financial mechanism for supporting the CBD implementation, in particular for Aichi Target 11. In the latest GEF replenishment, Thailand has received more financial support for biodiversity projects than in the previous replenishment. Most of the projects that received financial support Falls in Biodiversity Strategic Area 1 (Establishment and enhancing protected areas networks, and conserving species in protected areas), for example, the Catalyzing Sustainability of Thailand's Protected Area System (CATSPA) was developed by the Department of National Parks, Plants and Wildlife Conservation (DNP), has received 100 million Baht, and effectively support the works in national parks throughout the country.

**GEF small grant programme (GEF SGP)**, in biodiversity area, have supported:

- Small Community Project Support Plan, which support communities in developing countries in addressing environmental problems, including biodiversity. In Thailand, the support plan has started since 1994, and supported more than 300 projects throughout the country.

- In biodiversity areas, the support plan has supported conservation, sustainable use and restoration projects, such as “Mangrove for the future” Project at Pu Dum Community, the sea otter conservation project at Ban Bang La, “From Mountain to Coral Reefs” Project, “Biodiversity Resources Management Project” by Koh Mak community, “Orchids and Endemic Plants Conservation Project” at Koh Phra Thong, and “Towards the sustainability of community forest ecosystems” at Lahok Krasang, Buriram Province.

- **The Environmental Fund Division** of Ministry of Natural Resources and Environment, has enabled financial support from Global Environment Facility (GEF) in accordance with Article 23 (4) of the National Environment Quality Promotion Act., 1992, for the year period of 2014-2016, which comprises of seven focal areas, including biodiversity, and proactive projects to promote and develop eco-community around forest areas, in which GEF will support financial resources no more than 5 million Baht per each project. In addition, in 2013, The Environmental Fund Division has develop the matching fund policy with business and private sector to enable mutual support for the conservation and restoration of biodiversity, in particular through CSR activities, at present, this policy is in the process of seeking for National Environment Board Approval.

- **The Critical Ecosystem Partnership Fund (CEPF)**, implementing under the International Union for Conservation of Nature (IUCN) has supported the NGOs, communities, private sectors and the other civil society, to conserve and restore areas with high risk of biodiversity loss, forest corridor, and address threats to endangered species. The Project duration is between 2013-2018, and each year can support 10-20 projects with the budget of 200,000 Baht for each project.

- **The Agriculture Research Office** has supported researches on knowledge of biodiversity that can be used in improving quality of life, economic, social and environmental aspect in a sustainable manner. In 2014, the office had developed research framework on plants, fishery products, livestock products, microorganisms utilization, and other priority researches. One of the outstanding researches were the case of “Lady's Slipper” orchid, which has been bred and reintroduce to the wild, and to breed for commercial purpose, with permission from Department of Agriculture.

- **The Thai Health Promotion Foundation**, under Ministry of Public Health, has supported 1,100 projects in 63 provinces, which contribute to community's livelihood and local people's good health, through the conservation and sustainable use of biodiversity, by providing financial support of 200,000 Baht to each project annually. The example of successful projects are: “Baan Kham for the Environment” Project, Surin Province, which contributes communities to address the problems regarding pig's dung and landscaping; Baan Khak Local Fishery Group, Prachuap Khiri Khan Province, which contributes communities to address the problems regarding aquatic animal hatchery, by building “Sung Gor”, to be the habitat of marine animals; “Ecosystem Management towards Food Security” Project at Bann Sanom Community, Surin Province, which focuses on educating local people of the important and value of local plant species in terms of food and medicines, as well as source of income and “Water Restoration” Project at Bann Thung Si Siad, Prachuap Khiri Khan Province, which supports communities to eradicate invasive alien species such as water hyacinth and duckweed in Khlong Truan Water Reservoir, and making fertilizers and develop water quality standard for water resource in the reservoir.

- **The Conservation Trust Fund:** The Department of National Parks, Wildlife and Plants, in cooperation with UNDP, has adopted the Payment for Ecosystem Service (PES) as a key tool to enable responsibility among users of ecosystem services. In 2013, the Department had organized a meeting with tourists and hotels entrepreneurs and surrounding communities at Doi Inthanon, the highest mountain in Thailand, in order to establish a committee to regulate **Doi Inthanon National Park Conservation Fund**, which was established to facilitate the conservation and restoration of natural ecosystems in Doi Inthanon, the highest mountain in Thailand. The fund seeks support from the government, private sectors and the public.

# Chapter 5

## ***National Biodiversity Strategies and Action Plans (2015-2021)***

### **National Biodiversity Strategies and Action Plans (2015-2021)**

Thailand's latest national biodiversity strategies and action plans (NBSAPs) are the 4<sup>th</sup> revision of the on-going biodiversity planning process established in 1998. This national instrument provide covers a 7 year period between 2015 to 2021 in order to enable actions in accordance to the United Nations Decade on Biodiversity (2011-2020) and the Aichi Biodiversity Targets, particularly in addressing the underlying causes of biodiversity loss through conservation, restoration and maintenance of as well as enhancing benefits from biodiversity and ecosystem services by the year 2020. The NBSAPs were also formulated to complement the 12<sup>th</sup> National Economic and Social Development Plan (2017-2021) and other national policies of relevance. The NBSAPs are comprised of 4 main strategies to be implemented under the following vision, missions, objectives and targets, and are to be measured with a set of predetermined indicators.

### **Vision**

By 2021, people live in harmony with nature through collaborative promotion and support by the government and other sectors for conservation, restoration, and sustainable use of biodiversity.

### **Missions**

- 1) Integration of administration and management for conservation, restoration and effective utilization of biodiversity with participation from every level of society in order to halt biodiversity loss.
- 2) Leveraging policy and administrative importance of and enhancing public awareness on the roles and contribution of biodiversity in sustainable development and green economy as well as in enhancing livelihoods and quality of life.

### **Objectives**

- 1) To address the underlying causes of biodiversity loss by making biodiversity a national agenda for both the public sector and the civil society.
- 2) To reduce the direct pressure on biodiversity and to promote sustainable use of its components.
- 3) To enable improvement of the state of biodiversity with protection of ecosystem, species and genetic diversity.
- 4) To enable administration and management for enhancing benefits derived from biodiversity and ecosystem services.
- 5) To enhance efficiency in administration and management of as well as in meeting international obligations related to biodiversity with participatory planning, knowledgemanagement and capacity-building.

### **Overall target**

By 2021, administration and management of biodiversity are mobilized with participation of every level of the society.

### **Indicators**

- 1) The comparative increase in the annual allocation from the national budget for biodiversity.
- 2) The number of national, provincial and local policies, measures and plans addressing issues related to administration and management of biodiversity.

### **Main strategies**

**Strategy 1:** Integration of biodiversity values and management with participation from all levels.

**Strategy 2:** Conservation and restoration of biodiversity.

**Strategy 3:** Building capacity for utilization and sharing of benefits derived from biodiversity in accordance to the principle of the green economy.

**Strategy 4:** Developing knowledge and database system on biodiversity, consistent with internationally recognized standards.



## Implementation

The Office of Natural Resources and Environmental Policy and Planning under the Ministry of Natural Resources and the Environment is the implementing agency in enabling realization of the NBSAPs, including through development of mechanisms and guidance for and undertaking monitoring and evaluation of the implementation. The Office is to utilize mechanisms sanctioned by the National Committee on Biodiversity, biodiversity committees established by relevant public agencies as well as other related organizations and sectors at national, provincial and local levels in mobilizing and monitoring the implementation of the NBSAPs.

### National biodiversity targets

National biodiversity targets were identified to support and mobilize the implementation of National Biodiversity Strategies and Action Plans (2015-2021). The targets can be divided into 3 groups which are the immediate targets to be met by the year 2016 (18 targets), the intermediate target to be met by the year 2020 (9 targets) and the final targets to be achieved by the year 2021 (13 targets). This aims to ensure that progress made on these targets can be measured against the 12<sup>th</sup> National Economic and Social Development Plan (2017-2021), the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets.

National biodiversity targets		
By 2016	By 2020	By 2021
1. National, provincial and local agencies understand and are aware of values and importance of biodiversity.	1. Every sector of society, particularly the publics and local communities, has basic knowledge on biodiversity and are aware of the importance of the conservation and sustainable use of biodiversity.	1. Biodiversity is included in curriculums of institutions for learning and education at all levels.
2. Every sector of society, particularly local communities and their networks, significantly increase their participation in the conservation, restoration and sustainable use of biodiversity.	2. Biodiversity is integrated in relevant policies or plans at all levels.	2. Biodiversity management is mobilized with participation at all levels.
3. Guidelines are in place for reduction and elimination of harmful incentives for biodiversity and for promoting positive incentives for the conservation and sustainable use of biodiversity in relevant sectors.	3. Financial mechanisms are in place for mobilizing the conservation and sustainable use of biodiversity.	3. Regulations and laws that obstruct participation in biodiversity management are revised.
4. The rate of habitat loss, including forestlands is reduced.	4. The rate of habitat loss, including forestlands is reduced by 50%.	-
5. Protected areas and ecosystems are effectively managed to ensure their ecosystem services.	-	4. Protected areas are connected by networks, provide adequate ecological representation and have measures for managing critical habitats, biodiversity hotspots and areas of significant importance for ecosystem services.
6. Conservation status of threatened species and endemic species as well as the management of these species are improved.	5. Conservation status of threatened species and endemic species as well as the management of these species are improved with measures for conservation and protection of their habitats.	5. Mechanisms and measures are in place for the management as well as policy and legal actions for conservation and protection of the national genetic resources.
7. The threats from anthropogenic activities to species and habitats, particularly the coral reefs and other vulnerable ecosystem impacted by climate change are minimized	6. Pollutants are kept at the levels that would not damage ecosystem functioning and biodiversity.	-
8. Guidance is in place for mainstreaming biodiversity in relevant standards and criteria.	7. Tools/mechanisms/ guidance for sustainable use of biodiversity are applied in every relevant sector.	-

National biodiversity targets		
By 2016	By 2020	By 2021
9. Effectiveness in managing wetlands is increase at all levels.	-	6. The loss of wetland ecosystem is significantly reduced in order to enable ecosystem services and facilitate ecosystem-based adaption to climate change.
10. Invasive alien species and their major pathways are identified and registered.	8. Measures for managing priority invasive alien species and major pathways of the species are in place.	-
11. Laws and regulations for controlling modern biotechnologies and preventing their adverse impacts to biodiversity are enforced.	-	7. Regulations based on the pre-cautionary principle for supervising biosafety are in placed and adopted by relevant agencies for improvement of rules and mechanisms for transboundary movement of living modified organisms in accordance to the provisions of the Cartagena Protocol on Biosafety.
12. Responsible agencies have mechanisms and regulations for access and benefit-sharing of genetic resources in order to meet the obligations under the Nagoya Protocol.	-	8. Research community and local communities formulate their mechanisms and regulations for access and benefit-sharing of genetic resources.
13. Laws related access and benefit-sharing are developed for genetic resources and traditional knowledge of relevance.	-	-
14. Biodiversity-based competitiveness is increased.	-	9. Measures and mechanisms are in place for returning economic benefits from biological products to their origins in order to support the conservation and sustainable use of biodiversity.
15. Scientific knowledge is managed in the manner that contributes to the formulation of biodiversity policies and plans.	9. Mechanisms are in place to ensure contribution scientific knowledge to the formulation of biodiversity policies and plans.	10. Specific databases are created for priority biodiversity issues.
16. Mechanisms are in place to integrate and link biodiversity databases and therefore enable effective use of their resources.	-	11. Clearing-house mechanisms of every relevant agency are connected in an ever expanding network.
17. A focal point for mobilizing and utilizing resources of exiting databases for the conservation and sustainable use of biodiversity is identified or established.	-	12. Every municipality systematically collected information on their urban biodiversity.
18. National records and registers on local knowledge and traditional wisdoms supportive to the conservation and sustainable use of biodiversity are established.	-	13. Specific databases on local knowledge related to biodiversity are created to provide resources for protection of the country's and the communities' right over the knowledge.

The immediate targets to be met by the year 2016 provide the framework for the (draft) national biodiversity action plans (2015-2016) and can be measured by the following indicators.

- Percentage or number of agencies and sectors with knowledge and awareness on the values and importance of biodiversity.
- Increase in the number biodiversity committees established by relevant public agencies, relevant institutes and provincial authorities by 30%.
- Guidelines are in place for reduction and elimination of harmful incentives for biodiversity and for promoting positive incentives for the conservation and sustainable use of biodiversity in relevant sectors.
- Forestlands cover no less than 40% of the country.
- Each province has at least one ecosystem restoration project.
- At least 5 threatened species and endemic species are found to have increase populations.
- Numbers of policies and plans that integrate wetland and biodiversity management.
- Priority invasive alien species and their pathways are registered.
- Responsible agencies adopt and use regulations on access and benefit-sharing of genetic resources.
- Mechanisms are in place for meeting the obligations under the Nagoya Protocol.
- Enhanced capacity in developing biodiversity-based products.
- Database systems are in place to contribute to the formulation of biodiversity policies and plans.
- Increase in the proportion of taxonomists employed by agencies engaged in biodiversity works.
- Mechanisms are in place to integrate and link biodiversity databases.
- A focal point for mobilizing and utilizing resources of exiting databases for the conservation and sustainable use of biodiversity is identified or established.

#### **The national biodiversity action plan (2015-2016)**

The national biodiversity action plan (2015-2016) was formulated to facilitate practical implementation of the National Biodiversity Strategies and Action Plans (2015-2021) with specific targets and indicators. The action plan comprises of 4 strategies and 11 action plans as follow;

##### **Strategy 1: Integration of biodiversity values and management with participation from all levels**

- 1.1 The action plan on strengthening awareness and education on biodiversity.
- 1.2 The action plan on integrated and participatory administration and management of biodiversity.

##### **Strategy 2: Conservation and restoration of biodiversity**

- 2.1 The action plan on conservation and restoration of biodiversity.
- 2.2 The action plan on reducing the threats to and enhancing utilization of biodiversity.
- 2.3 The action plan on wetland management.
- 2.4 The action plan on addressing invasive alien species.
- 2.4 The action plan on managing biosafety.

##### **Strategy 3: Building capacity for utilization and sharing of benefits derived from biodiversity in accordance to the principle of the green economy**

- 3.1 The action plan on protection of genetic resources.
- 3.2 The action plan on research and development of bio-based economy.

##### **Strategy 4: Developing knowledge and database system on biodiversity, consistent with internationally recognized standards**

- 4.1 The action plan on management of knowledge and database systems.
- 4.2 The action plan on preservation of traditional knowledge related to biodiversity.

# Chapter 6

## Conclusion and Recommendations

The loss of natural habitats including forests, natural reservoirs and beaches from agricultural and urban expansion, industrial growth and transportation development as the results of the increase in population and the change in livelihood, in addition to the illegal harvest of wild flora and the commercial hunting of wildlife, remains the underling cause of the continuous decline in biodiversity in Thailand. Despite several policy actions taken in accordance to relevant international instruments and standards, there are still a number of gaps from inaction, inefficiency and ineffectiveness in many activities. These shortcomings have to be addressed by the end of the United Nations Decade on Biological Diversity.

### ■ Policy Level

● Addressing the root causes of biodiversity loss can be achieved by undertaking the following actions as far as possible by the year 2020 when the United Nations Decade on Biological Diversity is to be concluded.

**Raising awareness and knowledge** on values of biodiversity and impacts of biodiversity loss by adding relevant contents in curriculums at every level and prioritizing training on biodiversity, ecosystem services and their impact to people life for administrators from both public and private sectors.

**Conducting campaign and other public relation activities** for the general publics including students and business operators with the view to enhance their awareness on biodiversity values. These include campaigns for conservation of large trees and against trade of endangered species, distributing materials of practical steps to conserve wild plants, wild animals and natural ecosystem and to ensure their sustainable use and disseminating various forms of information on biodiversity to constantly keep every sector of the society informed and aware about the issue.

● Providing supports and allocating adequate financial resources for scientific researches for conservation and sustainable use of biodiversity and promoting applications of research-based knowledge as the basis for policy development and decision-making in national social-economic development.

● Incorporating natural capital and values of natural ecosystems, species and genetic resources in the national economic and social development plans, local development plans and the national accounting and integrating concerns on the loss of natural ecosystems and species extinction in national and local strategies for poverty reduction, disaster prevention, and gender equality while including the vision for “living in harmony with nature” in every strategy.

● Eliminating policies that provide incentives for distorting market prices including subsidy policies which are detrimental to biodiversity in order to minimize their impacts and/or to avoid their adverse effects as far as possible.

**Providing positive incentives** which include discouraging cultivation of energy and other commercial crops in importance areas for biodiversity and applying incentives for conservation and sustainable use such as tax break for business operators who engage in forest replantation and rehabilitation and investing toward enhancement of local community roles in carrying out surveillance of their ecosystems.

Undertaking steps with participation of business sector and other stakeholders at every level to enable sustainable production and consumption and to keep the impacts from utilization of natural resources for commercial production below ecosystems' carrying capacity.

● Creating more effective tools and mechanisms to facilitate meeting objectives of the Convention on Biological Diversity and the Aichi Targets.

Advancing legal measures for biodiversity with adoption of Thailand's Biodiversity Act consistent with the Convention on Biological Diversity. To this end, the Act should address the following issues.

- Reaffirming Thailand sovereignty over natural resources in the country's jurisdiction.
- Access to and fair and equitable sharing of benefits derived from genetic resources with the view to elevate authority provided by the 2011 regulation on criteria and procedure for access to and benefit-sharing of biological resources as adopted by the National Committee on Conservation and Sustainable Use of Biodiversity.
- Protection of threatened species and varieties and their natural habitats listed in Thailand's Red Data.

- Protection of areas with high biodiversity including Important Plant Areas (IPA) and Important Bird Areas (IBA) which have not been protected by law.
- Biodiversity protection at landscape level and in urban areas.
- Preventing the introduction of, elimination of and controlling invasive alien species by elevating authority provided by the Cabinet Decision of April 28, 2009 on the measures for preventing, controlling and eliminating invasive alien species and empowering local authorities in taking action on these issues.
- Minimizing or avoiding impacts to biodiversity and ecosystem services.
- Promoting communication, education and public awareness (CEPA) on values of biodiversity and ecosystem services.
- Supporting biodiversity researches as the basis for decision-making on national development.
- Supporting customary sustainable use of biodiversity and preservation of local tradition and knowledge associated with biodiversity.
- Establishing the National Office for Biodiversity with adequate workforce and resources for enabling effective implementation of obligation the Convention on Biological Diversity.

**Enhancing legal measures on wetlands by adopting Thailand's Wetland Act consistent with the Ramsar Convention.** In this regards, the Act should provide for the followings.

- Assigning authority to agencies involved in wetland protection.
- Ensuing protection of wetland ecosystems listed as Ramsar Sites as well as those included in the list of wetlands of national importance and identified in the Cabinet Decision of November 3, 2009.
  - Enabling protection of public wetlands including by empowering local authorities in maintaining every wetland used by the public for their livelihoods such as community wetlands.
  - Developing standard and guidance for ecologically sound restoration of reservoirs and rehabilitating wetlands listed for their urgent needs for restoration Community's right and participation in the environmental impact assessment of development project to wetland, and in the protection of wetlands, including the nomination of Ramsar site.

The establishment of the Office of wetlands Management, with sufficient human and financial resources to implement the Ramsar Convention.

Biosafety laws and regulations, which had been development since 2008, and have been approved by the Council of State, the next steps are :

- Developing Ministerial regulation to facilitate biosafety law implementation.
- Establishing the Office of Biosafety.

## **At Implementing Level Restoration**

### **Ecosystems, species and varieties restoration**

- Promoting the restoration of degraded ecosystems, through the integration of reforestation technology, soil and water resources management, GIS technology and other technologies suitable for the areas and ecosystems, and enhancing cooperation between the government, private sector, local communities and school/academic institution
- Encouraging related organizations and private sector to restore endangered species and varieties of wild plants, wild animals, crops, domesticated animals, through breeding, reproduction and reintroduction into the wild.
- Monitoring and evaluating the progress and achievement of restoration efforts in a timely manner and

### **Wetland Ecosystem Restoration**

- Developing public wetland protection strategies.
- Enhancing understanding on importance of wetland ecosystem services.



### **Coral Reef Rehabilitation**

- Developing integrated coral reef protection strategies to minimize or eliminate impacts from human activities to coral reefs.
- Suppress the violators of tourist and fishing laws/regulation.
- Developing mechanisms to monitor coral reef's status.

### **Protection of Urban and Local Biodiversity**

- Extending of terrestrial and marine protected areas to cover habitats of endemic and threatened species listed in Thailand Red Data.
- Promotion and encouraging urban and local communities' participation in the conservation and safeguard of natural ecosystem, including endemic species in their habitats, through the establishment of people networks or ecosystem watch guard communities, and enhancing understanding of value and services from ecosystems, and irreplaceable value of endemic species and varieties.
- Respecting and supporting traditional activities and practices of local communities that help protecting biodiversity.

### **Study Monitoring and Researches**

#### **Biodiversity Monitoring and Taxonomic Works**

- Promoting budget allocation to projects/initiatives regarding national biodiversity survey, monitoring and inventory, giving high priority to the unique or high biodiversity areas, to further develop national biodiversity database.
- Encouraging the development of List of Species in Thailand, classified by taxonomic group, and ongoing development of Thailand Red Data.
- Encouraging capacity building and expertise of taxonomists and establishing national taxonomic institution to complete the Flora of Thailand Project, and to initiate fauna of Thailand Project.
- Publicizing and mainstreaming taxonomic information via the media at all channels, to educate the public and encourage them to use taxonomic data of plants, animals, microorganisms and ecosystems in daily life, tourism, etc.

#### **Study of impacts from climate change to biodiversity, especial in vulnerable ecosystems**

- Monitoring and study ecosystems at long-term basis, in coral reef, mangrove forests, wetlands, forests, paddy fields, etc, including the World Heritage Site.
- Studying indicators on the strength and sensitivity of ecosystems, and developing early warning system.
- Strengthening capacities of related organization in using forest restoration. Technique, GIS technique, rapid Carbon Measuring, Statistics Knowledge and Models for future scenarios.

#### **Sustainable value of biological resources for commerce**

- Implementing under principles and criteria and good practice of Bio Trade Initiative of the UNCTAD ([www.biotrade.org/](http://www.biotrade.org/)) which encourage sustainable use in line with the development.
- Encouraging the compilation and development of database of traditional knowledge related to biological resources utilization.
- Promoting researches, technology transfer, the application and works related to traditional knowledge, in order to develop products and industry from biological resources, and introduce to the world market.

## Capacity Building of personnels and institutions

### Integration of implementation of biodiversity-related international agreement, including agreements in the ASEAN

- Developing Biodiversity Clearing-House Mechanism to be interlinked with relevant institution and organization, by compiling and organizing data/information regarding the implementation on the above-mentioned agreements, related researches, synthesis reports, national report, regularly updated and publicize to the public via the internet.
- Developing mechanisms to monitor the implementation under obligations of biodiversity-related conventions, and formulating policies to mutually protect and manage biodiversity, in order to harmonize and complement their works regarding conservation and sustainable use of biodiversity.

*Thailand*

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on the Implementation of the Convention on Biological Diversity

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