

An aerial photograph of a vast, lush green forest valley. A river winds through the center of the valley, surrounded by dense, vibrant green trees. The background shows rolling hills and mountains under a bright, slightly hazy sky. The overall scene is a beautiful representation of a natural ecosystem.

1. Introduction

The Convention on Biological Diversity entered into force in 1993 and now (June 2002) has 185 contracting parties. Thailand signed the Convention on Biological Diversity at the United Nations Conference on Environment and Development (UNCED) held in June 1992, in Rio de Janeiro, Brazil.

Even now Thailand has not yet ratified the Convention, the country has effectively used its provisions as guiding principles for biodiversity conservation and management. Two of the major outcomes were the establishment of the National Committee on the Convention on Biological Diversity and the development of National Policy, Strategies and Action Plan on Conservation and Sustainable Use of Biodiversity, 1998–2002 and 2003–2007. Details are presented in various chapters of this National Report.

The aim of this National Report is to present some of the activities and projects on biodiversity conservation Thailand has undertaken. After ratification of the Convention of Biological Diversity, Thailand will be ready to more effectively pursue its role to achieve conservation and sustainable use of biodiversity, for both national and global benefits.

Biodiversity in Thailand in Brief

Biodiversity Status

Thailand, covering a total land area of 513,115 sq.km., lies in a hot and humid climatic zone and hence supports a variety of tropical ecosystems. Forests, ranging in type from rain forest, evergreen forest, deciduous forest, and mangrove forest to shrub forest and savannah forest harbor the country's large portion of biodiversity. Freshwater ecosystem, covering rivers, reservoirs, swamps and ponds, is where the most endemic species of Thailand are found. For coastal ecosystems, the country's more than 2,000 km. coastline and the surrounding two hundred plus islands are comprised of coral reefs, sandy beaches, muddy beaches and seagrass beds. Marine ecosystems are located on both sides of the peninsular. Finally, agriculture ecosystems, which cover about one fifth of the country, also carry certain components of biodiversity, although they are man-made entirely.

Thailand has approximately 15,000 species of plant which accounts for 8% of estimated total number of plant species found globally.

In addition to plants, there are at least 292 species of mammal in Thailand of which 42% originated from the southern part of the region, 34% from Indochinese or Indo-chinese and Indian sub-region and the remaining 24% are species that are distributed throughout the Asian continent. Six of these mammal species are endemic to Thailand. As for other animals, there are at least 938 avifauna species, 318 reptile species and 122 amphibian species.

Thai waters support more than 2,000 marine fish species, accounting for 10% of total fish species estimated worldwide. Six hundred and six freshwater fishes species and 1,672 species of fishes have been found existed in estuarine and seawater. Thailand also has approximately 2,000 marine mollusk species and 11,900 species of marine invertebrate.

The causes of the reduction of biodiversity are usually over-exploitation, illegal trading of animal and plant species, disturbance to natural habitat, loss of habitat and environmental pollution. In the past, over-hunting of wildlife had resulted in the reduction in both populations and variety of wildlife. It can be pointed out that, the most serious threat to the biodiversity is human disturbance. The disturbance to natural habitat and ecosystem such as forest land reform of both evergreen and mangrove forest, construction of water reservoirs and hydro-electric dams, mining, urbanization, tourism and pollution have all threatened and contributed to the reduction of wildlife populations.

Biodiversity Conservation

The modern concept of ecosystems and biodiversity conservation was already well developed in Thailand, starting in 1958 when the Ministers of Agriculture and Cooperatives were directed to establish national parks and other protected areas and to draft their enabling legislation. In 1959, the Cabinet established the National Park and Wild Animals Reservation and Protection Committees. In 1960, the Wild Animals Reservation and Protection Act was passed, and in 1961, the National Park Act. Consequently, Khao Yai was established as the first Thailand's national park in 1962.

In Thailand, "conservation areas or protected areas" mean the areas designed as national parks, wildlife reserves and other protected areas pursuant to the governing laws related thereto. At present the protected area system of Thailand includes national parks (144 sites), wildlife sanctuaries (53 sites), forest parks (42 sites), wildlife non-hunting areas (52 sites), biosphere reserves (1 sites), World Heritage Natural sites (1 sites), watershed class 1 and conservation mangroves.

Concerned Issues

There are several concerned issues relating to biodiversity loss. Among these, forest fire, coral bleaching and wetland loss are selected to illustrate the major threats to different types of ecosystem.

Forest Fire

In 2000, forests in Thailand extended over areas of 172,049.988 sq.km. or 33.40% of total area of the country (from interpretation of 2000 satellite images). The forests comprised of 55,569.84 sq.km. of evergreen forests, 112,846.91 sq.km. of deciduous forests and 3,633.249 sq.km. of forest parks and naturally rehabilitated forests, accounted for 32.30%, 65.56% and 2.11% of total area of the country, respectively.

A study at Huai Kha Khaeng Wildlife Sanctuary, Uthaitхани Province indicates that the fuel in mixed deciduous and deciduous dipterocarp forests are approximately 1,792.98 and 1,823.13 kilogram/rai, respectively. Therefore, available fuel of the forest area of 116,480.16 sq.km. is as much as 132 million tons, and are undoubtedly a major factor of forest fire.

The Forest Fire Control Office, Royal Forest Department, is responsible for nationwide control of forest fire. The headquarter in Bangkok accommodates general administration, including the administration of the Operation Center for Forest Fire Control and Regional Forest Fire Control Section (for 4 regions). The local operational agencies of the Office comprises of 15 Forest Fire Control Centers, 64 Provincial Forest Fire Control Stations, 34 Forest Fire Control Units, 4 Forest Fire Control Training and Development Centers, 15 Royal Forest Fire Control Projects, a Project on Forest Fire Control in Biosphere Reserves and Huai Kha Khaeng Forest Fire Research Center.

Through satellite images of the year 2001, the Forest Fire Control Office estimated the loss of forestlands from forest fire in Thailand to be approximately 761.892 sq.km., of the total forest areas of 172,049.99 sq.km., or roughly 0.44%. From the reports of forest fire control agencies nationwide (from October 1, 2001–April 1, 2002), 7,681 incidents of forest fire were recorded, covering areas of 239.817 sq.km. or 0.14% of forest areas of the country and accounted for billions of economic loss.

Table 1 shows the forest areas and areas affected by forest fire during 1992 to 2002.

Protected areas are of significant importance to biodiversity conservation, particularly the ecosystem and genetic diversity. Various threats, especially threats to wildlife caused by human activities, cause decline in the population and diversity of other living species in the protected areas. Ten activities that are known to directly and indirectly impact on the existence of wildlife in both short and long terms are illegal hunting, crop and forest burning, grazing by livestock, clearing of forests, rafts and possession of water reservoirs, destructive fishing practices, collection of forest products, illegal logging, disturbance of natural conditions through transportation between communities, tourism, research and development activities and environmental pollution.

Table 1 : Forest Areas and Areas Affected

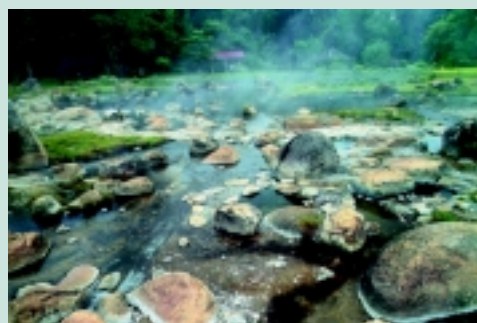
Year	Forest area (sq.km.)	Areas affected by forest fire (sq.km.)	Proportion of affected areas (%) Damage	(millions Baht)
1992	136,698.054	19,408.72	14.20	95,484
1993	133,553.547	14,596.174	10.93	71,808
1994	133,553.547	7,636.48	5.72	37,568
1995	131,485.057	6,438.054	4.90	31,673
1996	131,485.057	4,903.03	3.73	24,121
1997	131,178.161	6,602.08	5.02	32,479
1998	129,722.284	11,454.52	8.83	56,352
1999	129,722.284	2,949.011	2.27	14,508
2000	172,049.99	933.236	0.54	4,591
2001	172,049.99	761.892	0.44	3,748
2002	172,049.99	239.817	0.14	1,179

Note Information of forest fire in 1992-1998 is derived from aerial surveillance, information for 1999-2001 is from analysis of satellite images and 2002 information from reports of forest fire control agencies nationwide.

The Forest Fire Control Office has reported incidents of forest fire in 2002 (up to April,1) for each regions as follow;

- Northern Region: 4,040 incidents covering 64.976 sq.km.
- Northeastern Region: 2,413 incidents covering 101.199 sq.km.
- Central Region: 918 incidents covering 47.386 sq.km.
- Southern Region: 310 incidents covering 26.254 sq.km.

Three major causes of forest fire in 2002 are harvesting forest goods, hunting and burning of croplands, contributing to 2,828 1,805 and 1,385 incidents of forest fire, respectively and affecting 87.844 64.656 and 36.457 sq.km. of forest areas, respectively. Other causes include pasture, illegal logging, tourists and carelessness.



Coral Bleaching

During the middle of 1997, "El Nino" and significant climatic disturbance had caused fluctuation in water temperature in various parts of the oceans, and coral bleaching was sighted in several areas worldwide. The coral bleaching crisis started off in the Red Sea and Seychelles before later appeared in some parts of the Australia's Great Barrier Reef and several coral reefs in Indonesia. The bleaching was soon made its way to the Gulf of Thailand. Coral bleaching incident in Thailand disappeared in October 1998 only to be later found again in the Philippines and the southern parts of Japan.

Siting

In Thailand, coral bleaching caused severe but uneven impacts to coral reefs in the Gulf of Thailand. In total, approximately 30-40% of corals were destroyed, with 80-90% or even 100% death in some heavily affected areas. The impact of coral bleaching in the Andaman Sea was less severe due to cool current along the coastline.

✿ The Gulf of Thailand

March 1998

- Coral reefs around Sichang Islands, Chonburi Province, were found to be normal.
- Slight increase in sea temperature around Mak and Kradard Islands, Trat Province.
- The overall sea temperature in the Gulf of Thailand increased.
- Several large areas of bleaching were found among staghorn corals (*Acropora* spp.) in the shallow reefs of Rayong Nok Island, Trat Province.

May 1998

- Bleaching was found in coral reefs of Chumphon and Surat Thani Provinces.
- Approximately 30–40% of coral reefs in Sichang Islands bleached while sea temperature became extremely warm. In the following months, more deaths of corals from bleaching were reported. The most affected groups are staghorn (*Acropora* spp.) and ring corals (*Favia* spp.).

June 1998

- Complete bleaching of coral reefs in Mun Islands was reported. The bleaching was more severe than that at Sichang Islands since it also affected sea anemone, zoanthid and scaly giant clam.
- Some corals at Sa-mae San Island and other islands in Sattahip Bay were affected by the bleaching. Some were replaced by algae, in particular, the staghorn corals (*Acropora* spp.).

August 1998

- Bleaching was found in every coral reef in the Gulf of Thailand.
- Large number of coral reefs in Chantaburi Province were either vanished or replaced by algae or blanketed by sediment. Bleaching related death of corals in the province was found to be greater than other areas.

September 1998

- Some recovery was found in coral reefs at Kang Kao Island of Sichang Islands. However, the complete removal of all species of staghorn coral in the areas resulted in drastic reduction of many fish species and disappearance of several species.

✿ The Andaman Sea

From December 1997 to January 1998, the seawater around Paytra Islands (Satun Province), Surin Islands (Phangnga Province) and Similan Islands (Phangnga Province) was heavily concentrated with suspended particulate and phytoplankton. Abnormally large number of fish populations in the areas was reported, including some species new to respected areas. These were result of "upwelling" where cold nutrient-rich water from deep seas flow to shallow water, believed to be another consequence of "El Nino".

There are additional reports by the Department of Fisheries on degradation of several coral reefs in Chumphon Province and adjacent provinces. The incidents might be the consequences of coral bleaching.

Impacts

Although the coral bleaching in 1998 was not the first of its kind, it was the first bleaching that occurs extensive throughout the Gulf of Thailand. Previously in 1991 and 1995, the bleaching occurred only along the Andaman Sea's coastline and was found during the period that did not associated with El Nino. The bleaching was severe, causing large number of deaths of coral reefs around Phuket Island, Similan Islands and Surin Islands. Over 80% of staghorn coral and Mae Yai Bay vanished and was replaced by funnel weed (*Padina* sp.).

The most explicit impact of coral bleaching was the decrease in the number of living corals, leading to reduction of their predators. Removal of living corals also resulted in succession of other seabed species such as funnel weed (*Padina* sp.), sea anemone and soft corals. In addition, the remains of death corals were further damaged by crown-of-thorn starfishes (*Acanthaster planci*) and parrot/fishes (*Scarus* spp.) which prey on algae.

Overview of the coral bleaching phenomena in 1998 started with abnormal increase in sea temperature in late March before reached the peak in later May. The temperature remained high until mid June and gradually decreased back to normal in August. During the peak, sea temperature was maintained at 1 degree Celsius above the previously recorded maximum level, for approximately 4–5 weeks. At the high peak, the temperature reached 1.5 degree Celsius above the previous record.



Slow and Moderate Recovery

Approximately 3 years after the crisis of coral bleaching in 1998, there was a report of the bleaching off the eastern coast of the Gulf of Thailand over a short period in April 2001. No clear impact from the bleaching was reported. At the same time, coral reefs that were affected by coral bleaching in 1998, did not show any significant recovery. Slow recovery from coral bleaching may be the consequence of severity of the bleaching that almost completely wiped out the whole populations of many coral species, leaving insufficient population for natural recovery. Other causes include the lack of coral larvae in adjacent reefs, making natural replenishing difficult and presence of large populations of crown-of-thorn starfishes (*Acanthaster planci*), major predator of corals. These factors contribute to slow recovery found in heavily effected areas around Chang Islands.

The Marine Biology and Fishery Research Institute, Phuket Province reported recovery in coral reefs around Tao Island, Surat Thani Province. The institute also reported moderate improvement of recovery found during the survey made in February 2001. The institute estimated that without any repeat of coral bleaching and significant human disturbance such as anchoring, trawling and adverse tourist activities, the coral reefs should make full recovery within 2–3 years. However, with more littering and discharge of wastewater, number of algae may also be increased. On the eastern coast around Muang Bay and Hin Wong Bay (rocky bay), corals were found to be in moderate condition, making considerable recovery with large number of newly generated staghorn coral (*Acropora* spp.). The coral reefs are tightly packed and in good condition. On

the western coast, recovery however remained slow. At Nang Yuan Island, regeneration was found to be moderate, while recovery of the staghorn corals was minimal and somewhat replaced by flower coral (*Pavona* spp.). Similar finding was also observed on the beaches.

Wetland Loss

Large number of wetlands in Thailand have been loss and degraded. The loss and degradation are both clear visible or not clear visible, and both rapid and progressive.

Loss of Wetlands Area

The loss of wetlands, both the area and volume, include the permanent loss where the altered areas are no longer possess wetland characteristics or change from natural to semi-natural or unnatural, and the loss of natural wetlands because of conversion to man-made wetlands. Examples of quantitative loss of wetlands are as follow.

- Dike/weir construction encircled Nong Hang in the northern region and Nong Prakun in the northeastern region, which have encouraged alienation of the surrounded areas for agricultural used and, subsequently, resulted in the loss of wetlands.
- Bung Ping, Bung Kradan and Nong Talingchan in the Yom River Basin as well as Tatorn Floodplain and Nong Luang have been encroached upon and converted into agricultural lands.
- Draining and construction of canals encircling Nong Leng Sai have contributed to a reduction in the area of the site and has caused water shortages in the dry season.

- Destruction of natural forests in marshes and other wetlands has occurred through plantation of non-indigenous species, such as eucalyptus. Flooded areas along the Mun River, locally known as "Bung-Tam" forests, are all privately owned.
- Conversion of mangrove forests into shrimp farms and other aquacultural establishments is common along on the coastline of the Gulf of Thailand, in Samut Songkhram, Samut Sakhon, Rayong and Chanthaburi provinces. The mangrove forests have also been converted into tourist resorts, waste dumps and seaports. The forests are under threat from road construction and pylon construction from the city areas to the ports, as well as industrial facilities on coastline and rivers.
- Deterioration of seagrass beds from damaging fishing operations i.e. use of drift nets, mine tailings and construction on shores.

Loss of Wetland and Its Biodiversity and Functions

Although slow and progressive degradation of wetlands is natural phenomena, the degradation induced by intentional or unintentional activities are far more rapid and serious. Examples of wetland degradation are as follow.

- Wastewater discharged from paper mills has polluted water in Huai Sua Ten water reservoir, while wastewater from flour processing plants has polluted water in Nong Komkoh, and resulted in the loss of mollusc species.
- Pollution in the Mae Klong River during 1969-1974 was mostly caused by the discharge of wastewater from factories along the river. The pollution resulted in shortage of water supply, massive death of fishes, damage to mussel farms downstream (between 1969-1970) which lost almost 8 millions baht. The total damage caused by pollution to the aquaculture industry was later estimated at 50-60 millions baht annually. The pollution also has long-term impacts by preventing any further mussel farming in the areas where the river discharges into the sea.
- Food processing factories and power stations in Bang Pu, Samut Prakan province have caused water pollution in

the coastal areas, reducing the abundance of marine animals and causing damage to aquacultural operations. They have also caused damage to mangrove forests, especially through construction of drainage canals in the forests.

- Dam construction as seen in Nong Han Kumphawapi, dredging in Bung Lahan, building of weirs in Nong Parkun, road construction around Nong Luang and road construction to block the drainage of Nong Wieng, all contribute to shallowing of wetlands and blocking of migration of aquatic animals.
- Construction of a wastewater treatment system for the city of Pha Yao has turned Pha Yao into a sewage disposal site, while construction of roads isolated the area and has obstructed migration of aquatic animals to the surrounding areas.
- Impacts from tourists include littering, collecting flowers and plants, hunting rare and endangered wildlife, and collecting stones and shells as well as destruction of corals by collecting them as souvenirs and trampling.
- Bird hunting has significantly reduced numbers of some species. Some have become rare while others have virtually disappeared. The species are also under threat from burning of vegetation in the dry season, which destroys or alters their habitats and food sources.
- Expansion of the non-indigenous water hyacinth (*Eichhornia crassipes*) in reservoirs throughout the country. Water hyacinth is native to Brazil, but was actually introduced from Indonesia to Thailand. Its rapid expansion is largely due to its fast growing potential. Two individual plants can give rise to 30 new plants within 20 days, and individual plants can double their weight within 10 days. The species covers the water surface at the rate of 8% per day. Thus if 10 plants are introduced, within 1 year the population will increase to about 1 million. The impacts of water hyacinth include a significant increase in evapotranspiration (3-5 times), reduction of nutrients, and dissolved oxygen and reduction of light penetration, while providing habitats for pests. Thus, the presence of this species has a direct and serious impact upon other aquatic plants, plankton and aquatic animals.

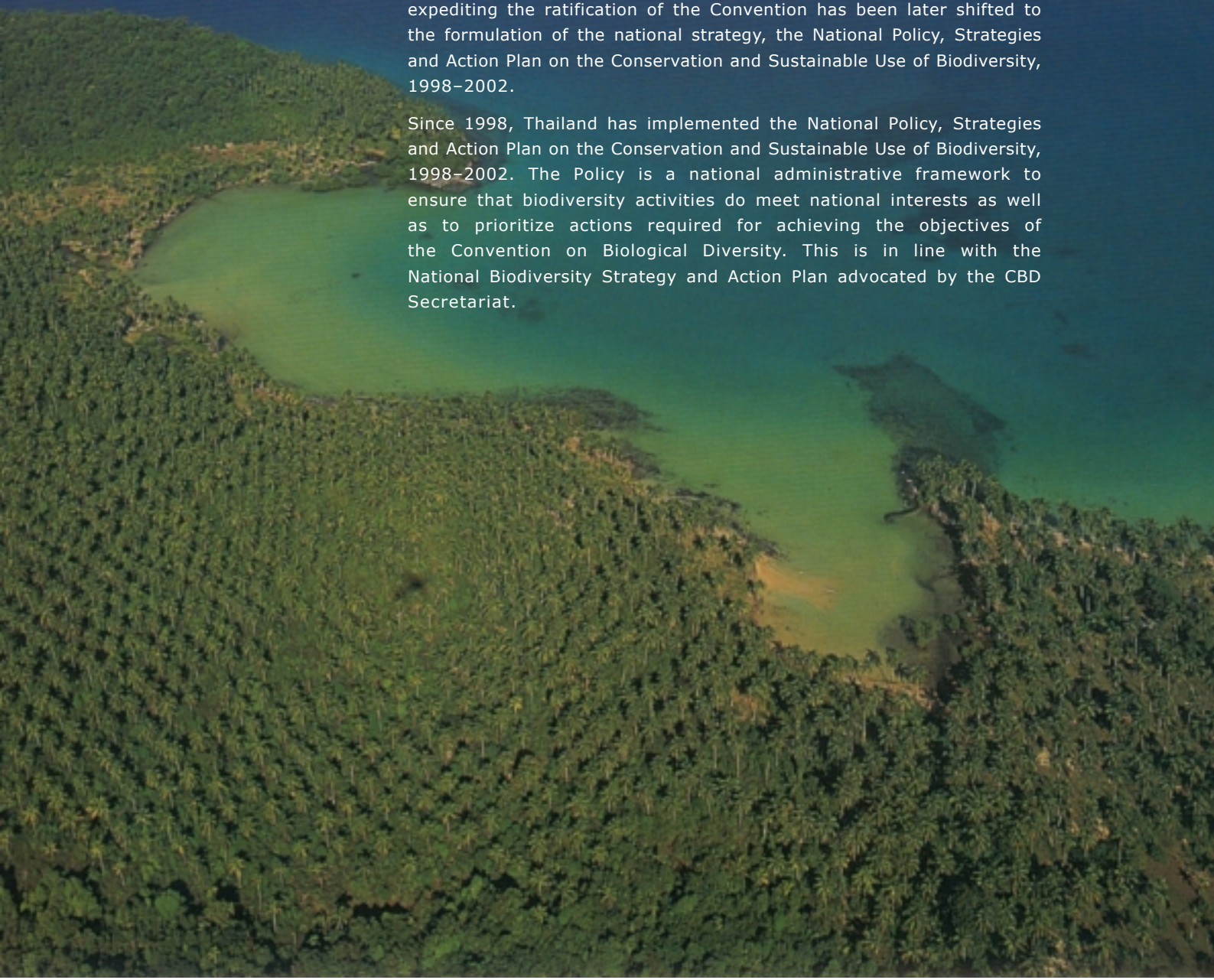
- The introduction and spread of golden apple snails (*Pomacea canaliculata*) has also caused problems. The species was introduced into Thailand in 1979, initially for consumption and household fish tanks. There had been farming of the species for export, but this later proved to be unsuccessful due to the lack of market demand. Individuals were thus disposed of into natural water bodies and their populations have expanded in greatly ever since. The species is now widespread in 7 districts of Bangkok and 30 provinces of the central region. The golden apple snails have so far caused damage to over 50,000 rai of agricultural lands. The damage is particularly severe in rice fields where 10,000–12,000 snails can overnight wipe out 1 rai of cultivated plot of rice. The species often lay eggs approximately 30 centimeters above water surface, usually during the night. About 388–3,000 eggs can be laid within 1–6 hours. The eggs are bright pink in color and gradually become pale before hatching after 7–10 days. After hatching, the juveniles feed on soft aquatic plants and eventually reach maturity in 3 months. The adults can breed every 7–10 days during their life span of 3 years. Thus, one snail can give rise to over 300,000 individuals. Without the Asian openbill (*Anastomus oscitans*) which feed on the snails, damage from the species could be much worse.
- A hybrid catfish, locally known as Russian catfish (possibly a hybrid of *Clarias gariepinus*), was introduced by the Department of Fisheries from South Africa in order to be used as an additional source of protein in rural areas. This species has caused severe damage to biological diversity in reservoirs of Thailand by feeding on fishes and other aquatic animals. The species has been intentionally released into reservoirs by those who brought the fish from temples in Bangkok (releasing fishes is considered a good deed in Thai tradition) or has escaped from fishponds in flooding periods. The species is now widespread throughout the country and poses serious threats to the indigenous catfish species of Thailand.
- Giant mimosa (*Mimosa pigra*) was introduced as soil cover and for protection of riverbanks. The species has however become invasive and has expanded beyond control. The species often obstructs water flow and reduces water quantity in reservoirs.
- Unsustainable use of wetlands in Nong Hang, including overfishing, the use of fine mesh nets, obstruction of migration of juvenile species in the flooding season and the use of electric fishing in the dry season have contributed to the reduction in number of aquatic animals. With such a reduction in the abundance of aquatic flora and fauna, the sites are no longer be able to host large numbers of migratory bird species.
- Bung Chawak is an example of a wetland that has been inappropriately rehabilitated or developed. New buildings have caused adverse impacts on local and natural architecture.
- Inappropriately managed water resources cause water shortages in the dry season and flooding in the rainy season. In 1994, water in major rivers was at an extremely low level, forcing the government to prohibit ship navigation in Suphun Buri, Noi and Chao Phraya Rivers since December 1993. In the same year, there was a severe shortage of water in Lop Buri and Saraburi provinces as well as in Pathum Thani, Samut Prakhon and Chachoengsao provinces.
- Wetlands have been destroyed by the loss of traditional ways of life that depend on the wetlands. Traditional agriculture has been replaced by commercial cultivation which removes numerous features of rural cultures, while increasing fertilizer and pesticide use in cultivated fields destroys aquatic species.

2. National Policy, Strategies & Action Plan on Conservation and Sustainable Use of Biodiversity, 1998–2002

After the signing of the Convention on Biological Diversity in June 1992, the implementation of the Convention would indeed require cross-sectional efforts. The establishment of a mechanism to initiate cooperation of relevant agencies and to coordinate their implementation tasks was an institutional action of high priority. Such a need was realized with the formation of the National Committee on the Convention on Biological Diversity¹, under the National Environment Board² (NEB), in June 1993. Direct linkage between the National Committee and the NEB is crucially important to expedite biodiversity and other CBD-related activities in Thailand.

The National Committee on the Convention on Biological Diversity is a firm and supportive mechanism in facilitating the implementation of the Convention. The earlier focus of the National Committee on expediting the ratification of the Convention has been later shifted to the formulation of the national strategy, the National Policy, Strategies and Action Plan on the Conservation and Sustainable Use of Biodiversity, 1998–2002.

Since 1998, Thailand has implemented the National Policy, Strategies and Action Plan on the Conservation and Sustainable Use of Biodiversity, 1998–2002. The Policy is a national administrative framework to ensure that biodiversity activities do meet national interests as well as to prioritize actions required for achieving the objectives of the Convention on Biological Diversity. This is in line with the National Biodiversity Strategy and Action Plan advocated by the CBD Secretariat.



Achievements

The overall achievement from the implementation of the National Policy, Strategies and Action Plan on the Conservation and Sustainable Use of Biodiversity, 1998–2002, are as follows:

Genetic Conservation

The Department of Livestock Development (DOLD) has successfully conserved and genetically improved 12 indigenous domestic animal varieties, including swamp buffalo (*Bubalus bubalis*), banteng (*Bos banteng*), gayal (*Bos frontalis*), Chinese geese (*Gygnopsis cygnoides*), native ox (*Bos indicus*) in the northeastern and southern regions, Hainan pig, native goat, native bred duck and native chicken. In addition, DOLD has monitored the status of important native varieties in Thailand for the sustainable use. DOLD has also reviewed and enacted the Animal Species Maintenance Act 1966 in order to be effectively responded to the conservation and improvement of animals species at the genetic level, according to the Convention on Biological Diversity. In addition, the Plant Varieties Protection Act 1999 was also enacted in the Department of Agriculture (DOA) in order to maintain and conserve the genetic diversity of endangered endemic plant species in Thailand.

The Silviculture Research Centers, under the Royal Forest Department (RFD) have founded the Gene Collection Center of Wild Trees to collect wild tree varieties which have good characteristic and economical values. The centers have been planting such tree varieties and established the permanent plots in 15 protected forest areas countrywide for the study and conservation of the genetic sources for tree varieties in natural forest ecosystems.

Species Conservation

The Department of Fisheries (DOF) has been monitoring the rare and endangered species both in the marine and freshwater ecosystems. DOF has identified the mealy crab (*Thaipotamon chulabhorn*) as the protected wildlife species, and monitored the status of many significant species in Thai marine ecosystems such as dugong, giant clams, dolphin, whale and sea turtle species for the better understanding of their habitats, population distribution and life-cycle, in order to develop the best guidelines for the conservation of these species. DOF has also improved many fishes and freshwater species, and released approximately forty million individuals annually into the natural habitats. These species includes Gunther's walking catfish (*Clarias macrocephalus*), snake-skin gourami (*Trichogaster pectoralis*) common climbing perch (*Anabas testudineus*), yellow mystus (*Hemibagrus nemurus*), red cheek barb (*Systomus orphoides*), white carp (*Henicorhynchus siamensis*), crazy barb (*Leptobarbus hoeveni*), bagrid catfish (*Hemibagrus wyckioides*) and rugosed frog (*Rana rugulosas*).

RFD has checked and added some species into the protected wildlife species list, and announced additional wildlife species whose captive breeding programs were allowed to the public.

Thailand has been progressively conserving wetland, as the Contracting Party of the Ramsar Convention since 1998. Office of Environmental Policy and Planning (OEPP) serving as the national focal point of the Convention had completed the inventory of wetlands in Thailand in 1999. The inventory identifies important wetlands in Thailand in 3 categories; Wetland of International Importance (61 sites), Wetland of National Importance (48 sites), and Wetland of Local Importance (19,295 sites). After the nomination of many wetlands of international importance to the Ramsar Bureau, in the year 2002, Thailand has six wetlands designated as the "Ramsar Site", which are the following.

- 1 The sub-committee members are composed of representatives from nine departments under the Ministry of Agriculture and Cooperatives, (MOAC), Ministry of Science, Technology and Environment, (MOSTE), Ministry of Public Health (MOPH), and Ministry of Foreign Affairs (MOFA). An NGO and three research institutes are also represented together with six distinguished experts from the universities and relevant institutions in the committee. The Office of Environmental Policy and Planning (OEPP) serves as a secretariat of the National Committee.
- 2 The Prime Minister serves as the Chairman of the National Environment Board.

- Pru Khuan Khee Sian, in Thale Noi Non-Hunting Area. (First Ramsar Site in Thailand)
- Bung Khong Long Non-Hunting Area
- Don Hoi Lot
- Krabi Estuary
- Nong Bong Kai Non-Hunting Area
- Princess Sirindhorn (Phru To Daeng) Wildlife Sanctuary
- Had Chao Mai Marine National Park-Ta Libong Island Non-Hunting Area-Trang River Estuaries
- Kaper Estuary-Laemson Marine National Park-Kraburi Estuary
- Mu Koh Ang Thong Marine National Park
- Pang Nga Bay Marine National Park

DOF has surveyed and rehabilitated the degraded coral reef ecosystems in 13 provinces, designated and zoned the areas for the sustainable use of coral reefs.

DOF has also improved and rehabilitated the fishing areas by established 8 sites of habitat for marine species, with the total area of 402 sq.km.

Forest Ecosystem Conservation

In 2000, additional 18,097 sq.km. of forest area has been conserved by RFD when compared to those in 1995. The additional conserved forest area is accounted for approximately 3.51 percent of Thailand's total area. RFD also reforested and restored the forest of 422.43 sq.km. during 1997-2000.

Protected Areas

During 1997-2000, RFD has designated additional 37 protected areas, which are 20 national parks, 2 forest parks, 9 wildlife sanctuaries and 6 non-hunting areas. Therefore, the recent protected areas in Thailand are 91,231.57 sq.km. or 17.8 percent of the country's total area. In addition, more protected areas are planned to be implemented. At present, at least 72 national parks and 40 non-hunting areas are in the process of cadastral survey, to increase the effectiveness of conservation efforts. In 2000, RFD has also established master plans for 6 national parks, 6 marine national parks and 8 wildlife sanctuaries.

Additionally, DOF has restricted and prohibited the use of fishing tools, such as some types of fishing net which may cause damage to the ecosystems, prohibited fishing in the breeding season, and established 37,500 sq.km. as controlled fishing areas.

Ex-situ Conservation

The Department of Agriculture (DOA) has established a Plant Gene Bank to collect and conserve wild and crop plant species, both native and exotic. The Bank currently has 73,574 accessions, including 28,243 accessions of the seed of 5 significant food plants and 350 accessions of wild rice species.

RFD has collected native and exotic plant species, and conserved them in 15 botanical gardens and 54 arboretums, with a total area of 95 sq.km. The Department has also bred endangered wildlife species and economically valued species in the breeding centers nationwide.

The Microbiological Resources Center, under Thailand Institute of Scientific and Technological Research (TISTR) has been successfully surveying, researching, collecting and preserving many microorganism strains that are important for biological and agricultural development, industry, environment and education. In addition, DOA has established the Center to collect mushroom species. At present there are over 750 collections in the Center.

Biodiversity Identification and Monitoring

RFD has surveyed the biodiversity in 122 national parks, 79 wildlife sanctuaries and 10 non-hunting areas. The work under the Flora of Thailand Program has been progressively completed including Euphobiaceae (85 genera 398 species), Malvaceae (12 genera 45 species) Leguminosae Papilionoideae (71 genera 450 species), Palmae (34 genera 90 species), and Araceae (25 genera 60 species). The list below covers other works of RFD.

- Collection of 300 forest fungi specimens.
- Collection of 60 mushroom species from pinewood.
- Monitoring the status of species in and outside the protected areas, and reported in 2 research papers.
- Survey the status and distribution of wild

mammals, and presented a research paper which includes 30 mammal species.

- Survey and monitoring the species which have ecological importance and reported wrinkled-lipped bat, common barking deer, Asian elephant, gaur, banteng, and wild water buffalo in research papers.

OEPP had surveyed and monitored biodiversity in the following protected areas.

- Phu Luang Wildlife Sanctuary, in cooperation with Khon Kaen University
- Doi Chiang Dao Wildlife Sanctuary, in cooperation with Chiang Mai University
- Bung Khong Long Non-Hunting Area, in cooperation with Kasetsart University
- Thale Noi Non-Hunting Area, in cooperation with Rajabhat Phuket Institute
- Pru Ban Mai Khao in cooperation with Rajabhat Phuket Institute
- Pru Sai Buri, in cooperation with Prince of Songkla University, Pattani Campus
- Taen Island, in cooperation with TISTR
- Dune Lampan, in cooperation with Mahasarakham University

Sustainable Use

DOA has promoted to implement sustainable agricultural and agroforestry practices for communities in the buffer zone of the protected areas. OEPP has encouraged sustainable use through the conservation and rehabilitation of many important cultural forests in the northeastern region, such as Pa Baan Na Di, Khoke Nong Meg and Pa Baan Alor in Surin province, Pa Boong Tam Rasi Salai in Sri Saket, Roi Et and Surin provinces.

Incentive Measures

RFD has restored the natural environment in national parks, and aggressively promoted "ecotourism" and "local community participation" in forest conservation and restoration in many areas. Many projects such as the Project on the Ecosystem Management of the Western Forests and the Project on the Management of Upper Nan Watershed have been implemented. Such projects emphasized the local community participation in natural resource management, through establishment of community network around the forest areas, and skill strengthening for the forest rangers. Each year, RFD has honored approximately 20 villages and organizations that implement conservation activities on sustainable use of biodiversity to secure foods. RFD has also established "community forests" to promote such participation.

DOF has bred and annually released throughout the country large number (about 800,000) individuals of freshwater fishes into the freshwater habitats, encouraging local communities to conserve the freshwater fish species.

Education and Public Awareness

The Department of Curriculum and Instruction Development, Ministry of Education, has published 2 additional reading books for elementary and high school students. The contents of the books focus on biodiversity. The Department of General Education has provided the curriculum and courses related to biodiversity, both in the elementary and high school levels.

In 2000, the Office of the Permanent Secretary for Education, in coordination with RFD and Ranong province, had nominated the mangrove



forest in Ngao district, Ranong Province, to be designated as the 4th Biosphere Reserve in Thailand. Such act will further benefit the education and research on biodiversity.

DOF has organized annual training courses in the conservation of freshwater species. DOA has publicized its works on the conservation of insect species, in the form of Guidebook of Insects in Thailand (5,000 copies).

RFD regularly holds exhibitions and provides the knowledge on wild plant and wildlife species conservation in the protected areas nationwide, especially at the Tourist Service Center in 102 National Parks and 19 Wildlife Conservation Development Station. Nature treks were also established in 204 protected area, to support educational activities on nature and biodiversity. In addition, the National Wildlife Protection Week was held every year in December. This event includes exhibition, seminar, contests and training courses for the public on forest and wildlife species conservation, throughout the country.

Capacity Building

DOLD has published research papers, and hold an annual meeting to strengthen the capacity of it staff in conserving indigenous animal varieties.

RFD organizes the training courses, at least once a year, in the field of biodiversity conservation, and the training courses to improve the skills of the forest protecting officers.

OEPP has supported to strengthen a capacity in taxonomy for relevant organizations and biological scientists, through the provision of 12 "Checklist of Flora and Fauna in Thailand" books (OEPP Biodiversity Series). For invasive alien species, OEPP had organized 3 meetings to inform and raise public awareness on threats of invasive alien species. OEPP also published books and brochures, which disseminate the knowledge and information on invasive alien species in Thailand.

Annually, OEPP organizes the meetings to celebrate "World Wetlands Day" and "International Day of Biological Diversity". Such events publicize the knowledge and information on wetland and biodiversity. Many books and brochures about wetland or biodiversity were published and provided to related organizations and interested persons, since OEPP works as the national focal point

of the Convention on Wetlands and the Convention on Biological Diversity.

Biotechnological Research and Transfer

The National Center for Genetic Engineering and Biotechnology (BIOTEC) has implemented the biotechnological project for plants in order to improve important plant species and products through utilizing "DNA marker" technology to produce the plant with desired characteristics. For animal, the Center has developed the cryogenic technology for effective egg cells and embryo collection. The Center has also established the biotechnological projects for farmer and rural development, and promoted the use of biotechnology for controlling plant pathogens and pests, such as improving fungi species to control pest insects, along with *Bacillus thuringiensis* bacteria.

Biosafety Protocol

Thai delegates from Thailand National Biological Control Research Center (NBCRC) and Thailand Biodiversity Center (TBC) have participated in every meeting of Biosafety Protocol and biosafety-related topics. The National Biosafety Committee (NBC) has been established since 1990 to implement the biosafety regulation and now the Biosafety Protocol. The Committee has coordinated with relevant organizations to establish appropriate guidelines and principles, and regularly publicizes the knowledge and information on biosafety.

Database Establishment

The collection and provision of biodiversity information have grown rapidly since 1996. DOF has succeeded in establishing plant species database of major crop plants including rubber plant, durian, mango, longan and rice species. The database is developed from data and information collected from its work on plant genetic conservation. This database will benefit further conservation of plant genetic resources in Thailand.

RFD has initially established the biodiversity network, built up the databases of wild plants, forest insects and mammals. The data and information of RFD's works on biodiversity conservation can be accessed at <http://www.forest.go.th>.

OEPP has been preparing a Clearing House Mechanism, through the provision of biodiversity data and information, and Thailand's implementation of the Convention on Wetlands and Convention on Biological Diversity at www.bdmthai.com and www.thaialienspecies.com. OEPP also has the biodiversity data and information, in the forms of printed documents, made available to interested persons and organizations (see more details in Chapter 4).

The Microorganism Collection Centers of Thailand, Institute of Scientific and Technological Research (TISTR), DOA, the Department of Medical Science, and BIOTEC have been cooperated in the "Thailand Microorganism Database Project" to establish microorganism database which supports exchange of information and can be accessed to relevant organizations, both at the national and international levels.

Institution / Organization Establishment

The Natural Resources and Biodiversity Institution (NAREBI) was founded in 1998, by the proposal made by the Committee on Agricultural and Cooperatives Policy and Planning. This Institution is responsible for the coordination in the field of natural resources and biodiversity policy and management within the Ministry of Agriculture and Cooperatives. Thailand Biodiversity Center (TBC), established in 2000, is a national focal point on the access and transfer of biological resources, under the National Committee on the Conservation and Use of Biodiversity.

International Cooperation

OEPP works as national focal points of the Convention on Biological Diversity and the Convention on Wetlands. It works include the following.

- Coordinate with the Secretariat of the two Conventions
- Nominate Thai representatives to participate in the Convention meetings.
- Organize the meeting of the working groups related to biodiversity and wetland, and the meeting or workshop to publicize the knowledge and information on biodiversity or wetland.
- Publish the National Report, to implement Article 6 of the Convention on Biological Diversity, and present it to the Convention's secretariat.

Obstacles and Trends

Because of the economic slow-down, the implementation of the National Policy, Strategies & Action Plan on Conservation and Sustainable Use of Biodiversity (NBSAP), 1998-2002 has not been fully supported. Tight budget allocation from the government caused delay or cancellation of some projects proposed in the NBSAP. Even then many institutions and organizations have been succeeding in achieving their goals; however, amendment of the NBSAP still is needed to reflect the current national and international issues. There is a need to strengthen the capacity building on researches for phant extracts, invasive alien species control and management, and taxonomic inventories and collections. More works are needed to implement the NBSAP on the ground by supporting activities of local authorities, organizations and communities to implement the plan in their local context, and improving feedback mechanisms from local and national levels. Details are further elaborated in Chapter 3.