

National Report

on the Implementation of
Convention on Biological Diversity



T H A I L A N D



OFFICE OF ENVIRONMENTAL POLICY AND PLANNING
MINISTRY OF SCIENCE, TECHNOLOGY AND ENVIRONMENT

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2002

C o n t e n t s

1.	<i>Introduction</i>	4
	◆ Biodiversity in Thailand in Brief	5
	◆ Concerned Issues	6
2.	<i>National Policy, Strategies & Action Plan on Conservation and Sustainable Use of Biodiversity, 1998–2002</i>	12
	◆ Achievements	13
	◆ Obstacles and Trends	17
3.	<i>National Policy, Strategies & Action Plan on Conservation and Sustainable Use of Biodiversity, 2003–2007</i>	18
	◆ Challenges for the National Policy, 2003-2007	19
	◆ Directions	19
	◆ Efforts	20
	◆ Coordinating Mechanisms for the Implementation of the National Policy, Strategies and Action Plan	20
4.	<i>Management Efforts</i>	22
	◆ Biosafety	23
	◆ Information Management & Networking	26
	◆ Invasive Alien Species	29
5.	<i>Capacity Building Efforts</i>	36
	◆ Training Needs Assessment on Biodiversity	37
	◆ National Taxonomic Needs Assessment	42
6.	<i>Future Directions and Trends</i>	48
	<i>Annex</i>	51
	◆ National Policy, Strategies and Action Plan on the Conservation and Sustainable Use of Biodiversity, 2003-2007	51
	<i>Bibliography</i>	58
	<i>Acronyms</i>	59

P r e f a c e

The Convention on Biological Diversity, since its adoption, has become the major instrument in protecting biodiversity and its components worldwide. Its provisions are landmark measures adopted by many countries for effective management of Biological resources. Recognizing this fact, Thailand has long attempted to find the most appropriate adoption of the Convention for the best interest of the country.

The Office of Environmental Policy and Planning, the national focal point for Convention on Biological Diversity, is pleased to present the second Thailand's national report on the implementation of the Convention. The report is a compilation of progresses and success achieved through the National Policy, Strategies and Action Plan on Conservation and Sustainable Use of Biodiversity (NBSAP), 1998–2002, which have stimulated overwhelming contributions from relevant agencies toward the development of the new NBSAP, 2003–2007. The report also addresses the country's efforts in managing biosafety issues in accordance to the Cartagena Protocol, and in capacity building of institutions and human resources for conservation and sustainable use of biodiversity which is also the priority agenda of Thailand.

The significant progress in implementing the Convention on Biological Diversity in

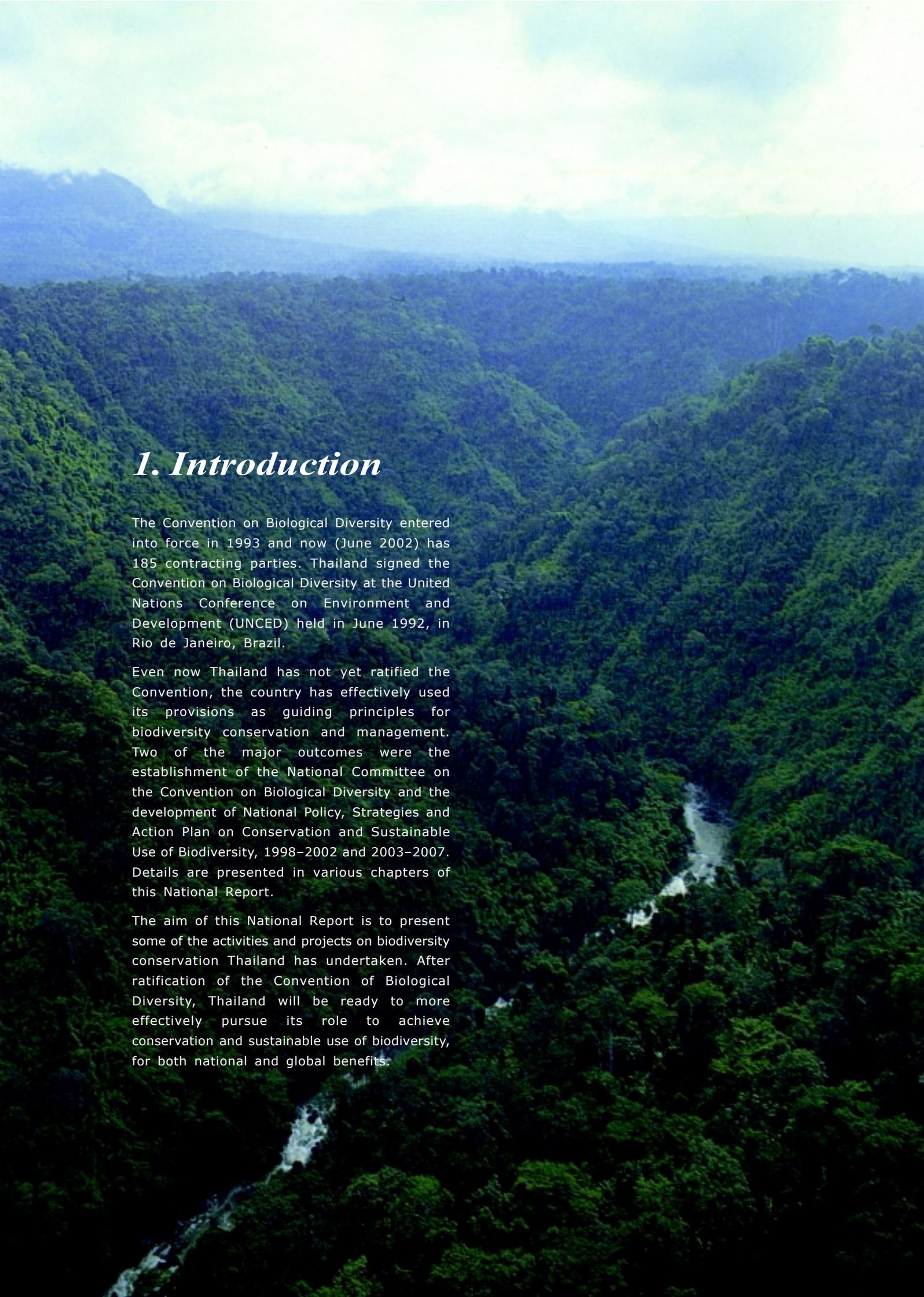
Thailand is the result of cooperation among relevant agencies under the supervision of the National Committee on the Convention on Biological Diversity. In this regard, the Office of Environmental Policy and Planning would like to extend the sincerest gratitude to Mr. Petipong Pungbun Na Ayutya, the Permanent Secretary of the Ministry of Agriculture and Cooperatives and the Chairman of the National Committee on the Convention on Biological Diversity. The Office would like as well to express our thanks to the members of the National Committee, in particular Dr. Banpot Napompeth, the Chairman of the Working Group on Drafting of the National Report, and Dr. Utis Kutintara, the Chairman of the Working Group on formulation of the NBSAP, 2003–2007, for their contribution toward the implementation of the Convention and development of this national report. Thanks are due to Mr. Donald Gordon ARCBC expert who assisted in summarizing the work carried out under the topic Information Management and Networking.

The Office of Environmental Policy and Planning hopes that the national report will benefit the Secretariat of the Convention on Biological Diversity and relevant organizations both in the country and overseas, in monitoring the progresses implemented through obligations under the Convention and further enhance the cooperation on conservation and sustainable use of biodiversity at the national, regional and international levels.



(Mr. Chalerm Sak Wanichsombat)
Secretary – General

Office of Environmental Policy and Planning

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 by

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 Krardard 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.

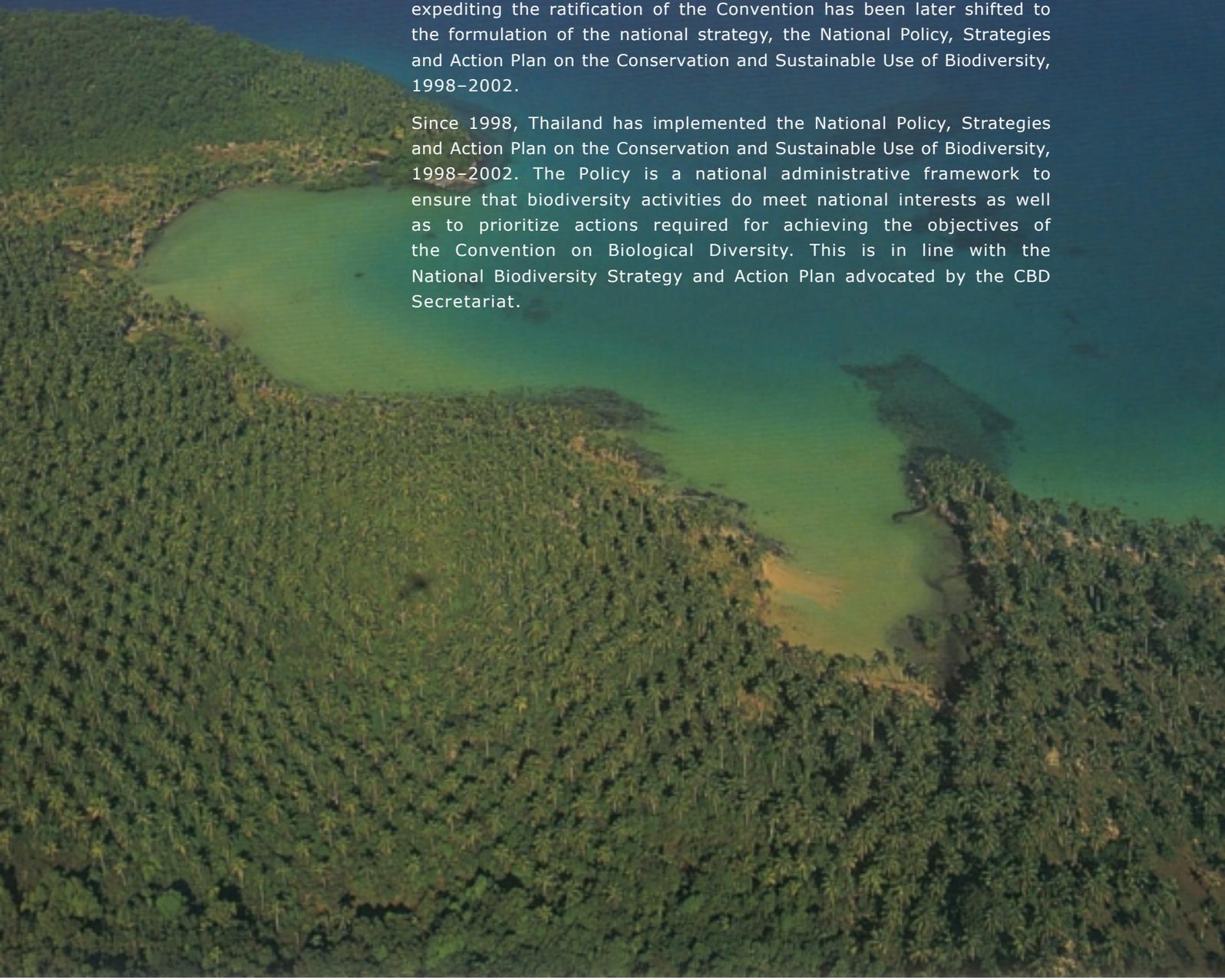
- The introduction and spread of golden apple snails (*Pomacea canaliculata*) has also caused problems. The species was introduced into Thailand in 1979, initially for consumption and household fish tanks. There had been farming of the species for export, but this later proved to be unsuccessful due 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.

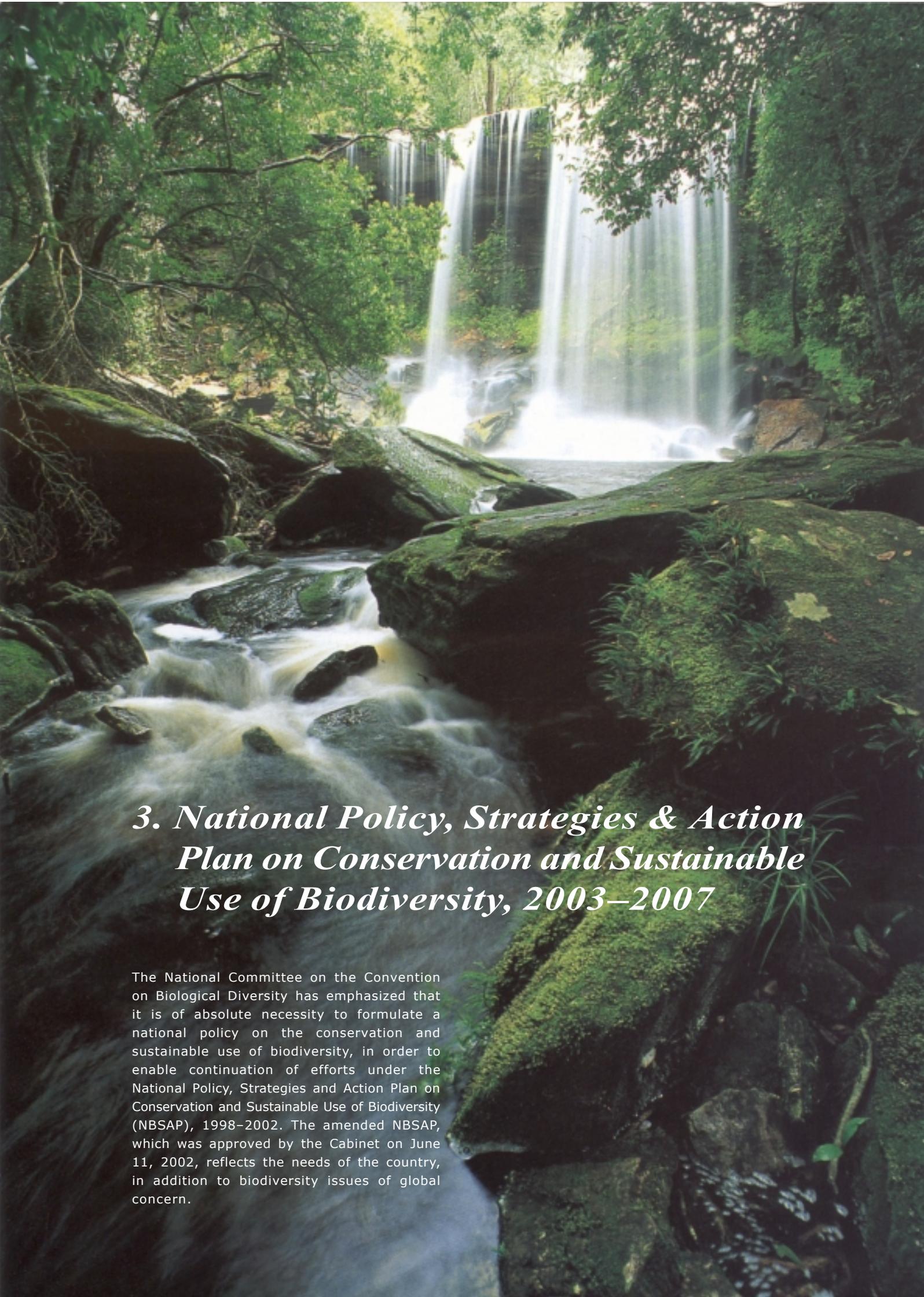
International Cooperation

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 plant 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.

A photograph of a waterfall in a dense forest. The water is white and foamy as it falls over several tiers of large, moss-covered rocks. The surrounding trees are vibrant green, and the overall scene is serene and natural.

3. National Policy, Strategies & Action Plan on Conservation and Sustainable Use of Biodiversity, 2003–2007

The National Committee on the Convention on Biological Diversity has emphasized that it is of absolute necessity to formulate a national policy on the conservation and sustainable use of biodiversity, in order to enable continuation of efforts under the National Policy, Strategies and Action Plan on Conservation and Sustainable Use of Biodiversity (NBSAP), 1998–2002. The amended NBSAP, which was approved by the Cabinet on June 11, 2002, reflects the needs of the country, in addition to biodiversity issues of global concern.

Challenges for the National Policy, 2003-2007

There were various weak points that obstruct effective conservation and sustainable use of biodiversity, learned from implementing the NBSAP, 1998-2002.

- * Provision of education, knowledge and promotion of awareness on value of biodiversity is the weakest point of any implementation on biodiversity, and thus has become the first priority for NBSAP. However, greater focus is needed for the amended NBSAP since there was very limited progress in this field during the implementation of NBSAP, 1998-2002. Efforts should be made to provide more information and better education to youths, educators and NGOs through more diversified media.

- * Biodiversity data and information are still essential for facilitating conservation and sustainable use of biodiversity. In addition, agencies that were custodians of large amount of biodiversity information did not propose on building relevant databases and creating web sites. At present, the world has become smaller by the availability and accessibility of news and information. It is envisaged that without a dissemination of information necessary for biodiversity conservation, an improvement of the capacity for the conservation cannot be realized.

- * Strengthening capacity of personnel and institutions on biodiversity is a matter that requires a lot of funding and continuation of efforts. It is accepted by various agencies that the officials have relatively limited knowledge on biodiversity and are without sufficient expertise on conservation and rehabilitation. The officials must be familiar with the use of computer to store information, and be acquainted with GIS to the extent that information produced by the system can be drawn for planning. Such system will allow the officials to learn the names of animals and plants in national parks/ wildlife sanctuaries and be able to identify wildlife non-hunting areas with wetland characters, thus recognizing their works as maintaining wetlands as bird habitats and not just another wildlife non-hunting areas.

- * Research is a contributor to building capacity for conservation. While researches in public offices usually meet the conservation need, those conducted in universities remain mostly specialized endeavors or based on specific interests. Biodiversity research funding agencies in Thailand are often without clearly defined policy and goal. Such practices are unlikely to neither meet the national need nor achieve the national goals for biodiversity conservation.

Directions

Several recommendations of the National Committee on the Convention on Biological Diversity have provided directives that govern the nature of NBSAP, 2003-2007. The recommendations are considered as significant differences between NBSAPs for the years 1998-2002 and 2003-2007.

- * The framework of NBSAP, 1998-2002 was again used since it was developed in accordance to the framework of the Convention on Biological Diversity. Such framework is a comprehensive directive for all aspects of biodiversity works in enabling the conservation and sustainable use of biodiversity and ensuring fair and equitable sharing of benefits deriving from the use of biodiversity.

- * The proposed projects included in NBSAP, 2003-2007 should reflect the real needs. Such projects were previously omitted from NBSAP, 1998-2002. When the success of the implementation of biodiversity works was assessed, it was found that these projects have not yet been implemented.

- * The monitoring mechanism was lacking in the previous NBSAP, with the absence of annual reporting of progress. Thus NBSAP, 2003-2007 emphasizes the role of the National Committee on the Convention on Biological Diversity as the mechanism for monitoring the status and success of NBSAP, with committees in the agencies undertaking monitoring and annual reporting.

In addition to the recommendations made by the National Committee on the Convention on Biological Diversity, various brainstorming sessions were organized to gather recommendations from national experts and stakeholders, and the following issues to amend NBSAP, 1998-2002 can be concluded.

Efforts

* The wetland management plans that were formulated in accordance to the Convention on Wetlands should be integrated, in order to reflect the linkage between the Convention on Biological Diversity and the Convention on Wetlands at the global level. The alliance between these two conventions exists as a joint work plan where the Convention on Wetlands' s focuses on freshwater ecosystems and marine and coastal ecosystems coincide with specific thematic areas on such ecosystems under the Convention on Biological Diversity. Inclusion of the wetland plans would thus bring the relationship into the implementation at the national level.

* The 7th Strategy (International Cooperation) of NBSAP, 2003–2007 is vital that Thailand's image at the international forum is clearly established. Enhancing the country's profile through nomination of World Heritages, ASEAN Heritages, Ramsar Sites, Biosphere Reserves and even joining the flyway network for migratory species under the Convention on Conservation of Migratory Species of Wild Animals should thus be focused under the amended 7th Strategy.

* Issues on GMOs and invasive alien species should be focused more in the amended NBSAP. This is due to persisting public confusion on GMOs issues and very little or no implementation on the management of invasive alien species, despite their potential of becoming a major threat to biodiversity in the country.

Formulation of NBSAP, 2003–2007 primarily aims to ensure result-based implementation in the area and to continue cooperation between relevant and competent agencies under common goals and in accordance to biodiversity management that was described in the Convention on Biological Diversity. In developing NBSAP, the National Committee appointed the Working Group on National Policy, Strategies and Action Plan on Conservation and Sustainable Use of Biodiversity for 2003–2007, consisting of representatives of relevant agencies and with the Office of Environmental Policy and Planning (OEPP) serves as a secretariat. The Working Group had set out to draft NBSAP for a 5-year period, between 2003–2007.

The Working Group met in 3 separate occasions to deliberate the issues, as addressed by the Convention, to be included in the institutional directive as well as associated measures work plans and projects for the 2003–2007 period. In addition to meetings, various activities were implemented. The preliminary draft of NBSAP was finalized. However, in order to ensure comprehensiveness of their components, multi-party forums were set up and their comments were incorporated in the final version of NBSAP (see Box 1).

Coordinating Mechanisms for the Implementation of the National Policy, Strategies and Action Plan

The coordinating and monitoring mechanisms for the implementation of the National Policy, Strategies and Action Plan on the Conservation and Sustainable Use of Biodiversity are in forms of the following.

National Committee

- The National Environment Board
- The National Committee on the Conservation and Use of Biodiversity
- The National Committee on the Convention on Biological Diversity
- The National Committee on Wetland Management

These Committees consist of representatives from relevant organizations, either government or NGOs, such as Royal Forest Department, Department of Fisheries, Department of Agriculture, Department of Livestock Development and OEPP.

The Working Group

This Working Group on the Monitoring and Assessment of the Implementation of the Policies, Measures and Plans, under the National Committee on the Convention on Biological Diversity will work as the coordinating body, which coordinates with the committee/working group from governmental departments. For the coordination at the local level, it will

be done under the annual Action Plan for Provincial's Environmental Quality Management.

The Annual Meeting

OEPP will work as the coordinating body to coordinate, collect and compile reports from the implementing agencies and present them to the meeting for monitoring and reporting the implementation of NBSAP, 2003–2007.

Box 1 : Milestones: Formulation of the National Policy, Strategies and Action Plan on Conservation and Sustainable Use of Biodiversity (NBSAP), 2003–2007

- The Chairperson of the of the National Committee on the Convention on Biological Diversity signed the Committee's order number 1/2001 appointing the Working Group on Formulation of the National Policy, Strategies and Action Plan on Conservation and Sustainable Use of Biodiversity, 2003–2007, on January 24, 2001. Mandates of the Working Group are to compile lists of projects related to conservation and sustainable use of biodiversity of relevant agencies as well as to propose national measures, program and projects on conservation and sustainable use of biodiversity for inclusion in NBSAP. The Working Group is chaired by Dr. Utis Kutintara, Dean of Faculty of Forestry, Kasetsart University and comprised of representatives of relevant agencies
- The Working Group on Formulation of NBSAP, 2003–2007 met for the first time on March 8, 2001 to determine its scope of work and issues to be included in the draft NBSAP. At the meeting, the Working Group endorsed the inclusion of the wetland management plan in NBSAP, based on the view that wetlands are ecosystems with high level of biodiversity and constitute a vital part of national biodiversity.
- The Office of Environmental Policy and Planning (OEPP), as the secretariat of both the National Committee and the Working Group, issued letters in April 2001 requesting 148 public and private agencies to review and provide additional input for targets, principles, strategies, objectives, measures and action plans in the draft NBSAP. Seventy-nine agencies later responded to the request.
- The Working Group met on June 21, 2001 to deliberate on reviews and additional input proposed for the draft NBSAP by 79 respondents.
- The National Committee on the Convention on Biological Diversity, in the 3/2001 meeting on June 26, 2001, asked the Working Group to revise the draft NBSAP in accordance to observations and recommendations of the National Environment Board (as agreed in the Board meeting on May, 31, 2001).
- The Working Group met on July 13, 2001 to deliberate on the proposed addition of biodiversity status and other revisions of draft NBSAP, as recommended by the National Committee. The Working Group also decided to send the revised draft to relevant agencies for further review and endorsement.
- The OEPP, as the secretariat of both the National Committee and the Working Group, issued letters in July 2001 requesting 151 public and private agencies for comments and to propose projects tentatively for the 2003–2007, to be included in the draft NBSAP. Fifty-five agencies responded to the request.
- The OEPP, as the secretariat of the Working Group, organized the following 2 meetings to gather opinions and recommendations from relevant agencies; the first meeting on August 8, 2001 at Maruay Garden Hotel, Bangkok and the Second Meeting on August 27–28, 2001 again at Maruay Garden Hotel, Bangkok
- The OEPP compiled opinions and recommendations from both meetings and lists of projects proposed by 77 agencies that responded to the requested letter in July, for final revision of the draft NBSAP. The final draft was then circulated to 191 agencies for final endorsement in September 2001. The Working Group met on September 15, 2001 to amend additional revision of the final draft before submitted to the National Committee on the Convention on Biological Diversity and the National Committee on Wetland Management.
- With the inclusion of national wetland management plan in the draft NBSAP, the OEPP, as the secretariat to the Technical Working Group on Wetlands and the National Committee on the Wetland Management, submitted the draft NBSAP, 2003–2007 to the Technical Working Group for endorsement at its 2/2001 meeting on September 10, 2001. The draft NBSAP were also presented before the National Committee on Wetland Management at its 3/2001 meeting on September 24. Both the Technical Working Group and the National Committee endorsed the draft.
- At the 4/2001 meeting on September 25, 2001, the National Committee on the Convention on Biological Diversity requested the secretariat (OEPP) to prepare an executive summary of the NBSAP. At the following meeting held on October 19, 2001, the National Committee formally endorsed the draft NBSAP, 2003–2007 and requested the secretariat to submit the NBSAP to the National Environment Board and upon the Board's approval, to the Cabinet.
- At the 5/2001 meeting on October 19, 2001, the National Committee on the Convention on Biological Diversity officially endorsed the draft NBSAP, 2003–2007 and requested the secretariat to submit NBSAP to the National Environment Board for endorsement of the following issues;
 - Endorsement of the draft NBSAP, 2003–2007 with a total budget of 7,538.97 million Baht.
 - Endorsement of the inclusion of projects in the action plans of the draft NBSAP, 2003–2007, in the "Biodiversity Conservation Work Plan" budget from 2003 onward.



4. Management Efforts

In addition to achievements from the implementation of the NBSAP, 1998–2002 mentioned in Chapter 2, Thailand had responded to Convention on Biological Diversity in various specific issues such as wetland management, invasive alien species regulation, Red Data, taxonomic data gathering, biosafety and information management & networking. This report elaborates mainly on biosafety, information management & networking priorities and invasive alien species issues.

Background

Actions on biosafety in Thailand were initiated by the National Genetic Engineering and Biotechnology Center (BIOTEC) in 1983. In 1995, the National Office on Science and Technological Development, governing the BIOTEC, established the National Biosafety Committee (NCB) to support, control, regulate, provide consultation and review on biotechnology researches through sub-committee on specific fields. Also in 1992, a biosafety guideline was formulated as a laboratory regulation on biosafety for every concerned agency. In addition, Institutional Biosafety Committees (IBC) were established in universities, education institutes and research institutes of both public and private sectors, as self-regulated mechanisms under the guideline as well as to coordinate efforts on biosafety with the NCB. After the Regulation of the Prime Minister Office on Conservation and Sustainable Use of Biodiversity entered into forces on January 12, 2000, responsibilities on biosafety fall under the Thailand Biodiversity Center, under the National Committee on Conservation and Sustainable Use of Biodiversity. Under this new framework, the Sub-committee on National Biosafety Policy was formed to supervise biosafety issues that derived from modern biotechnology, especially in the overall policy at the national level.

Despite the above-mentioned progress, Thailand remains without a legislation that directly addresses biosafety. There are, however, some efforts to adopt existing laws for such need. The Department of Agriculture has revised annexes of 1964 Plant Quarantine Act (revised 1999) to extend its original objective of minimizing pathogenic risk from imported seed of transgenic plants. The revised annexes now contain a list of 40 species where their transgenic varieties are prohibited from imported into the country, except for soybean and corn that used for processed food and as seeds for specific industries.

Policies

The Sub-Committee on Policies Concerning Biotechnology Products under the National Committee on International Economic Policy, has assigned the Working Group on Measures Concerning Production and Trade of Biotechnology Products, to revise the draft policy on genetically modified food and agricultural product (2002–2006) in accordance to its decision on February 13, 2001. The draft consists of policies in 6 areas as follow.

Policy on Production

Thailand has not yet produced genetically modified plants, animals and microorganisms or used genetically modified organisms in production processes for trade, unless scientifically sound evaluation has been conducted to warrant biosafety of such activities.

Policy on Human Resources and Technological Development

Supporting development and strengthening of capacity in research and production of genetically modified food and agricultural products to ensure self-reliance, effectiveness and competitiveness while taking into account safety of the consumers.

Promoting development of knowledge and experience for those associated with monitoring genetically modified food and agricultural products in several areas including research, laboratory analysis, biosafety evaluation and risk assessment.

Policy on Biosafety Evaluation

Biosafety evaluation and risk assessment of genetically modified food and agricultural products are to be carried out on scientifically sound basis and in transparent manner procedures basis. Relevant agencies are requested to jointly conduct these tasks using the same measures for imported domestically produced and exported products.

In the case where certain products may pose health risk to specific groups of consumers, such risks must be clearly displayed on the labels. This labeling measure is applied to imported, domestically produced and exported products.

Monitoring long-term impacts to health and the environment after production/cultivation or distribution of genetically modified products is approved.

Policy on Trade

Importation and domestic distribution of genetically modified food and agricultural products are subjected to prior biosafety evaluation and risk assessment.

Supporting preparation for exporting genetically modified food and agricultural products that their (bio) safety has been certified and in accordance to rules, regulations, conditions and demands of trading partner countries.

Policy on Public Relations

Collecting, analyzing and promoting compilation and dissemination of news and information on scientific issues, trade, governmental regulations and procedures and findings on genetically modified food and agricultural products in Thailand and other countries to involved parties and general public, to ensure correct understanding of the issues. These are to be carried out in an objective and transparent manner.

Policy on Participation

Supporting partnerships between public and private sectors, both domestically and internationally, in the implementation of policies related to genetically modified food and agricultural products, and providing support to the formulation of clear guideline on international trade of genetically modified food and agricultural products.

Status of Research and Development in Genetic Engineering

In Thailand, there are genetic engineering research and development activities in at least 5 groups of commercial plants, tomato, papaya, chili, cotton and orchid. The first four groups concern research and development on pest resistance, while the last one is research and development for producing new colors in existing species.

Details of research and development activities in each group are as follow:

Tomato

To tackle tomato yellow leaf curl disease caused by tomato yellow leaf curl virus (TYLCV), TYLCV-CP gene was inserted with agrobacterium method with NPTII (monitoring plasmid), NOS and GUS genes (inspecting genes in various parts of the transgenic plant) as components. The experiment is still confirmed in the greenhouses (the transgenic plants suffer from slower growth, 10–14 days behind the growth of the regular plants).

Papaya

To treat ringspot disease caused by papaya ringspot virus (PRSV), PRSV-CP gene was inserted by particle bombardment (gene gun), with NPTII (monitoring plasmid), 35S promoter and GUS genes (inspecting genes in various parts of the transgenic plant) as components. The Kaek Dum and Australian cultivar 2001 varieties were used as the hosts. The experiment is still confirmed in the greenhouses. Mahidol University and the Department of Agriculture (DOA) have also carried out similar researches.

Chili

To tackle chili vein-banding mottle disease caused by chili vein-banding mottle virus (CVbMV), (CVbMV)-CP gene was inserted via agrobacterium method with NPTII (monitoring plasmid) and GUS A genes (inspecting genes in various parts of the transgenic plant) as components. The experiment is still confirmed in the greenhouses (the amount of virus found varied between each plant).

Cotton

To provide resistance against cotton bollworm (*Helicoverpa armigera*), Bt gene from *Bacillus thuringiensis* was transferred as synthetic cry1A(b) by agrobacterium method with GUS genes (inspecting genes in various parts of the transgenic plant) as a component. Sri Somrong variety was used as the host for the experiment, which is still confirmed in the greenhouses.

Orchid

To produce new colors for *Dendrobium sabin*, chalcone synthase (CHS), chalcone isomerase (CHI) and dihydroflavonol reductase (DFR) were inserted. The experiment is still confirmed in the greenhouses.



Status on Importation

DOA, an authorized enforcer of the 1964 Plant Quarantine Act amended 1999, has issued a declaration banning importation of 40 genetically modified commercial plant species, except soybean and corn when used for production of animal feed/food and industry. Others are allowed for experiments under criteria and conditions set forth by the Department's Director General.

At present, DOA has approved import of 5 genetically modified plants for experiment. These are Bt corn (resistance against cotton bollworm), Round-up Ready corn and cotton (herbicide resistance), tomato to extend the ripeness, papaya with resistance against ringspot and Jasmine Rice 105 with resistance against bacterial leaf blight.

In addition, DOA has issued a declaration and the following actions to regulate the genetically modified plants in Thailand:

- * Department of Agriculture's Declaration on Request for Certification Documents from Exporters of Seeds, which are not genetically modified, issued on January 7, 2001.
- * Department of Agriculture's Declaration on Import of Plant Breeding Materials, including seed, where certification documents that such materials are not derived from genetically modified plants, from exporters are required, issued on February 8, 2001.
- * Department of Agriculture's Declaration on Cultivation of Genetically Modified Cottons, issued on March 6, 2001.

Status on Biosafety Testing

DOA issued a Declaration on Operational Guidelines on Request for Approval of Import or Transit of Materials Prohibited by the 1964 Plant Quarantine Act, 3rd revision (2001), on March 7, 2001. Importers are required to follow guidelines described in the Declaration as well as ensure that their activities are consistent with biosafety guidelines for experiments concerning genetically modified plants.

The guidelines comprise the following 3 steps.

- * **The First Step**
Studies conducted in confinement in the greenhouses and/or laboratories.
- * **The Second Step**
Studies conducted in small-scale experiment plots.
- * **The Third Step**
Large-scale field experiment.

The latest biosafety testing conducted by DOA, as assigned by the Ministry of Agriculture and Cooperatives, is the testing of Bt cotton (NuCOTN 33B) imported by Monsanto (Thailand). The testing was conducted in large experiment plots in 4 department's crop research centers and experimental stations. The testing has so far found neither negative impacts nor adverse effect to the environment nor natural enemies and other non-target organisms.

Status on GMOs Products

Labelling as a mean to inform the consumers of product's components that are derived from genetically modified organisms (GMOs), should be regulated in parallel with efforts to ensure accurate public understandings of GMOs, in order to mitigate public concerns and enhance consumer's right to know and choice.

The Food and Drug Administration (FDA) is currently drafting a Ministerial Declaration on Labelling of Food derived from genetic modification or genetic engineering. Under the Declaration, annexed soybean, corns and products derived from soybean and corn with genetic materials (DNA) or proteins resulted from genetic modification more than 5% in the first 3 main components which made up more than 5% of the weight of the products, must be labelled "Genetically Modified" with the name of the product. In order to prevent misleading to consumers, wording such as "GMO-Free", "Non-GMOs", "Without Components derived from GMOs" or "Selectively Excluded GMOs", are prohibited in the label.

After series of public hearing on the draft Declaration, the Working Group on Labeling on Genetically Modified Food approved the draft. The revised version must be submitted to the Sub-Committee on Safety of Genetically Modified Food, under the National Committee on Food, for further deliberation.

Trend

The Cartagena Protocol on Biosafety was created to ensure safety in movement of living modified organism with focus on transboundary movement and impacts to conservation and sustainable use of biodiversity as well as human health. Thailand needs to be prepared for meeting obligations of the Protocol. These include institutional development such as building appropriate databases and clearing houses on genetically modified organisms, establishing national focal point which acts also as the main biosafety clearing house and identifying Competent National Authorities which include departments and divisions with legal authorities in regulating biosafety.

Information Management & Networking

Background

As a focal point to the Convention on Biological Diversity (CBD), a long-standing priority of the Office of Environmental Planning and Policy (OEPP) has been the management and networking of biodiversity information to support conservation and sustainable use initiatives. This has manifest itself in projects such as the UNEP-supported Biodiversity Data Management Project (BDM) and recent initiatives aimed at developing metadatabases, the Thai Clearing House Mechanism, and harmonized reporting to international conventions through collaboration with national partners and regional organizations such as the ASEAN Regional Centre for Biodiversity Conservation (ARCBC).

Context

The effective management of biodiversity information is fundamental to the implementation of many provisions of the Convention. It is called for specifically under Article 7 Identification and Monitoring; supports *In-situ* (Article 8) and *Ex-situ* (Article 9) Conservation and the Sustainable Use of Components of Biodiversity (Article 10); is a cornerstone to developing programs in Research and Training (Article 12) and Public Education and Awareness (Article 13); and is vital in promoting the Exchange of Information (Article 17) and in facilitating Technical and Scientific Cooperation (Article 18), including the development of national Clearing House Mechanisms. Further, the effective management, networking and use of biodiversity information is instrumental in developing national strategies, plans and programs called for under Article 6 of the Convention. In Thailand, this has translated into the preparation of documents such as the National Policy, Strategies and Action Plan on Conservation and Sustainable Use of Biodiversity and Biodiversity Conservation in Thailand: A National Report.

Biodiversity Data Management Project (BDM)

Launched in the mid-1990s, Thailand was one of ten countries involved in the Biodiversity Data Management Project (BDM). This project was initiated to enhance biodiversity data management capacity of developing countries in support of implementation of the Convention. In Thailand, outputs of the BDM project included:

- * **Preparation of a National Institutional Survey.** This survey aimed at identifying datasets held by organizations, as well as institutional capacity to handle and manage biodiversity information.
- * **Development of a Guideline on Biodiversity Data Management.** This Guideline was developed as a measure for improving the management and availability of biodiversity information, and includes the following major components:
 - Guideline on the Development of Efficiency in Biodiversity Data Management.
 - Establishment of a Biodiversity Information Network (BINET).
 - Biodiversity Data Management Standards (BDMS).
- * **Preparation of a Biodiversity Data Management Action Plan.** In promoting the management and exchange of biodiversity information, the Action Plan comprises 4 policies, 15 measures and 51 specific activities. Elements of the Action Plan have been incorporated into the National Biodiversity Strategy, initially approved by the Working Group on Biodiversity Data Management under the National Committee on the Convention on Biological Diversity, and subsequently by the Cabinet in 1997.

Due to a downturn in the regional economy in the late 1990s, implementation of the Action Plan has proved difficult. Nevertheless, there has been a continued and increasing need for biodiversity information to support decision-making and educational processes in addressing environmental problems, and in enabling Thailand to meet its obligations to a range of international conventions and programs.

Identification of Information Management & Networking Priorities

Against this background, a number of priorities have been identified in the management and networking of biodiversity information in Thailand. These include the following:

- * Continued implementation of the BDM project, particularly revision of the institutional survey and building of institutional capacity to manage biodiversity information.
- * Enhanced institutional networking through mechanisms such as BINET.
- * Establishment of the Thai Clearing House Mechanism.
- * Harmonized reporting to the international conventions.

Taken together, these priorities form the basis of an integrated program of activities in information management and networking that supports conservation and sustainable use initiatives as well as monitoring and reporting requirements for a range of conventions and programs.

Collaboration between OEPP & ARCBC

The ASEAN Regional Centre for Biodiversity Conservation (ARCBC) is a joint EU-ASEAN initiative whose goal is to intensify biodiversity conservation throughout the region by working with a network of National Biodiversity Reference Units (NBRUs). Through this cooperative arrangement, integrated programs of research, training, networking and information management is being delivered.

In serving as NBRU for Thailand, OEPP and ARCBC are collaborating in a range of information management and networking activities to address stated priorities. These include updating the biodiversity information survey, metadatabase development, building institutional capacity, establishing Clearing House mechanism, and harmonized reporting to international conventions.

Updating the Biodiversity Information Survey

Based on the questionnaire design developed by UNEP-WCMC and used in the original BDM study (see Box 2), survey forms on Organizations, Datasets and Experts were prepared and distributed to several hundred organizations and individuals at both national and international levels in 2001. This effort has resulted in more than 300 questionnaires being returned on Organizations and more than 200 forms being returned on each of Datasets and Experts, respectively. Results are being managed in a relational database, and a Biodiversity Information Survey Report has been prepared, serving to outline the current situation in information management and networking in Thailand. The Report also draws some interesting comparisons with the original BDM survey. As part of the process in updating the survey, meetings with national partners were conducted and used to help determine the design, analysis and outputs (e.g. report and on-line metadatabases) of the survey questionnaires.

Box 2 : Development of three survey questionnaires

- Register of Biodiversity Specialists (to complement the ARCBC metadatabase on 'Biodiversity Specialists' for the region). A process was also elaborated to enable Thai experts to either complete the questionnaire on paper or enter details directly on the ARCBC website.
- Survey of Institutions. This survey questionnaire was based on the form used in the earlier Biodiversity Data Management (BDM) project, work of UNEP-WCMC in developing institutional surveys, and following review of current metadatabase developments.
- Survey of Datasets. Developed as for Institutional Details outlined above.
- Discussed the survey questionnaires with staff from national focal points to the international conventions and affiliated biodiversity institutions at a meeting facilitated by OEPP. This meeting also discussed information management and networking issues in Thailand, and harmonized reporting to international conventions. A report from this meeting is being prepared by the OEPP team.
- Process elaborated and agreed with OEPP staff for implementing the institutional survey.
- Preliminary discussions held with OEPP on further training and capacity building support from ARCBC.
- Process discussed with colleagues at ARCBC and OEPP for developing the Thai Clearing House Mechanism, with a view to extending the model developed to other countries of the region.

Metadatabase Development

An important output of the biodiversity information survey is presentation of a web-based catalogue on organizations, datasets and experts involved in the conservation and sustainable use of biodiversity. This metadatabase, due to be released in the second half of 2002, will be linked to ARCBC Interactive and, where possible, other metadatabases dealing with wider environmental issues at national, regional and

Building Institutional Capacity

A vital component in the management and networking of biodiversity information is building institutional capacity insofar as infrastructure, technology and human resources are concerned. Through support from ARCBC, this has translated into the purchasing of computer hardware and software at OEPP, the provision of training in computer programming languages and web design, and the facilitation of workshops in

Table 2 : Information Extracted from the Metadatabase on Datasets

<i>data_id</i>	<i>title_of_dataset</i>	<i>key_words</i>	<i>web_address</i>	<i>contact</i>
131	Butterflies in Thailand	butterfly, identification	www.butterflysite.com	webmaster@butterflysite.com
55	Wetlands	wetlands, inventory, national		sirikb@yahoo.com
115	Lichens in Thailand	lichens, taxonomy, pollution		kansri@ram1.ru.ac.th
105	National Park Database	natural resources, national park	www.forest.go.th	(66)2-5614292-716
116	Biodiversity of Marine Vertebrates	mammal, fish, mangrove		(66)38-391671-3

international levels. The metadatabase will allow on-line updating of institutional, dataset and expert details and will, in due course, be available in English and Thai languages. An extract from the metadatabase on datasets is illustrated in the Table 2.

developing information management and networking initiatives at a national level. The expertise gained is now being used to present the metadatabase and OEPP Biodiversity Series on the web, and will eventually be used to link organizations and datasets in support of networking activities in Thailand. In support of these initiatives, OEPP have also designated three staff to work specifically on information management and networking activities.

Establishing Clearing House Mechanism

Many countries have developed a Clearing House mechanism to the Convention on Biological Diversity. Development of these Clearing House mechanisms is intended to promote scientific and technical cooperation, and the exchange of information in support of biodiversity conservation and sustainable development.

In Thailand, presentation of an on-line metadatabase and links to key datasets themselves will directly support goals of the Clearing House Mechanism in the following ways:

- Provide an invaluable information resource.
- Support and re-invigorate networks such as BINET.
- Provide a platform for the further implementation of the Biodiversity Data Management Action Plan.
- Identify capacity building needs in partner institutions involved in the conservation and management of biodiversity, and support initiatives such as harmonized reporting to the international conventions.

Bodies such as the Informal Advisory Committee to the CBD Clearing House Mechanism (CHM), as well as other national and regional CHM focal points will be engaged to support the conceptual design and further development of the Thai Clearing House Mechanism-partnerships which could also facilitate the development of other national Clearing House mechanisms in ASEAN.

Harmonized Reporting to International Conventions

Internationally, an area of great interest is in developing mechanisms that simplify and streamline reporting requirements to international conventions. The UNEP World Conservation Monitoring Centre (UNEP-WCMC) is currently involved in a pilot project to review different models of harmonized reporting, one of which is being developed in Indonesia. ARCBC is currently exploring ways of providing regional support to this initiative that would allow extension and adaptation of appropriate models to other countries of the region. In Thailand, there have been initial discussions with focal points to the international conventions to consider key data holders in relation to the information requirements of the major conservation-related conventions. This process is being supported by information from the Biodiversity Information Survey, and it is envisaged that further discussions will result in a model being developed that addresses reporting needs in a Thai context.

S u m m a r y

There are a number of complementary initiatives currently ongoing in the management and networking of biodiversity information in Thailand. These initiatives are closely integrated and, collectively, provide the basis for a strategic program that promotes the effective management and networking of biodiversity information, and initiatives aimed at the conservation and sustainable use of biodiversity. Using the Convention on Biological Diversity as a framework for action, a further development has been the establishment of an increasing number of partnerships at national, regional and international levels in support of conservation efforts in Thailand.

B a c k g r o u n d

Invasive alien species has continuously been an issue discussed by the Conference of the Parties to the Convention on Biological Diversity. Concerns of international community over uncontrolled introduction of non-indigenous species has been confirmed by several reports on the failure to distinct the species from native ones. Moreover, invasive alien species have long records in causing changes to plant and animal communities, loss of biodiversity and even adverse impacts to economy with high cost for their control and eradication.

These effects can be seen from several species that take root in Thailand such as giant sensitive plants and water hyacinth.

W o r k i n g G r o u p o n A l i e n S p e c i e s

Efforts to combat adverse impacts from alien species in Thailand have been carried out under the National Committee on the Convention on Biological Diversity with OEPP serves as the secretariat. The Committee appointed the Working Group on Alien Species in Thailand on January 23, 1996 to compile information on non-indigenous species in the country and provide consultation on formulation of measures to control and prevent loss of biodiversity derived from the spread of alien species.

The Working Group and OEPP jointly organized 2 meetings to discuss and exchange experiences on alien species. The first one was held between October 24–26, 1996 at Amari Orchid Resort Hotel, Pattaya, Chonburi Province, while the other on December 16, 1997 at Chaopraya Park Hotel, Bangkok.

There were several discussions on legal aspects on controlling and eradicating alien species in Thailand. These discussions found several relevant legislation including the 1913 Waterhyacinth Eradication Act, 1964 Plant Quarantine Act (revised 1999), 1975 Plant Variety Act (revised 1992) and 1947 Fisheries Act.

A list of alien species in Thailand, containing approximately 1,500 species, has been compiled and is now available at www.thaialienspecies.com. In addition, the Working Group has formulated a work plan on control and prevention of loss of biodiversity derived from impacts of invasive of alien species. These information and efforts were presented to the public at another meeting held on May 22–23, 2001, to stimulate further dissemination of information, exchange of experience and enhancing capacity for future implementation.

Invasive Alien Species in Thailand

There are many invasive non-indigenous plant and animal species in Thailand. The notable ones are the following.

Waterhyacinth (*Eichhornia crassipes*)

Waterhyacinth is a native aquatic plant of South America. In its native habitats, the species does not adversely impact the environment since its populations are controlled by several natural grazers. Its introduction into Thailand has a long history. Waterhyacinth was taken from South America and exhibited at a show in New Orleans, U.S.A. The visiting Dutch citizens were fascinated by the species and took its for propagation in their home country. However, it was later found that climate in Amsterdam is not suitable for the species, so the waterhyacinth was sent to the Dutch colonies in Indonesia. The species entered Thailand from Indonesia during the reign of King Rama V and originally planted in Sa Pratum Palace. After the flooding, waterhyacinth in the Palace spread quickly into almost every natural freshwater reservoirs of the country and become one of the most serious

waterweed. Thailand enacted Waterhyacinth Eradication Act in 1913, which was before IUCN issued its first recommendation on the species. The Act imposed hefty fines (at the time) for transportation of waterhyacinth by car or train; however, did not contribute much impact on reducing its populations. Biological control is now used for controlling waterhyacinth in Thailand. The National Biological Control Research Center has introduced 4 natural predators to control the species which are mottled waterhyacinth weevil (*Neochetina eichhorniae*), chevroned waterhyacinth weevil (*Neochetina bruchi*), waterhyacinth moth (*Sameodes albiguttalis*) and waterhyacinth moth (*Xubida (Acigona) infusella*). Results from the use of these predators have been satisfactory with significant reduction in populations of waterhyacinth in several reservoirs.

Alligator weed (*Alternanthera philoxeroides*)

Alligator weed was another serious weed species. The species is now rarely found due to effective control by chrysomelid (*Agasicles hygrophila*), which was introduced from Argentina.

Water fern (*Salvinia molesta*)

Water fern is a new invasive alien species. It was previously sold in various markets. After control, water fern still can be ordered through black markets.

Giant sensitive plant (*Mimosa pigra*)

Giant sensitive plant was believed to first enter into Thailand by tobacco farmers who visited Indonesia on a field trip. The farmers found that the plant was used for composting organic fertilizer in Indonesia and brought its seeds back for such use in Mae Tang and Chiang Dao Districts, Chiang Mai Province. Soon, the species spread around cultivated plants and along irrigated canals near Mae Tang Irrigation Office. Believing that the species could be used to prevent collapse of bank areas from livestock, the Irrigation Office released the seed into irrigation canals and caused the species to quickly spread through out the country. Two species, seed bruchids (*Acanthoscelides puniceus*) and seed bruchids (*A. quadridentatus*), were introduced from Mexico for controlling the giant sensitive plant.



Siamweed **(*Chromolaena odorata*)**

Siamweed is originally from Central America. Its seeds are believed to be unintentionally introduced into Thailand as a contaminant of ballast. The spread of the species was a serious problem after the second World War, but its reputation is now improved due to its use as a herbal plant. Siamweed can be found in lower plain areas up to 600–900 meters above the sea level. Chalcid (*Branchymeria euploaeae*) and tephritid gall fly (*Cecidocharef connexa*) are used for biological control of the species.

Crofton weed **(*Pamakani, Ageratina adenophora*)**

Crofton weed entered into Thailand via Myanmar and Southern China. The species is similar to Siamweed and can be found at elevation over 600–900 above the sea level. The National Biological Control Research Center had introduced tephritid gall fly (*Procidochares utilis*) into areas of Doi Suthep and Doi Inthanon since October 19, 1989 as an experiment to control crofton weed. The result found in 2000 confirmed effectiveness of the insect in obstructing the growth of crofton weed.

Lantana **(*Lantana camara*)**

Lantana is a native plant of Mexico but has found to be a serious weed in several countries such as Hawaii, Australia and India. Lantana is not an invasive alien species in Thailand since there are many insect species that can be used for controlling its population.



Mile-a-minute **(*Mikania micrantha*)**

Mile-a-minute is a new alien species found in Chiang Mai Province and northern Thailand. The species is a creeper with leafs similar to Mexican creeper (*Antigonon leptopus*). The pace of its expansion in number was found to be exceeding even the giant sensitive plant. Mile-a-minute has been known as a weed in Malaysia for many years. It was, however, first found around Chiang Mai University approximately 10 year ago. Thus, it is believed that the species might be introduced from Malaysia by foreign experts or spread from Southern China where the species has also been found. Mile-a-minute can be used for controlling the giant sensitive plant, by blanketing the whole plant until its dead. Unfortunately, the species also damage other commercial species such as lychee, in this manner, causing serious economic loss to farmers. A species of thrips (*Scirtothrips citri*) was found to be able to control mile-a-minute but it is yet proved to be effective.

Giant African snail **(*Achatina fulica*)**

Threat from giant African snail was, at one time, more serious than the golden apple snail (*Pomacea canaliculata*). The National Biological Control Research Center introduced 2 molluscs from Hawaii, rosy snail (*Euglandina rosea*) and gonaxis snail (*Gonaxis quadrilateralis*), into Muak Lek District, Sara Buri Province and Pakchong District, Nakhon Rachasima Province as an experiment to control the species. Effectiveness of the species as found in the experiment has not been conclusive. However, the method that has proved to be very effective is collection of the snail for canning industry, export products to European market.

Draft Work Plan

Draft Work Plan on Control and Prevention of Loss of Biodiversity derived from Impacts of Invasive Alien Species;

Objectives

To enable coordination between public and private organizations in protecting biodiversity from impacts of invasive alien species and to maintain natural ecosystems.

- * To enhance awareness on impacts from invasive alien species.
- * To create mechanisms for education on invasive alien species and their control.
- * To reduce unintentional introduction of invasive alien species.
- * To ensure that intentional introduction is under control and has been adequately assessed before carried out, in particular on impacts to biodiversity.
- * To assist those involved in introduction of alien species in making informed decision and taking appropriate actions.
- * To ensure systematic monitoring of invasive alien species with early warning systems.
- * To facilitate eradication/control of existing invasive alien species with the most appropriate methods.
- * To create legal basis and international cooperation on prevention, eradication and control of invasive alien species.

Actions

Biodiversity agency is to carry out the following tasks.

- * Compile reports on alien species and their status in Thailand.
- * Prioritize alien species (based on the report) for control/eradication/management in accordance to their respected priorities and status.
- * Formulate regulations or laws that are necessary to control and prevent loss of biodiversity from the spread from alien species.
- * Establish databases on invasive alien species with linkage to international communities and disseminating information to relevant agencies.
- * Encourage, in international meeting, discussions on international regulations on import/export of alien species, global list of invasive alien species, establishment of global databases on alien species, and prohibited species for specific country.
- * Provide education and promote awareness on danger and loss derived from the spread of alien species as well as provide practical knowledge on controlling alien species through various media.

Spiralling whitefly (*Aleurodicus dispersus*)

Since it was firstly found in 1981, the spiralling whitefly has caused severe damages to several crops and fruits. The species often leaves the powder-like marks on leaves of plant. The National Biological Control Research Center has introduced coccinellid (*Nephaspis oculatus*) from Hawaii to control the species. The Center has also known of another invasive alien insect, coconut whitefly (*Aleurodicus destructor*) which is relatively similar in appearance to the spiralling whitefly and has long been a pest in Thailand without any control. The coconut whitefly is, after all, an invasive species only in the early phase of its introduction. It will gradually assimilate into ecosystems and become less serious due to control of natural predators.

Leucaena psyllid (*Heteropsylla cubana*)

Leucaena psyllid entered into Thailand in 1986, causing damage to Leucaena nationwide. The National Biological Control Research Center introduced coccinellid (*Curinus coeruleus*) from Hawaii, *Olla v-nigrum* from Tonga and encyrtid (*Psyllaephagus yaseeni*) from Trinidad, to control leucaena psyllid. The use of these species has proved to be effective.

✿ **Controlling Introduction of Alien Species**

Controlling Unintentional Introduction

Biodiversity agency is to implement and coordinate the following.

- * Disseminate information on invasive alien species in Thailand and oversea officers/staff who inspect imported plants and animals on the border, in order to facilitate their inspection.
- * Disseminate information to oversea travelers who enter the country either by air or sea and enable them to take some care to prevent introduction of alien species into Thailand. Practical information may be provided via various media.
- * Coordinate cooperation among relevant agencies in controlling import of alien species:
 - Coordinate for inclusion of provisions to prohibit introduction of alien species (including unintentionally) in any international agreements;
 - Coordinate for inspection of samples of plant and animal species intended for import and export;
 - Coordinate for review/study of transboundary movement of species from international development projects, such as International Water Diversion Project, etc.
 - Coordinate the following actions in controlling import and export.
 - Prohibiting export of specifically ordered species and species that have not been promoted for mass export, in order to

- reduce the risk from extinction;
- Ensuring that exporters take adequate care in preventing contamination of products and package with alien species;
- Ensuring that transport firms or importers undertake adequate prevention of unintentional introduction;
- Movement of packages containing biological materials must be registered, to identify liable party in the case where unintentional introduction does occur;
- Inspecting or issuing certificate from the point of export to confirm that goods are free from contamination as well as declaration by exporters from the point of export and certification to confirm that vehicles for transportation is free from contamination.
- Coordinate for providing information classifying risks of flights/shipments in order to enable target-oriented, effective, and timely inspection, including special inspection of goods from areas with problems or potential problems of invasive alien species, particularly from island states.
- Coordinate for registering of imported biological materials.
- Coordinate for insect fumigation of incoming flight to the Kingdom.
- Coordinate with the Port of Authority of Thailand and the Harbor Department for eradicating alien species that contaminate ballast water and its sediments.

- * Monitor and evaluate the control of import of alien species and present the findings to the National Committee on the Convention on Biological Diversity in order to formulate regulations and laws to control such import, if necessary.

Controlling Intentional Introduction

Assigned introduction

- * Establish a committee/sub-committee, with biodiversity agency serves as secretariat, to undertake the following.
 - Formulate a guideline on risk assessment, including regulations and processes for approval of import of alien species.
 - Evaluate the risk when there is a request to import alien species for agricultural and nutritional benefit, especially for the species that have not been introduced and/or reported to be invasive in other countries.
 - Control exports in accordance to regulations of importing countries.
 - Control an escape of alien species into the environment.

Species that escape into the environment may become invasive and have adverse impacts on biodiversity. The Committee must formulate measures for relevant agencies and private sector to cooperate in controlling and preventing such escape, including by registering dangerous species to identify the sources and enable regular monitoring of the species.

Unassigned introduction

Biodiversity agency is to carry out the following tasks.

- * Forward the list of prohibited alien species to the Communications Authority of Thailand in order to declare postal ban of the species and prosecute lawbreakers.
- * Forward the list of alien species to plant/animal quarantine officers at airports and seaports to enhance efforts against trafficking.
- * Coordinate with relevant agencies for setting up or increase penalty for trafficking and include the cost in eradicating and controlling the spread of alien species in the fine.
- * Enhance public awareness on impacts of trafficking of alien species to biodiversity.

Management of Invasive Alien Species

Spread of alien species which are without any benefit and/or harmful to local animals/plants and ecosystems, must be controlled or eradicated. Immediate actions are vital since the greater the affected areas, more difficult it would be involved to control or remove the species. In any case, priority must be reserved for areas of special importance such as islands, protected areas, habitats with endemic and/or endangered species and areas with exceptional level of biodiversity.

In areas where alien species have established themselves, controlling methods with prioritized strategies and methodologies for respected species could be appropriate, providing that they comprehensively take into account available human and financial resources.

When problem from invasive alien species is known or reported to biodiversity agency, the responds must follow the following steps.

- * The biodiversity agency conducts initial fact-finding exercise.
- * If potential impact of the species is confirmed, the biodiversity agency must proposed the National Committee on the Convention on Biological Diversity to establish a task force to supervise action to control or irradiate the invasive alien species.
- * The task force plans and determines appropriate methods for controlling or eradicating the invasive alien species. In the case where enforcement of more than one legislation is required, authorized agencies must immediately consult together for timely enforcement.
- * Coordinating for cooperation from local agencies.
- * Regularly reporting to the National Committee on the Convention on Biological Diversity.
- * Monitoring the implementation until the spread of the species is stabilized. When confirm, the actions are then concluded.



Cost of Implementation

* Controlling Import of Alien Species

Biodiversity agency is to formulate a national plan on controlling import on alien species with identification of responsible agencies for each activity. The agency, through the national plan, will request for a budget from the government.

* Controlling or Eradicating Invasive Alien Species

Implementing and supporting units of public agencies are to allocate their own budget for the implementation. The cost can later be reimbursed from the biodiversity agency, under the regulation of the Ministry of Finance, providing that all required documents are submitted with reimbursement claims.

Legal Implementation

- * Importers must be make liable to damage caused by spread of alien species and its impacts to biodiversity.
- * Trafficker must be prosecuted.

Environmental Rehabilitation

In the case that invasive alien species destroy or deteriorate natural environment and biodiversity, the Ministry of Agriculture and the Cooperatives and the Ministry of Science, Technology and Environment are to jointly prepare environmental rehabilitation action plans for affected areas on a case by case basis.

Trends

Despite continuous efforts, Thailand is still adversely affected by problems from spread of alien species. These problems are often consequences of shortcomings in controlling importation of the species and the lack of understanding of long-term impacts from alien species to biodiversity. Thus, there is an urgent need to enhance dissemination of information to relevant agencies, organizations and individuals as well as mobilizing ideas to improve mechanisms for protection and eradication that are consistent with international efforts.

5. Capacity Building Efforts

The earlier National Policy, Strategies and Action Plan on the Conservation and Sustainable Use of Biodiversity (NBSAP), 1998–2002, mentioned in Chapter 2, stressed the needs of strengthening the capacity of relevant agencies and personnel for efficient and effective biodiversity conservation and sustainable use. However, the implementation of such NBSAP, 1998–2002 has not fully attained the objectives, especially in capacity strengthening. The major obstacle was lack of sufficient financial support. In 2000, the Office of Environmental Policy and Planning (OEPP) assessed the training needs on biodiversity and the outcomes were forwarded to the ASEAN Regional Centre for Biodiversity Conservation (ARCBC). In the following year, OEPP also surveyed the needs on strengthening the capacity in the field of taxonomy. The survey result was analyzed and submitted to CBD Secretariat, for consideration to be included in the Global Taxonomic Initiative (GTI) Program.



Training Needs Assessment on Biodiversity

Background

In early August, 2000, ARCBC requested Thailand, as ASEAN member country and the member of the ARCBC, to conduct an assessment of training needs on biodiversity and protected areas in Thailand. OEPP as the National Biodiversity Reference Unit of the ARCBC, was the agency undertaking the assessment during the months of September and November 2000. An assessment methodology covers data collection and analysis, questionnaire survey, brainstorming among experts and a national seminar. An analysis of the information received provides the results shown as the following.

Current Status on Biodiversity Conservation

Issues Affecting Biodiversity Conservation

* Biodiversity data management

- The lack of baseline information on most of the protected areas.
- The lack of a body responsible for disseminating news and knowledge on conservation and sustainable use of biodiversity.
- The lack of comprehensive national database on biodiversity and protected areas. At present a large amount of information is scattered in various stakeholders.

Not Publicly Disclosed or Inaccessible Information

* Taxonomy, inventory and assessment

- Existing scientific institutions lack proper supports on biodiversity inventories. For example, with only few experts on bryophytes in Thailand, the inventory of the species in all national parks would take considerable number of years to complete. Thailand seriously lacks qualified personnel on all species, including higher plants and animals.

* Ex-situ conservation

- Thailand has relatively clear policies at the national level, approved by the Cabinet. At the agency level, however, policies on each biodiversity issue have not been clearly described or identified.
- The lack of acceptance of central organization in setting direction for conservation and sustainable use of biodiversity, by both public agencies and general public.
- Inappropriate classification and declaration of the protected areas.
- The lack of independence in biodiversity administration (overlapping responsibility).
- The lack of detailed studies and researches related to management aspect.
- The lack of strong responding measures.
- Presence of some self-interest organizations.
- The lack of cross-sectional coordination and collaboration between different government and private agencies.

* In-situ conservation

- Low social basis for conservation.
- The lack of variety of legally protected areas, limiting management flexibility of the areas.
- Concerned legislation do not provide clearly defined primary and secondary objectives of the protected areas, creating confusion to both the population and the authorities enforcing the laws.

- Confusing administration of some protected areas.
- The lack of management plans and administrative guidelines for certain types of protected areas as well as for some specific areas.
- The lack of efficient monitoring systems.
- The lack of cooperation amongst public agencies and between public agencies and private organizations.
- Problems from decentralization and inappropriate public participation. The local participation in natural resource and protected area management and biodiversity conservation, is still limited even though various laws including the Constitution promote the decentralization of authority to the local governments and public and local participation. The major limit is in terms of their management capacity.
- The lack of social cooperation and responsibility.
- The failure in promoting and supporting biodiversity related activities of the local people.
- The lack of continuity due to the absence of planning that enables supported projects to be self-sustained.
- Absence of demonstration for executing personnel.

✿ **Biodiversity awareness**

The lack of awareness and understanding on biodiversity and protected areas leads to the following situations.

- An inability to properly oversee natural areas and biodiversity due to the lack of experience personnel and of interest by authorized decision-makers, in addition to conflicts due to the lack of understanding of principles and underlining rational, self-interest and political indecisiveness.
- High level administrative organizations have minimal interest and limited action.
- Intermediate level administrative organizations (ministerial) lack sufficient understanding and proper coordination.
- Executing agencies lack understanding and clear direction resulted in overlapping and conflict.

- Problems concerning the lack of research coordination, tools and equipment and new techniques.
- The lack of acceptance of governmental legislations and regulations.
- The society lacks scientific knowledge.
- The society is misled by incorrect views from within and outside the country.
- The lack of consistency in governments policies.
- The lack of acceptance by certain groups of the population. Several groups do not accept the declaration of national parks.
- The lack of scientific development.
- Global awareness of biodiversity importance, through its inclusion as condition for international trade.

✿ **Economic evaluation**

- Ignorance and unawareness on the economic value of biodiversity conservation especially in protected areas such as some important wetlands of the country.

Stakeholders' Competencies

In Thailand, the tasks of biodiversity conservation and protected area management are conducted by at least 15 governmental agencies. In addition, various private sectors and non-governmental organizations are also involved.

For effective biodiversity conservation and protected area management, stakeholders must possess certain skill, knowledge and values. Those quality are possession of basic and thorough understanding and knowledge, personnel interest, and ability to identify problems and develop mitigation measures, in addition to an awareness on importance of biodiversity conservation and protected area management.

Major Concerns

From an assessment, lacks of sufficient, correct and common understanding on issues concerning biodiversity conservation and protected area management were found among various stakeholders.



✿ Politicians

The lack of interest by politician can be seen from extremely limited public funding and financial assistance approved to support works on biology and ecology, in comparison to those allocated for construction and infrastructure development. Provision of ecological and biological knowledge and understanding, via training, for high-ranking politicians are thus of significant importance. With such knowledge and understandings, the politicians would also be better equipped to identify and subsequently take proper action to prevent biodiversity loss from national development projects.

✿ Administrators

The administrators and decision-makers should understand the importance of biodiversity and protected area to ensure their recognition of conservation value. These can be assisted by development of decision-maker's handbooks, to be used for making decision in areas, which are of considerable importance for biodiversity. Issues to be highlighted in the manual should include botany and zoology as well as ecological mechanism for biodiversity conservation.

✿ Researchers and technical staff

Many technical staff, researchers and stakeholders are not familiar with the term "biodiversity" and believe that the concept (biodiversity) is not related to their works. Such belief has resulted in the absence of interest in developing training courses on biodiversity. Therefore, the researchers and staff must be equipped with clear understanding of biodiversity in order to enable further communication and dissemination of the concept to individuals at other levels.

✿ Taxonomic personnel

Limited number of taxonomic personnel and funding for taxonomic researches in Thailand is the underlining reason of the country's failure in completing classification of all plant and animal specimens collected from the past surveys. This problem is of significant importance since identification of species is the primary basis for biodiversity conservation. Proper classification of species would allow for determination of their conservation status and eventually formulation of protection regulations and measures for the species. Training activity on taxonomy is therefore urgently required.

✿ Locals

One of the factors of the loss and threat on biodiversity and protected areas is the lack of participation and sense of ownership of biological resources by the community. Provision of proper knowledge to locals who live with and make use of biodiversity and its components, would enable them to cooperate and undertake scientifically sound conservation of biodiversity.

✿ Youths

New generations of youths, with interest on biodiversity issues, should be provided with an in-depth understanding of biodiversity conservation, in order to secure social strength and support for the conservation.

✿ National representatives

Thailand still lacks qualified personnel that are capable of performing the role of national representatives in coordinating international cooperation. Such need must be urgently addressed and met through training of the personnel.

Needs on Training

Current Training Programs

Various stakeholders have implemented existing training programs in Thailand. Some of them have sole responsibility in training, while other have training divisions or training responsibility attached to their major function on biological conservation and protected area management. Some of the latter stakeholders are within the Ministry of Agriculture and Cooperatives, i.e. the Department of Livestock Development (DOLD), the Royal Forest Department (RFD), the Department of Agriculture (DOA) and the Department of Fisheries (DOF).

Biodiversity Research and Training Program (BRT), under the National Science and Technology Development Agency (NSTDA), has one of the seven programs implemented on Human Resource Development and Training in Tropical Biology. During the last five years (1996–2000), nearly 50 training projects have been organized. The Asian–Pacific Regional Training Center on Community Forestry is another example of agencies with significant role in biodiversity related training. This training center aims to support public participation in sustainable forest resource management. The Center gives training priority to biodiversity conservation issues. Other than those, the Wildlife Fund Thailand, in 2000, organized at least 12 training courses related to biodiversity conservation.

At present, however, most of the current training programs or training courses offered by the above stakeholders are on the conservation and management of natural resources designed for participants responsible for specific resources. Moreover, even though there are training courses to strengthen the capacity of the stakeholders' staff, still the training is organized with certain purposes and without clear evaluation of the effectiveness and ultimate impact of the training.

Strategies

✿ Covering all types of ecosystem

Such training would allow for the formulation of appropriate guidelines on biodiversity conservation for each type of ecosystems that are able to accommodate flexibility and convenience in the conservation of biodiversity and protected areas. Such training would be effective in communicating correct understanding to the participating public as well.

✿ Covering all target groups

The target groups for training include politicians, high-ranking administrators, medium-level administrators, public servants, students, general public, locals, community leaders, NGOs, related development groups and the press. Different training courses should be designed and offered for each target group.

✿ Covering broad and specific technical aspects

The courses offered are designed and based on the gaps of tasks in biodiversity conservation and protected area management in addition to the gaps of existing training program offered and being offered in Thailand. For these reasons, technical in addition to general courses are proposed.

Training Programs Needed

Training programs that would support and strengthen the capacity of all stakeholders to perform their tasks on biodiversity conservation and protected area management for Thailand can be summarized in seven prioritized programs: biodiversity data management; taxonomy; biodiversity inventory and assessment; *ex-situ* conservation; *in-situ* conservation and protected areas management; biodiversity awareness; and economic evaluation. List of the programs is shown in the Table 3.

Table 3 : Training Needs on Biodiversity for Thailand

Program	Training needs/targets
Biodiversity data management	<ul style="list-style-type: none"> * Botany * Biodiversity data management, to enable an establishment of networks of database on biodiversity conservation and protected area management * Promotion on the use of appropriate software for prediction and planning * Training of high-ranking administrators on importance of biodiversity information management
Taxonomy	<ul style="list-style-type: none"> * Training for production of taxonomists and para-taxonomists, including students and other interested individuals * Training of high-ranking administrators to ensure their understanding on importance of taxonomists and taxonomic researches * Training of science writers to enable them to better understand taxonomy and to correctly and effectively transfers such understanding to the public * Training of scientific illustrators * Training of personnel of other biodiversity related stakeholders * Training on the use of technologies for taxonomic works, such as the use of DNA for identification of species
Biodiversity inventory and assessment	<ul style="list-style-type: none"> * Use of appropriate indicator for inventory and assessment * Monitoring the hatchery and nursery grounds * Inventory techniques and methodology for different kind of plant and animal species * Identifying key species for inventory * Assessment of impact from development to biodiversity, and mitigation measures
<i>Ex-situ</i> conservation	<ul style="list-style-type: none"> * An understanding on conservation and management principles and the recognition of the need of conservation * A knowledge on present national policy and measures on biodiversity conservation and protected area management * An understanding on criteria and process on access to genetic resources
<i>In-situ</i> conservation and protected areas management	<ul style="list-style-type: none"> * Training concentrating on <i>in-situ</i> biodiversity conservation for different types of ecosystems * Training on conservation of species, in addition to awareness raising and the significance of establishing networks * Understanding of measures for biodiversity conservation in selected protected areas * Understanding of conservation of biodiversity for sustainable development * Understanding the values of endangered species in local area * Creating awareness and networks for learning, community participation to initiate social cooperation and responsibility * Sustainable planning and monitoring for conservation
Biodiversity awareness	<p>To rectify those problems, training should be provided for the following target groups;</p> <ul style="list-style-type: none"> * General public * NGOs with emphasis on common and correct understanding on biodiversity conservation * Locals and local leaders, focusing on correct and continuous understanding of biodiversity conservation * Relevant development sectors, to ensure understanding of biodiversity conservation
Economic evaluation	<p>A direct and indirect technique on economic evaluation of biodiversity and promotion of understanding and knowledge on economic value of biodiversity conservation offered to public servants and government officials, especially at the local level, will allow them to realize the economic value attached, and help decreasing the loss.</p>

National Taxonomic Needs Assessment

Background

Realizing the lack of taxonomic knowledge as an obstacle to biodiversity conservation, the Conference of the Parties (COP) to the Convention on Biological Diversity has established the Global Taxonomic Initiative (GTI). GTI will provide common framework for combating inadequacy of taxonomic information and experts and enhancing informed decisions on conservation of, sustainable use of and equitable sharing of benefit deriving from biodiversity components. The GTI targets strengthening of relevant national institution, providing linkage between institutions in developing and developed countries and seeking means to enable effective use of taxonomic information by countries of origin.

Coordinating mechanism for the GTI, established in accordance to a decision of the 5th Meeting of the Conference of the Parties, has coordinated activities implemented under the GTI and ensured harmonization with activities under the Convention. The Secretariat of the Convention prepared and submitted a work program on the GTI to the 6th Meeting of the Convention's Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA). The Secretariat also requested the Convention's Contracting Parties to nominate a national GTI focal point to enable linkage with the Secretariat, to coordinate with other countries on sharing information through regional network, to be responsible for providing requested taxonomic information to the Secretariat and to prepare for international consultation on the GTI.

The Office of Environmental Policy and Planning (OEPP) was appointed by the National Committee on the Convention on Biodiversity at the meeting on June 26, 2001, as the national GTI focal point, responsible for carrying out the following activities;

- Conducting national taxonomic needs assessment, including review and study of specific requirements.
- Compiling a national list of institutions and experts on taxonomy.
- Compiling a national list of agencies with collection facilities or museums.
- Establishing and maintaining a national taxonomic network.

OEPP designed and distributed a questionnaire entitled "A National Taxonomic Needs Assessment" to agencies involved in taxonomic works. These agencies include the Royal Forest Department (RFD), Department of Fisheries (DOF), Department of Livestock Development (DOLD), Department of Agriculture (DOA), Department of Agricultural Extension (DOAE), institutions under the Ministry of University Affairs (university's institutions) and other relevant agencies. The questionnaires were distributed to the agencies in early July 2001, to initiate linkage of taxonomic information in Thailand between experts in the agencies.

Sixty-seven questionnaires were returned to OEPP (three specified that they were not involved in taxonomic works and did not inform any needs). Preliminary analysis of the information received provides the results shown below.

In addition, the GTI Thailand Regional Meeting on a National Taxonomic Needs Assessment was held in Bangkok from October 17-18, 2001. The Meeting was financed by the ASEAN Regional Centre for Biodiversity Conservation (ARCBC).

Current Status on Taxonomic Institutions

Types of Institution

Most of the 64 institutions who returned the questionnaires, is not directly responsible for taxonomic collection, but required to collect specimens for their own needs. Up to 86% of institutions have undertaken some forms of specimen collection, however there are few funding institutions in comparison to these involved in taxonomic works (see Figure 1).

Types of Collections in Relevant Institution

The returned questionnaires revealed that 55 institutions had been assigned to collect taxonomic specimens. These institutions include 7 herbariums, 2 botanical gardens, 13 zoological museums (and aquariums), 6 germplasm collection centers, 1 gene bank, 8 agencies where collections are carried out by individual researchers and 18 institutions where there is more than one type of collections (see Figure 2).

Numbers and Conditions of Specimens

Of the total 55 specimen-collecting institutions identified, specimens in more than 80% of institution were reported to be in good condition and can be used for reference. Five institutions were found to collect more than 100,000 specimens. These institutions are National Inland Fisheries Institute and Marine Biological and Fishery Research Institute of DOF, Entomology and Zoology Division of DOA, Department of Entomology, Faculty of Agriculture and Faculty of Forestry, Kasetsart University.

Other Capacities of Institutions

Collection facilities

Most of the specimen-collecting institutions were equipped with 1–2 collection rooms. Twelve institutions were identified to store their collections in properly designated building. These institutions are Wildlife Museum Institution of DOF, Forest Botany Division of Forest Research Office, Herbarium of Suan Luang Ro Kwao (King Rama 9th Park), National Science Museum, Zoological Park Organization, Botanical Garden Organization, Specialized Microbe Specimen Collection Center, Department of Biology, Faculty of Science, Chulalongkorn University and Department of Biology, Faculty of Science, Chiang Mai University.

Taxonomic laboratories

From the above-mentioned 55 institutions, larger proportion was reported to have 1–5 taxonomic laboratories.

Equipment for taxonomic works

Equipment for Collecting Specimens

The equipment reported was diversified in accordance to organisms studied by each institution. These usually include nets, forceps, alcohol and other liquid for preservation, jars, cabinets etc.

Equipment for Classification of Specimens

The equipment reported varies in accordance to type of studies and size of specimens. These include stereo microscope, compound microscope, related camera lucida, PCR etc.

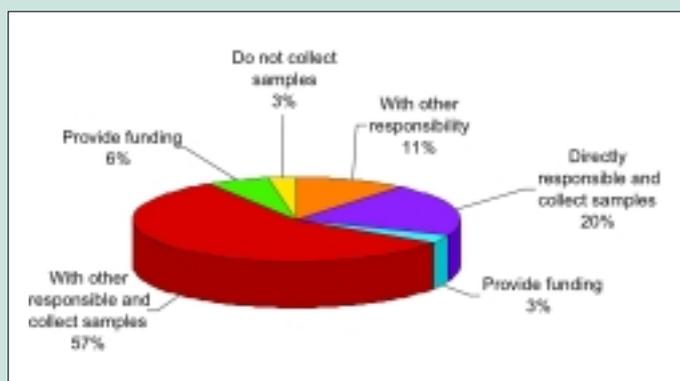


Figure 1 Types of national institutions

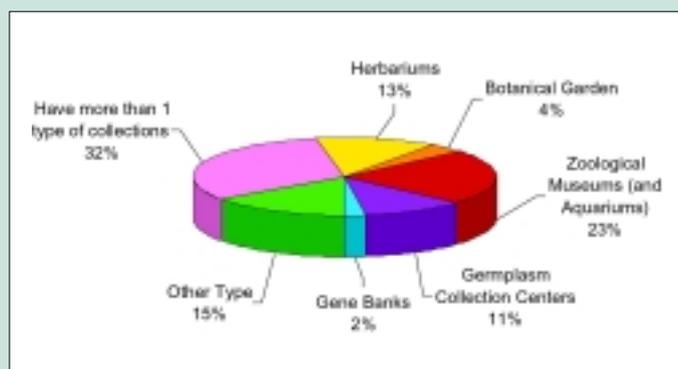


Figure 2 Types of collections in various national institutions

> *Data Collection Instruments*

The data was reported to be collected, stored and analyzed with conventional computers.

> *Vehicles Used for Specimen Surveys*

Most institutions were found to use cars for field visits. Some were reported to access to the sampling sites by boats.

✿ **Annual budget for taxonomic works**

Sixty-four institutions responded to the questions concerning budget allocated for taxonomic works. It was cleared that very limited funding has been provided for taxonomic works, while specific taxonomic works are often without any funding. Majority of finding for taxonomic works was reported to come from governmental budget, which is inadequate for carrying out the works. Only 5 institutions were reported to be allocated with budget greater than 1 million Baht for taxonomic works. These institutions are Aquatic Genetic Research and Development Institute of DOF, Entomology and Zoology Division and Botany and Weeds Division of DOA, Department of Biology, Faculty of Science, Ramkhamhaeng University, and Environment, Ecology and Energy Section of Thailand Institute of Scientific and Technological Research (TISTR).

✿ **Number of personnel involved in taxonomic works**

Of 49 institutions, 277 taxonomists were reported. Of 39 institutions, 217 para-taxonomists were identified.

Status of Taxonomists

The survey found that of 277 taxonomists, 75 are with institutions directly responsible for specimen collection, 187 are employed in institutions with other responsibilities but required specimen collections, 8 are with institutions responsible for taxonomy-related tasks but do not carry out any specimen collections and 7 works for institutions with other responsibilities. Fifty-one percents of the taxonomists are female. Most of them are Master degree graduates and belongs to 26–45 year olds age group. When classified in accordance to the groups of organisms they are responsible, 82 work on botany, 70 on invertebrates, 47 on vertebrates, 51 on microorganisms, 10 on plankton, 9 on algae, 6 on parasites and 2 on protozoa. Those responsible on animal and plant groups are accounted for over 70%, due largely to diversity of known species, followed by microorganisms, plankton and algae, respectively. Very few taxonomists were found to work on parasites and protozoa (see Figures 3-5).

Needs on Taxonomic Capacity Building

Institutional Capacity Building

✿ **Need for additional taxonomists**

Forty-two institutions expressed their need for additional 190 taxonomists in total, 93 from institutions directly responsible for specimen collection, 74 from institutions with other responsibilities but required specimen collections, 6 from institutions responsible for taxonomic related tasks but do not carry out any specimen collections and 17 from institutions with other responsibilities. When classified on the basis of specialization, the required taxonomists include 79 plant specialists, 44 invertebrate specialists, 37 vertebrate specialists, 25 specialized in micro-organisms, 2 plankton specialists, 2 parasite specialists and one algae specialist. The needs are often based on the lack of particular specialists in the institutions, transfer or retirement of existing taxonomists, overwhelming amount of specimens yet to be classified or the desire to enhance effectiveness and capability.

✿ **Needs for para-taxonomists**

In total, 40 institutions stated their need for additional 432 para-taxonomists. Para-taxonomists are mainly required for providing assistance to existing taxonomists such as in the survey and specimen collection, specimen maintenance, systematic storage and management of data as well as to reduce workload of the taxonomists in researching and teaching and allowing more productive works on taxonomy.

✿ **Needs for collection facilities**

From 55 institutions where specimen collection have been conducted, 31 (56.36%) indicated their needs for rooms/buildings to store the increasing amount of specimens. The main reasons provided are to accommodate better arrangement of present and future collection, enabling more sustainable use and to enable better access to interested individuals for study and other reference works.

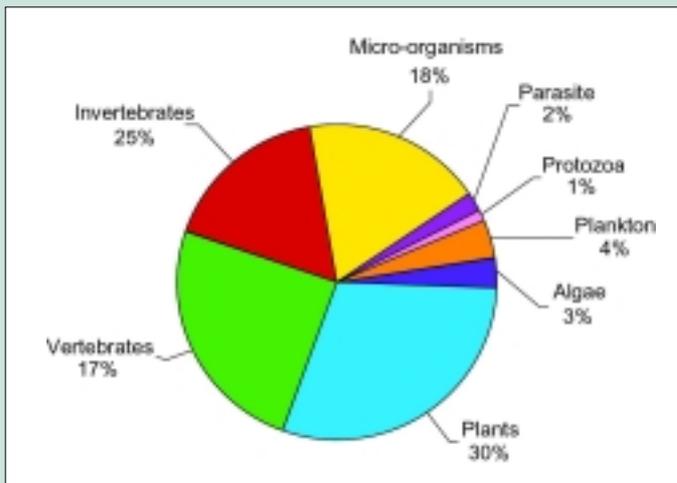


Figure 3 Percentage of existing taxonomists in each discipline

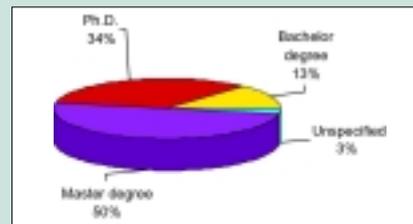


Figure 4 Qualification

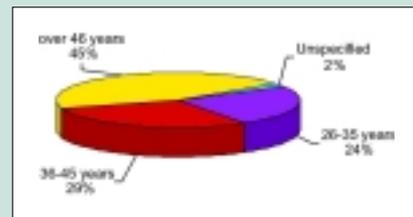


Figure 5 Ages

✿ Needs for taxonomic laboratories

Twenty-nine institutions (52.73%) from 55 specimens-collecting institutions stated their needs for additional laboratories in order to separate specimen classification and analysis from other research activities, enabling greater efficiency and teaching of visiting classes.

✿ Equipment/instruments needs for collecting specimens

Over 50% of 55 specimens-collecting institutions confirmed their demands for additional equipment for collecting specimens or replacing existing ones with more appropriate tools. The equipment required is varied accordance to organisms being studied. In general, these include nets, scuba diving gears, forceps, preservation liquid, liquid nitrogen, specimen jars, oven, cabinets, etc.

✿ Equipment/instruments needs for specimen classification

From the above-mentioned 55 institutions, 32 (58.20%) specified their needs for additional equipment for classifying specimens. Most of them demanded microscopes with varied specification, depending on types of studies and sizes of concerned specimens, including stereo microscope, compound microscope, related camera lucida, PCR machine, DNA sequencing, electrophoresis equipment etc.

✿ Equipment/instruments needs for data collection

Thirty-four institutions from 55 specimens-collecting institutions (61.82%) stated their needs for computers to be used for data collection tasks, in order to facilitate searching and retrieval for analysis and other uses.

✿ Needs for vehicles

Approximately half of 55 specimens-collecting institutions expressed their needs for vehicles (cars & boats) to facilitate specimen collection expedition.

✿ Needs for funding for taxonomic works

From all respondents, 29 institutions stated their needs for additional funding for taxonomic works, ranging from 100,000 to 1,000,000 Baht annually.

Capacity Building for Taxonomists

There were 43 institutions expressing their needs for training on various topics, varied in accordance to their types of works and concerned groups of organisms. Examples are shown below.

> *Department of Fisheries*

The National Inland Fisheries Institute expressed a demand for training to produce 40 para-taxonomists. Such training should last 10 days of lectures and field exercises and 5 days of training on specimen preservation. This training requires that the applicants must be at least vocational college graduated and have no less than 2 years experience. The Fisheries Resources Conservation Division stated a need for 3 days basic taxonomic training on protected species (listed in the 1992 Wildlife Protection Act) to be provided to 30 fishery conservation officers, fisheries quarantine officers and resources administration and management officers. The Aquatic Animal Health Research Institute seek 2–4 months training on classification of parasitic fungi in aquatic animals at the Veterinary and Science University, Japan, on the classification of aquatic parasites with both classical and modern taxonomy at the Institute of Parasitology, Czech Republic and classification of bacteria and virus with modern taxonomy in Japan.

> *Department of Livestock Development*

The Animal Disease Diagnosis and Research Center–Lower Northeastern Region stated the need for training courses on specific working areas of the Center, which are communicable diseases, parasite, virology, bacteriology, immunology, toxicology and biochemistry. The training should be provided for at least one person from the Center in either domestic or oversea institutions. The Animal Disease Diagnosis and Research Center–Western Region (Ratchaburi Province) expressed the need for taxonomy training on parasite, virology and bacteriology to be provided to at least 2 persons per subject at the National Animal Health Institute, Chulalongkorn University. The training should last 10–15 days per course at the veterinarian and scientist levels.

> *Royal Forest Department*

The National Park and Wildlife Research Division stated the need for 2 months training on zoological classification for 4 persons at the National History Museum, London. The Forest Botany Division of Forest Research Office expressed the need for overseas training in internationally recognized institutions, the like of those in the United Kingdom, Netherlands and Japan, and visits of the Division's taxonomists to overseas herbariums.

> *Universities*

The Department of Biology, Faculty of Science, Chulalongkorn University can organize training courses on zoological taxonomy to interested institutions. Professor Kasin Suvataphun, Department of Botany, Faculty of Science, Chulalongkorn University is able to offer training on numerical taxonomy, pollen analysis, pollen biology, basic training on ornamental plants, plant specimen preservation techniques and botanical classification. The participants include elementary and secondary school teachers, national park officers, and tourist guides. Training on algae can be offered to high school teachers and university lecturers. The training is offered for 25–30 persons in 3–5 courses. The Department of Biology, Faculty of Science, Ramkhamhaeng University stated the need for training on higher plants, fungi, lichen, birds, insects, mammals and corals at RFD, Royal Forest Herbarium and DOA. The training should be offered twice a year in 5–7 days courses for 10–15 persons. The Marine Science Institute, Burapha University requested 2–3 months systematic taxonomy training on sea sponges and marine molluscs at the Western Australian Museum for 1 person per subject and 3–4 months training on molecular technique for taxonomic study at Mahidol University for 1 person. The Department of Plant Pathology, Faculty of Agriculture, Khon Kaen University demanded for Certification Identification of Bacteria level training mycology at CAB UK for 2 persons in a 20 days certified course.

Capacity Building on Information

✱ **Needs for additional human resources for data collection and programmers for building taxonomic database**

All institutions that work on taxonomy or with taxonomic specimen collection requires, on average, addition 1–2 staff to assist in data management tasks.

- There are 42 institutions indicating the needs for additional data management personnel, totaling 79 persons (one institution did not specify the number of required staff).
- There are 37 institutions indicating the needs for additional programmers, totaling 44 persons (one institution did not specify the number of required staff).



✿ **Need for the establishment of taxonomic information network**

There is 39 institutions endorsed the proposed establishment of taxonomic information networks. Of these, 36 are those working on taxonomic researches or with specimen collections while the remaining 3 are institutions responsible for inspection and control of import, export and illegal trade, diagnosis of animal diseases and teaching. All institutions agreed that there is a need for linkage of taxonomic information on various disciplines with relevant institutions, domestically and internationally, including at the ASEAN regional level and with those in Europe and Africa.

✿ **Needs for organizing meeting to exchange views/information on taxonomy**

Thirty-five institutions stated the demand for forums/ meetings for exchanging overall views on taxonomy. The institutions also demanded

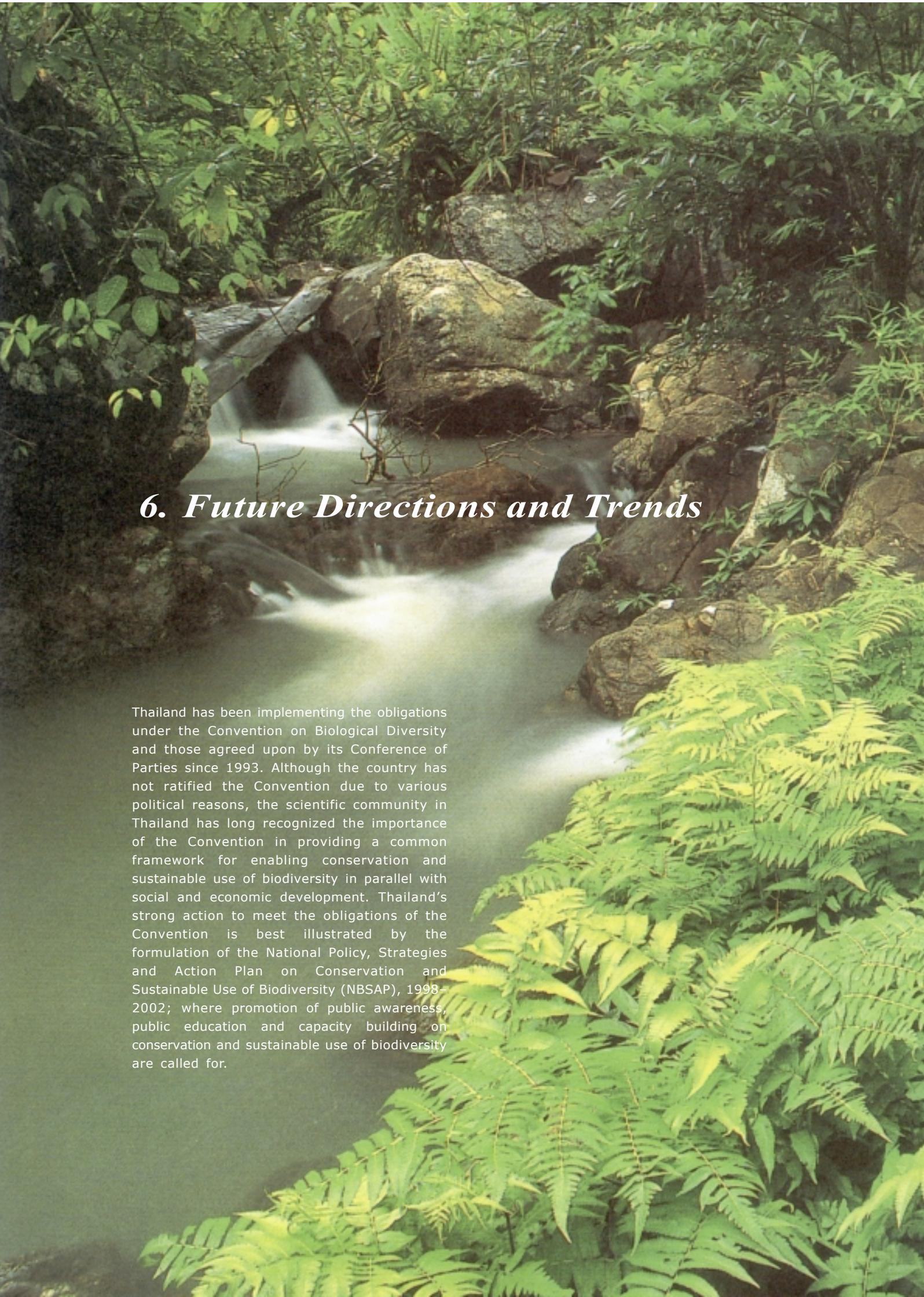
for meetings to discuss and share opinions/information on specific topics, based on types of works and groups of species, between academics and experts from institutions in the country and from overseas.

✿ **Need for specialists**

There are, in total, 30 institutions indicating their need for domestic and foreign specialists to assist them in certain areas where expertise is inadequate, especially in new classification methodologies and techniques.

Other Needs

Other needs of respondents are relatively similar, such as additional budget, promotion of taxonomic works, textbooks and other taxonomic reference materials, annual training, provision of opportunities and support of new generations of taxonomists. Meeting these needs, however, depends on cooperation between taxonomists.

A photograph of a small waterfall in a dense forest. The water flows over several large, dark rocks, creating white foam. The surrounding vegetation is thick and green, with many ferns visible in the foreground and on the right side. The lighting is soft, suggesting a shaded forest environment.

6. Future Directions and Trends

Thailand has been implementing the obligations under the Convention on Biological Diversity and those agreed upon by its Conference of Parties since 1993. Although the country has not ratified the Convention due to various political reasons, the scientific community in Thailand has long recognized the importance of the Convention in providing a common framework for enabling conservation and sustainable use of biodiversity in parallel with social and economic development. Thailand's strong action to meet the obligations of the Convention is best illustrated by the formulation of the National Policy, Strategies and Action Plan on Conservation and Sustainable Use of Biodiversity (NBSAP), 1998-2002; where promotion of public awareness, public education and capacity building on conservation and sustainable use of biodiversity are called for.

National Policy, Strategies and Action Plan on Conservation and Sustainable Use of Biodiversity

Despite a shortage of funding due to economic crisis, the first NBSAP was actively implemented by designated agencies and, in principle, achieved most of the expected goals. Although several activities included in the NBSAP were not carried out, the NBSAP did stimulate awareness of relevant institutions and individuals on importance of national strategies on biodiversity and led to overwhelming contributions from these institutions in preparing the following NBSAP, 2003–2007. The Cabinet endorsed the second NBSAP on June 11, 2002 with an approved budget of 7,536.97 million Baht.

To achieve real results, implementation of NBSAP in Thailand requires exceptionally comprehensive cooperation. Therefore, the second NBSAP (2003–2007) is drafted on an area approach basis with more focus on local conservation of biodiversity where provincial authorities, respected Rajabhat Institutes and local NGOs play more active roles in its implementation. More clearly defined mechanisms for monitoring are included in the second NBSAP and could enhance effectiveness in meeting its objectives.

Biosafety

During the past decade, Thailand developed regulations on controlling the use of GMOs as described in Chapter 4. Although the country's efforts in controlling the use of GMOs for agriculture and food industry have been quite effective, Thailand still lacks mechanisms to oversee and regulate import, export, research and experiment concerning transgenic plants, animals and microorganisms. Therefore, the country has not been able to adequately meet obligations under the Cartagena Protocol. There are also needs for an establishment of coordinating mechanisms, appointment of a national focal point and creation of Biosafety Clearing House to enable Thailand to effectively and efficiently enhance the capacity of institutions and their human resources.

Invasive Alien Species

There has not been a national effort to address management as a whole of invasive alien species in Thailand. Despite the fact that several laws are related to invasive alien species and prohibit importation of non-indigenous pests, Thailand still requires mechanism for monitoring and eradicating invasive alien species. Other mechanisms include a focal point who is capable of coordinating efforts between agencies and international organizations and guidelines or legal measures to ban import of non-indigenous species, eradicate invasive alien species and disseminate relevant knowledge to the public.

Global Taxonomic Initiatives

Local taxonomists have consistently called for an establishment of an agency to coordinate capacity building in the field of taxonomy. In addition, the National Taxonomy Council is required to harmonize efforts of approximately 200 taxonomists in Thailand and to provide attention to the areas where assistance is needed. More capital investment is also needed for equipment to be used for the preservation of samples and specimens in the museum while additional financial resources should be allocated to enable studies of native samples specimens in oversea collection facilities.

Biodiversity Inventories and Red Data

Thailand has recognized that a national inventory of biodiversity is of critical important, particularly in identifying undocumented biodiversity "hotspot". Compiling Red Data of plant and animal species is an efficient and vital mean in meeting objectives of such inventory, by providing indicators of level of biodiversity in areas of interest. In addition, the list of Red Data species is a baseline information for developing and revising species protection legislation and readily adaptable reference for decision-making process. OEPP has completed the Red List for vertebrates but has been without sufficient financial resources to prepare the list for plant and invertebrate species.

Coordination between Agencies Concerned

Thailand is faced with many different international agreements related to biodiversity. It is difficult to integrate and coordinate their implementation. Responsibility for the Convention on Biological Diversity and the Convention on Wetlands is left to a handful of staff of the Biological Resources Section who are faced with a huge workload and have little time left for coordination activities. Improvement of work structure and increase of number of man-power will facilitate coordination between agencies concerned to implement the NBSAP and the Convention on Biological Diversity as well. New Biodiversity Division under the Office of Environmental Policy and Planning is needed to be established to harmonize the activities in response to the multilateral environmental agreements related to biodiversity.

Financial Support

By not ratifying the Convention on Biological Diversity, Thailand has remained ineligible to apply for GEF funding during the past 10 years. Mobilizing financial resources from other sources has also been difficult due to an unavailability to the GEF's fund.

Clearly, important progress has been made to implement the convention since the Rio Conference. However far more work is required to integrate biodiversity into mainstream development planning, public investment and business activities. This will require much stronger political commitment to the Convention on Biological Diversity. There is a need to enhance development and wide dissemination of tools for integrating biodiversity, social and economic objectives, and making trade-offs between them. Implementation of the NBSAP and the Convention is needed to be carried out on the ground by supporting activities of local authorities, organizations and communities to work in their local context.

A n n e x

National Policy, Strategies and Action Plan on the Conservation and Sustainable Use of Biodiversity, 2003-2007

Approved by the Cabinet on June 11, 2002

R a t i o n a l e

Biodiversity is one of the most important factors in human subsistence. People from all over the world use and consume abundance of species, as food, clothing, housing equipment and medicines. People through the ages have been used many types of ecosystem, such as tropical rain forest, mangrove forest, peat swamps, rivers, bogs and coral reefs.

Thailand is a geographical center of a distinct biogeographic realm and has a high level of species richness, genetic diversity and ecosystem diversity. But during the past century, the unsustainable development and the lack of awareness on the importance and value of biodiversity have led to reduction and loss of such diversity and richness. The rate of biodiversity loss of Thailand is the second highest in Asia.

To implement the Convention on Biological Diversity, Thailand has established its first National Policy, Strategies and Action Plan on the Conservation and Sustainable Use of Biodiversity (NBSAP), 1998–2002, which will be ended in the year 2002. The National Environment Board, hence, had endorsed the formulation of the second NBSAP which will be the guidelines for the conservation and use of Thailand's biodiversity during the period of 2003–2007. NBSAP will be formulated in accordance with the international cooperation in biodiversity and wetlands conservation, the 9th National Economic and Social Development Plan, the government policies, and the Environmental Quality Management Plan.

S t a t u s

Thailand has endorsed the Convention on Biological Diversity since 1992. Despite of having not ratified the Convention, Thailand has proceeded following its framework for the country's image and reputation in the environmental conservation, and for the progress in the mitigation of biodiversity loss, which occurs ten times more rapidly than the previous 50 years.

The unsustainable development combined with the economical, political and social and social problems and the rapid population growth since 1961 until 1998, having resulted in the loss of many forest ecosystems. The conversion of forests into agricultural or other specific areas has also eliminated a lot of ecologically important forest areas. The average ratio of forest loss in Thailand is 58,759 hectares per year, or 160 hectares a day.

The long and continuous loss of forest ecosystem has further resulted in the declining population of wild animals and plants. Some significant animal species such as the Asian elephants, wild water buffaloes, and tigers are critically endangered. Brow-antlered deer, Javan rhinoceros, and Kouprey are currently believed to be extinct in the wild. Many wild plants were also disappearing, such as some endemic plant species in the peat swamp forest of Phru To Daeng Wildlife Sanctuary.

The loss of wetland areas, from the change of land use in the Chao Phraya River Basin, has led to the extinction of many freshwater fishes which include *Balantiocheilos melanopterus* and *Platytrapius siamensis*. Fifty percent of coral reefs in the Andaman Sea and the Gulf of Thailand were heavily bleached and degraded and large fish species such as rays and sharks are critically endangered.

Hundreds of endemic and wild rice species have become extinct as the result of land conversion into urban areas and the popularity of newly modified rice species. Many native crop plants are also vulnerable from the destruction of plantations. The introduction of exotic animal species has also led to the negligence of some indigenous species such as native ox, Hainan pigs, banteng (*Bos banteng*) and Nakhon Pathom duck, and these species are currently critically endangered.

In an overview, for the next decade, Thailand urgently needs the efforts to promote, facilitate and encourage every appropriate activities/projects to maintain natural ecosystems by reducing biodiversity loss. The country also needs capacity building for personnel on the conservation, collection and dissemination of information through the electronic communication system, researches for use of biological resources. Every Thai citizen especially the students should understand and have the good attitude towards the conservation and sustainable use of biodiversity.

Principles

- * Biodiversity is the national heritage, which has to be conserved and protected for future generation, through the management and sustainable use based on the "Wise Use Concept".
- * Biological resources are natural capital, and their conservation is the investment that will give benefits locally, nationally and globally.
- * Conservation of biodiversity is the most suitable manner possible which include the *in-situ* conservation, alongside with the need for *ex-situ* conservation. Alongside with the recovery of degraded ecosystems, the prevention of threats to biological resources and mitigation of the impacts to biodiversity with concern of indigenous knowledge, innovations and practices.
- * The high-priority elements for the conservation and sustainable use of biodiversity in Thailand are the education and public awareness, capacity building for institutions/organizations and their staffs.

- * The research in biological resources and the development of biotechnology have to be fully encouraged, promoted, based on the equitable benefit-sharing principle.

- * The implementation of activities on the conservation and sustainable use of biodiversity essentially requires participation of local community and cooperation between various responsible agencies, both at the national and international level.

Vision

Within the next 20 years, Thailand will be one of the leading countries in the conservation, research, and sustainable use of tropical biodiversity.

Objective

To mitigate the loss of biodiversity in Thailand by ensuring that the country has a capacity to protect and maintain biodiversity and to make sustainable use of biodiversity for the best environmental conditions and life-qualities of Thai people.

Main Target

To maintain and conserve ecological process and ecosystems for biodiversity conservation and sustainable use based on the equitable benefit-sharing principle.

Specific targets / indicators

- * Promote the education on the basic knowledge of biodiversity and public awareness in every age-group to the minimum 50% of the entire population in each province and every local administrative organizations, by the year 2007.
- * Encourage the implementation to increase the number of taxonomists for every taxa in government organizations and academic institutions, at least 20 personnel by the year 2007.
- * Develop and harmonize the biodiversity database of every institution/organization. Keep them updated and linked together as "Thailand's Biodiversity Information Network" by the year 2004.

* Conserve the forest ecosystems at least 30% of the total area. And additionally recover about 10% of the total area to create “the community forest” and other uses by the year 2007.

* Conserve and restore wetlands at least 35% of the total area in the country.

* Survey and monitor the biodiversity of plants, animals, insects and micro-organisms in the following protected areas and wetlands, by the year 2007:

- > The Biosphere Reserves
- > Western Forest Complex (in the western region)
- > Eastern Forest Complex (in the eastern region)
- > Khlong Sang-Khao Sok Forest Complex
- > Doi Phu Kha-Mae Yom Forest Complex
- > Songkram River Basin Forest

* Proceed the taxonomic studies, collect and conserve the diversity of plants, crops, rice species, herbal plants, microorganisms, fungi and insects by the year 2007.

* Survey the presence and distribution of invasive alien species in and surround the protected areas, and develop the measures to control the invasion of alien species, by the year 2007.

* Develop “the Biodiversity Conservation Network” which has the unity nationwide, by the year 2007.

* Building capacity of the people and local administrative organizations on the conservation and sustainable use of biodiversity at least 40% of the country’s total area.

* Support the Thai delegates/representatives to participate and negotiate in the international or regional meetings or workshops concerning biodiversity.

* Organize at least two international workshops on biodiversity in Thailand.

* Nominate the most appropriate sites for biodiversity conservation to the following Convention and Agreement by the year 2007.

> At least one site to the Convention on World Heritage

> At least one site to the ASEAN Agreement on ASEAN World Heritage

> At least twenty five sites to the Ramsar Convention

> At least two sites to the Convention on Migratory Species of Wild Animals

> At least five sites to the Man and Biosphere Programme

* Support the education and improve laws or regulations on the access to biological resources, technological transfer and benefit sharing, by the year 2007.

Policy Statement

To conserve Thailand’s biodiversity and to ensure the sustainable use of its components in order to continue the nation’s economic and social security and the progress in science and technology development.

Strategies

* Enhance knowledge, understanding and public awareness in the importance and value of biodiversity.

* Building capacity and expertise of institutions and their staff on the biodiversity conservation.

* Strengthen capacity in conservation, restoration and protection of natural habitats, within and outside the protected areas.

* Increase efficiency in the conservation and sustainable use of species and genetic diversity.

* Control, regulate, and reduce the threats to biodiversity.

* Provide incentives and encourage public participation for the conservation of biodiversity in accordance with traditional Thai cultural practices.

* Promote and develop cooperation between international agencies/institutions in the conservation and sustainable utilization of biodiversity.

Objectives and Actions

- ✳ **Strategy 1**
Enhance knowledge, understanding and public awareness in the importance and value of biodiversity.

Objective

To increase awareness and appreciation of the value and importance of biodiversity to general public.

- ✳ Disseminate knowledge and information on the importance of biodiversity to the society and the culture.
- ✳ Develop campaign to raise awareness of the importance and value of biodiversity.
- ✳ Build up the participation in conservation and sustainable use of biodiversity and stimulate the sense of ownership among stakeholder.

Objective

To strengthen knowledge and understanding of biodiversity conservation and sustainable use.

- ✳ Provide knowledge and basic understanding of the importance and need in conserving biodiversity.
- ✳ Strengthen knowledge and basic understanding of biodiversity to those who are "core" in the dissemination of information and biodiversity conservation.
- ✳ Disseminate knowledge and strengthen capacity for local community in the sustainable use of biodiversity.

Objective

To use an education outside the classroom as a tool to raise awareness on biodiversity conservation.

- ✳ Use the formal education system to improve awareness on biodiversity and need in conserving biodiversity.
- ✳ Encourage the development of information sources on biodiversity in local area or natural zone.

- ✳ **Strategy 2**
Building capacity and expertise of institutions and their staffs on the conservation of biodiversity.

Objective

To strengthen capacity in taxonomic works for institutions/agencies and their staff.

- ✳ Strengthen national capacity of taxonomic works to facilitate the biodiversity conservation.
- ✳ Establish first priorities to the national taxonomic research, specimen collection and the comparison of the collection with relevant institutions.
- ✳ Enhance taxonomic skill for personnel in institution/organization which needs taxonomic knowledge in conserving biodiversity.
- ✳ Manage to fulfil the taxonomic needs and requirements to facilitate efficient and effective fieldwork and laboratory work.

Objective

To develop human resource capacity for biodiversity conservation.

- ✳ Support training and continuous education in occupations related to biodiversity.
- ✳ Strengthen capacity for NGOs and private sector in biodiversity conservation.

Objective

To develop and strengthen capacity of research institution/organization and their staff in the conservation and sustainable use of biodiversity.

- ✳ Provide financial support and facilities to the research related to biodiversity.
- ✳ Encourage the inventory and monitoring of biodiversity and periodically disseminate the information or the output of such activities.
- ✳ Support the research and development of biological resources for sustainable use.

Objective

To strengthen capacity of institution/organization in the dissemination of data and information which are needed for conserving biodiversity.

- ✳ Build capacity of institution responsible for collecting and dissemination of biodiversity information.
- ✳ Establish the national biodiversity information network to transfer, disseminate and exchange biodiversity data and information.

- * **Strategy 3**
Strengthen capacity in conservation, restoration and protection of natural habitat, within and outside the protected areas.

Objective

To conserve and restore biodiversity in natural ecosystem.

- * Enhance the *in-situ* conservation, protection, rehabilitation and wise use of wetlands and the upper watercourse areas.
- * Encourage and support the cooperation, protection and monitoring of activities and use in wetland areas.
- * Promote the conservation and restoration of biodiversity in the marine and coastal ecosystem.
- * Integrate biodiversity consideration in agricultural practices.

Objective

To strengthen the protected areas to ensure their sustainability and their contribution to biodiversity conservation.

- * Conduct national reviews of plan for protected area system to ensure coverage of biodiversity conservation.
- * Improve and expand legal mechanisms to protect endangered species.
- * Enhance the efficiency in management of protected areas to be used as the basic knowledge for conservation.

Objective

To encourage and support research on biological science.

- * Promote and encourage basic and applied research on biological science emphasizing protected area conservation.
- * Support the education and research emphasizing natural ecosystem conservation.

Objective

To promote sustainable use within and outside the protected areas.

- * Recognize the vital roles of local communities outside the protected areas (in buffer zones and the vicinity area) as partners in conserving protected areas.
- * Broaden the support from the public and NGOs in conserving protected areas.
- * Seek for fund to support for managing the protected areas.

- * **Strategy 4**
Ensure the efficiency in conservation and sustainable use of species and genetic diversity.

Objective

To improve capacity to conserve species and genetic diversity in natural habitats.

- * Conserve the habitats containing viable populations of economically important genetic resources and promote the effective agriculture for sustainable use.
- * Promote sustainable agricultural system for conserving and sustainable use of genetic diversity.
- * Increase capacity in genetic resources conservation of crop, medicinal, indigenous and wild plants, and livestock and on-farm conservation.

- * Amend, improve and revise legislative mechanisms to protect species and genetic diversity.

- * Improve basic knowledge of biological science by support the research emphasizing species and genetic resources conservation.

Objective

To improve the capacity of *ex-situ* conservation to enable biodiversity conservation, promote public education, and support sustainable development.

- * Develop microbial culture collection centers as *ex-situ* network.
- * Strengthen and support gene banks, seed banks and plant breeding centers to ensure the protection and exchange of plant and animal genetic resources.
- * Develop botanical gardens as a network for conserving wild plant resources.
- * Strengthen the roles of zoos, wildlife breeding centers, aquarium and aquatic animal breeding stations in the conservation of biodiversity.
- * Extend the roles of *ex-situ* conservation to include reintroduction into the wild.
- * Improve the capacity of *ex-situ* conservation through the support of relevant research.

✳ **Strategy 5**
Control, regulate and reduce the threats to biodiversity.

Objective

To ensure the effective regulation and management for biosafety.

- ✳ Increase understanding on the use of genetically modified organisms (GMOs) resulting from modern biotechnology which is likely to have adverse impacts on the conservation and sustainable use of biodiversity.
- ✳ Develop biosafety clearing house mechanism, in order to create linkage with relevant national and international institution/organization.
- ✳ Improve capacity in regulations, policy and administration to control transfer handling and use of GMOs, under the Biosafety Protocol.
- ✳ Improve capacity in the monitoring and risk assessment of GMOs.

Objective

To prevent and control invasion of alien species which are likely to affect the change of biodiversity.

- ✳ Increase understanding on the impacts of invasive alien species to biodiversity.
- ✳ Provide additional legislative mechanisms in introduction, control and eradication of invasive alien species.
- ✳ Control, regulate, eradicate and monitor alien species that threaten biodiversity.

Objective

To enable effective protection of biodiversity.

- ✳ Provide specific protection for endangered, rare and endemic species.
- ✳ Conduct biodiversity impact assessment especially for projects in the protected areas and wild lands.
- ✳ Control and reduce pollution from their sources to maintain the quality of water in natural ecosystems.

✳ **Strategy 6**
Provide incentives and encourage public participation for the conservation of biodiversity in accordance with Thai traditional cultural practices.

Objective

To use economic incentives in the promoting of conservation and sustainable use of biodiversity.

- ✳ Use the benefits from implementing ecotourism as the economic incentive in the conservation and sustainable use of biodiversity.
- ✳ Increase incentives for communities to conserve public lands that are biologically diverse.
- ✳ Develop and publicize roles of medicinal and traditional herbs, and ensure appropriate and sustainable use of herbs.

Objective

To integrate biodiversity conservation into the traditional lifestyle and local customary practices.

- ✳ Support maintenance of traditional culture practices in biodiversity conservation.
- ✳ Enhance awareness on the value of indigenous knowledge and biological resources.
- ✳ Support community rights to protect and sustainable use of local biological resources.

Objective

To support the roles of private sector in implementing biodiversity conservation programs.

- ✳ Provide incentives for conservation to private firms or organizations implementing biodiversity conservation program
- ✳ Support the conservation of wild lands to maintain biodiversity.

Objective

To ensure biodiversity conservation throughout the urban and rural environment.

- ✳ Promote the conservation of biodiversity in accordance with the rural communities.
- ✳ Promote the maintenance of natural conditions in tourist attractions, workplaces and public areas.

*** Strategy 7
Promote and develop
international cooperation and
collaboration in the conservation
and sustainable use of
biodiversity.**

Objective

To enhance international cooperation in the conservation and sustainable use of biodiversity.

- * Promote cooperation with the international agreements related to biodiversity.
- * Support the joint works or activities in the South East Asian Region and Mekong River Basin Sub-Region to conserve biodiversity.
- * Encourage active participation of Thailand in the international forum/meetings related to biodiversity conservation.
- * Enhance the international cooperation on biodiversity conservation as a tool in the economic recovery, tourism promotion and the country's fame.
- * Accelerate Thailand's role in the international cooperation for the progress in science, technical and technology related to biodiversity.

Objective

To progress towards good reputation of the country on biodiversity conservation in the global environmental conservation forum.

- * Nominate the appropriate protected areas to be the World Heritage Site under the Convention on World Heritage, and to be the ASEAN Heritage Parks and Reserves under the ASEAN Working Group on the Nature Conservation and Biodiversity (AWGNCB).
- * Nominate additional wetland areas to be the Ramsar Sites under the Ramsar Convention, and to be the Anatidae and Shore Bird Network under the Convention on Conservation of Migratory Species of Wild Animals.
- * Nominate additional eligible sites to be the Biosphere Reserves under the Man and Biosphere Program.
- * Support the establishment of Transboundary Reserves.

Objective

To ensure the benefits from the access to biological resources, transferring of technologies and information sharing with other countries.

- * Ensure equitable and fair sharing of benefits derived from the use of biological resources on basis of sustainable use, in accordance with the Convention on Biological Diversity.
- * Promote international cooperation on access and transfer of technologies on the conservation and sustainable use of biodiversity.
- * Develop the National Clearing House Mechanism (CHM) to disseminate and exchange biodiversity information, both at the national and international level.

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A c r o n y m s

ARCBC	ASEAN Regional Centre for Biodiversity Conservation
BDM	Thailand's Biodiversity Data Management
BIOTEC	National Center for Genetic Engineering and Biotechnology
BRT	Biodiversity Research and Training Program
CBD	Convention on Biological Diversity
COP	Conference of the Parties
DOA	Department of Agriculture
DOAE	Department of Agricultural Extension
DOF	Department of Fisheries
DOLD	Department of Livestock Development
FDA	Food and Drug Administration
FFI	Fauna & Flora International
GEF	Global Environmental Facility
GIS	Geographic Information System
GMOs	genetically modified organisms
GTI	Global Taxonomic Initiative
IBC	Institutional Biosafety Committees
IUCN	World Conservation Union
MOU	Memorandum of Understanding
NAREBI	Natural Resources and Biodiversity Institution
NBC	National Biosafety Committee
NBCRC	National Biological Control Research Center
NBRU	National Biodiversity Reference Unit
NEB	National Environment Board
NGOs	Non-government Organizations
NSTDA	National Science and Technology Development Agency
OEPP	Office of Environmental Policy and Planning
RFD	Royal Forest Department
SBSTTA	Convention's Subsidiary Body on Scientific, Technical and Technological Advice
TBC	Thailand Biodiversity Center
TISTR	Thailand Institute of Scientific and Technological Research
UNEP	United Nations Environment Programme
WCMC	World Conservation Monitoring Center
WWF	World Wildlife Fund for Nature

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