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National Report

on the Implementation of Convention on Biological Diversity



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

Thailand

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on the Implementation of Convention on Biological Diversity

(4th National Report on 2009)

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FOREWORD



Biodiversity's contribution to wealth and well beings of Thailand has long been recognized, at least by those affiliated with nature conservation. Such awareness spawned many activities that lead to conservation of important ecosystems and associated species as well as genetic resources of these organisms. The recognition also became the driving factor for Thailand's signing of the Convention on Biological Diversity in 1992 and cradled the country through the struggle until the eventual ratification of the Convention in October 2003. Becoming the Contracting Parties to the Convention, however, is not the end of the country's efforts for the conservation, but rather the end of the beginning for overcoming the challenges to maintain biodiversity for future generations.

Progress on biodiversity conservation, as with other initiatives and enterprises, can only be realized through taking stock of past achievements and failure. The Convention on Biological Diversity, therefore, mandated the Contracting Parties to regularly submitted reports on implementation of its provisions as well as action to address other related issues identified by the Conference of the Parties. Thailand has complied to this reporting obligation even before becoming the official Contracting Parties, with submission of the first and second national reports. Such action was often applauded by the Conference of the Parties and the country was expected to be among the first group of the Contracting Parties to submit the third national report. This report is therefore the evidence of the success in meeting such expectation.

Thailand's 3rd national report on implementation of the Convention on Biological Diversity is a chronicle of the country's actions undertaken to ensure biodiversity conservation and sustainable used. Based on the Convention's endorsed guideline, the report also illustrates status and trends of biodiversity and its components in the countries and identifies the threats to their existence. The report describes the efforts to implement provisions in selected articles and activities called for by thematic programmes of work and cross-cutting initiatives of the Convention as well as measures to provide support from the implementation Furthermore, this publication also presents highlight on the effects of the tsunami on biodiversity and the government's effort to cope up with the damage and loss of biodiversity of the Andaman Sea.

The publication of the 3rd national report by Office of Natural Resources and Environmental Policy and Planning, the Convention's national focal point for Thailand, was aimed to enable greater public awareness of the Convention and efforts taken to implement its provision. Above all, the report serves as a prime exhibit of how extensive biodiversity conservation could and should be. We are hopeful that this report could be useful not only for the Convention in the reviewing its global implementation but also the interest public who eager to learn about the real works and people behind biodiversity conservation in Thailand.

Office of Natural Resources and Environmental Policy and Planning

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Perspective of Biodiversity

Thailand is rich of biodiversity for long time ago. From the past until now, biodiversity plenteousness supports the Thai life to goes on with wealthy, far away from famishing and starving. Biodiversity brings Thai food a diversity of type, smell, and taste. Moreover, biodiversity appears in the form of quack medicine and maintaining healthiness. As well, biodiversity provides necessary utensil in daily life. Biodiversity is also admired and satisfied by the Thai tradition that has been inheriting until now.



Biodiversity in Thai culture and tradition

Mostly, Thai culture and tradition, following cultural believe, shows biodiversity plenteousness of Thai bio-nature, especially it relates to the use of plant, at least 200 types.



Royal Ploughing Ceremony.

This is a rice farming ceremony that lends moral support to Thai farmers and blesses them with a good harvest. This ceremony is carried out for at least 20 plant species, including good unmilled rice and many plant seeds, such as *Brassica pekinensis* Rupr. var. *laxa*, Corn (*Zea mays*), Cucumber (*Cucumis*

sativus), *Vigna radiate*, *Labla purpureus*, *Cajanus cajan*, *Arachis hypogaea*), and *Glycine max* Merr. The seeds are placed in a silver and golden basket that is made of bamboo (*Bambusa* spp.). The ploughing Phya and four beautiful ladies sow the seeds on the land at the end of the ceremony, before the royal cow, which is a white Lampion type native to the northern region, moves towards a tray that contains various types of foods, such as *Oryza sativa*, Corn (*Zea mays*), *Vigna radiate*, *Sesamum orientale*, and *Brachiaria mutica*, plus whiskey and water



✿ **Songkran.** This is the observance of the Thai New Year which is based on the lunar system and is celebrated on 13-15 April every year. During the Songkran festival, women in northern Thailand use at least 25 species of plants as ornaments. Their necklace is made of *Jasminum samba*, while their hair decoration is made up of orchids. To bless the young people, the elders pour water on their hands. The water is mixed with *Acacia concinna*, (*Curcuma longa*), *Mammea siamensis*, and *Carthamus tinctorius*. Food is distributed to monks and other people and the selection includes *Kang Oom* and *Kang Hungle*, which contain spices obtained from seven to eight plants. Also served is *Kae* soup which contains more than ten kinds of traditional vegetables.

✿ **Loy Krathong.** This is a much cherished festival that is held during high tide in the middle of the lunar month. People all over the country make *krathongs* to float along the river in order to pay respects to the water goddess (*Kongka* Mother) and to thank her for her kindness. The water goddess provides water for drinking and living and forgives the people for their bad deeds that affect the river, such as discarding waste. Each *krathong* makes use of at least ten different plants. The *krathong* bowl is made of ใบตอง (*Musa* spp.) or กาบพลับพลึง (*Crinum asiaticum*), while the flowers inside the *krathong* are of various types, mainly ดอกพุด (*Tabernaemontana pandacaqui*), ดอกรัก (*Calotropis gigantean*), ดอกดาวเรือง (*Tagetes erecta*), กุหลาบมอญ (*Rosa damascene*), orchid (*Dendrobium* spp.), lotus (*Nelumbo nucifera*), and others. It is believed that a *krathong* that is made of banana leaf and containing colourful flowers would bring happiness and comfort to its owner.





Biodiversity Policy



Thai Government's Biodiversity Policy (2009). This focuses on the protection and restoration of conservation areas that are important to the preservation of ecology in support of biodiversity conservation. The policy is implemented through surveys, database development, conservation and development. Biodiversity is used in order to secure food, energy and health, and to bring about economic benefits. Its use is based on traditional knowledge and culture and the equal sharing of benefits while ensuring biosafety.



Country Management Plan (2008 – 2011). The 4th policy on land, natural resources, and the environment promotes conservation, development, and sustainable utilization of biodiversity in order to yield better economic benefits. As its goal, the policy seeks a balance between biodiversity conservation and biodiversity development. Key indicators are based on a biodiversity and natural resources database that supports economic development and promotes strong and self-reliant communities, particularly with regards food and health, as result of sustainable bio-resources use and management.




Policy, Measure, and Plan for Sustainable Biodiversity Conservation and Utilization (2008 – 2012). This instrument seeks to enhance the abundance of biodiversity as a secure foundation for the Thai way of life. It also promotes biodiversity research to raise its economic value and to formulate mechanisms so that benefits resulting from biodiversity development are shared throughout the country, based on equality and fairness. The ultimate goal is to significantly reduce the rate of biodiversity loss by maintaining the health of associated types of ecology, different animal and plant species, and important genetic sources, and also by protecting related biodiversity components in a sustainable manner. This instrument is composed of five measures and 17 action plans that support the objectives and goals of the Convention on Biological Diversity.


This instrument was approved by the Cabinet on 5 January 2008. It is carried out by relevant organizations including the Office of Natural Resources and Environmental Policy and Planning, Department of National Parks, Wildlife, and Plants, Royal Forest Department, Department of Livestock Development, Department of Agriculture, and Department of Medical Sciences. Each organization carries out tasks assigned to it.





Biodiversity in Law


Thailand's biodiversity is protected by various laws, the most important ones being the **National Park Act (1961)**, **National Conserved Forest (1964)**, **Wildlife Conservation and Protection Act (1992)**, **Plant Storage Act (1964)**, **Second Plant Storage Act (2008)**, **Animal Species Maintenance Act (1966)**, **Export and Import to the Kingdom Act (1979)**, **National Environment Enhancement and Conservation Act (1992)**, and **Plant Species Protection Act (1999)**.


 **Thailand Constitution, 2007.** Article 66 states that local or traditional communities are required to participate in the balanced and sustainable management, maintenance, and utilization of natural resources and the environment. Article 67 provides the rights of personnel to participate with the Government and the community in the conservation, maintenance, and utilization of natural resources and the environment. Article 85 provides plans for systematic management of water resources and other natural resources for the benefit of the public. As well, it requires public participation in the balanced conservation, maintenance, and utilization of natural resources and biodiversity.


 **National Park Act, 1961.** This concerns national park areas, the objectives being to protect, control, and oversee the ecology and natural habitat of plants and animals in national park areas. It forbids collecting, harming and bringing out wood, natural resources, animals and plants, orchids, including flowers, leaves, and fruits.


 It also forbids harmful and destructive activities.


 **National Conserved Forest Act, 1964.** This forbids personnel to collect wood and cut forest trees and plants in national park areas, and to seek permission from the officer in-charge in order to identify and declare specific forests as national conservation forests, even with a view to maintaining the forest and various natural resources in good condition. This can be done based on ministerial regulations from the Ministry of Agriculture and Cooperatives.


 **Plant Storage Act, 1964 and the Second Plant Storage Act, 1994,** including a notification from the Ministry of Agriculture and Cooperatives, entitled "Determination of Plants, Pests, or Carriers from Specified Sources that are Forbidden". These state that genetically engineered plants, which resulted from bio-technology, are forbidden. Their import and transfer require permission from the Department of Agriculture. Permission is restricted to experimental and research activities.


 **Animal Species Maintenance Act, 1966.** This concerns the protection and maintenance of reserved animal species for genetic purposes. Castrating and killing animals and exporting them from the Kingdom without permission are forbidden.


 **Fishery Act, 1947.** This concerns plant conservation in temple and shrine areas and other areas that are connected to these sites, as well as water gate areas, dams and weirs, and other areas that are appropriate for aquatic animal conservation. Fishing or raising aquatic animals is forbidden without prior permission from the Director-General of the Department of Fisheries. This law forbids importing aquatic animals that are specified in the Royal Decree on Forbidding of Importing Specified Aquatic Animals into the Kingdom, 1982 and 2nd edition, 1993.

 **Exporting and Importing Goods to the Kingdom, 1979.** This controls import and export based on the Royal Decree on Goods Export from the Kingdom (39th edition), 1975, and the 11 notifications of the Ministry of Commerce on goods export from the Kingdom since 1974. These cover lists of wildlife, carcasses, 400 types of aquarium fish, and 258 types of other aquatic animals that require permission prior to being exported from Thailand, following the criteria, methodology and conditions set by ministerial regulations.

 **Wildlife Conservation and Protection, 1992.** This revised version of the Wildlife Conservation and Protection (1960) is concerned with wildlife conservation areas, with a view to protecting natural habitats. It lists 15 types (formerly nine types) of rare wildlife. It seeks to improve the Act and make it in harmony with the current situation, in accordance with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). It also concerns import and export control, encouraging the breeding of certain wildlife species with a goal to increasing the wildlife population as well as to conserve breeding and reduce the pressure from hunting wildlife.

 **National Environmental Quality Conservation and Protection, 1992.** This provides authority to the Minister of Science, Technology and Environment to regulate ministerial regulations for specific vulnerable areas that contain natural ecology and to consider these as environmental protection areas that need particular management and appropriate protection, depending on conditions in the concerned areas.

 **Plant Species Protection Act, 1999.** This provides protection to new plant species, traditional plant species (local and in general), and forest plant species. It stipulates the need for permission and benefit sharing agreements in the case of collecting, procuring, and gathering plant species or parts of plant species for the purpose of species improvement, study, experiment, and research for commercial benefits.


 **Traditional Thai Medical Knowledge Enhancement and Protection Act, 1999.** Section 3 on Herb Protection covers plant, animal, bacteria, and herbal sources. Protection is of two types: The first type, following Article 57, determines that

protection of herbs and herbal sources in protected areas shall develop a “herb protection management plan”. The second type, following Article 61, determines that protection of herbs in areas that have not yet been declared as protected area shall promulgate “ministerial regulations to determine those areas as herbal protection areas”.



Biodiversity in the Environment

Thailand has a land area of 513, 115 square kilometers located in a hot and humid climate in the middle of Southeast Asia. This has led to a rich natural diversity. Thailand is a bridge that connects communities from the northern parts of the world in the Himalayan mountain range and southern China to the Malay Peninsula, including hot and dry areas from Cambodia to Laos. It is a rich source of various types of ecology in hot areas.

 **Ecological System** Up to 30.92% of Thailand is covered by forests, including humid tropical rain forest, drought tropical rain forest, pine forest, mixed forest, *Dipterocarpaceae* forest, and savannas. 40.63% of the land is rich in agricultural ecology that consists of rice farms and crop and garden areas. Water resources cover around 10% of the land, consisting of rivers, canals, swamps, freshwater swamp forests, wetlands, and estuaries. The coastal area is 2,631 – what measurement? in length. The Gulf of Thailand and the Andaman Sea contain 936 islands. The coastal ecology consists of beach forests, mangrove forests, and beach areas that feature mud, sand, and rocks, as well as sea grass and coral reef areas.


 **Plant.** Thailand contains around 15,000 plant species, which is eight per cent of the world total of plant species. Thailand is at the center of the plant group in the region of India-Burma, Indo-China, and Malaysia. It is estimated that there are 12,000 species of vascular plants, of which 658 are fern species, 25 are uncovered seeds, 10,000 are flowering plants and 1,140 are orchids. Non-vascular plants consist of over 2,154 species, including algae and bryophytes, such as moss, hornwort, and liverwort.

Table: Number of Plant Species in Thailand

Types	Number of Species
Non-vascular	2,154
Algae	1,334
Bryophyte	925
Vascular	~12,000
Ferns	658
Uncovered Seed Plants พืชเมล็ดเปลือย	25
Flowering Plants	~11,000

✿ **Animals.** Thailand has 4,591 species of vertebrate animals, consisting of 302 species of mammals, of which 42% are Malay peninsula species, 34% from Indochina or Indochina region and the sub-Indian continent, and 24% from the Asian continent. There are at least 982 bird species, 350 reptile species, 137 semi-water animals species (138 forms), and over 2,820 fish species (720 freshwater species and 2,100 marine water species), which is 10% of the world's total number of fish species. Invertebrate animals consist of around 83,000 species (mostly insects). Only 14,000 species of the total have been identified,

Table: Number of Animal Species in Thailand

Types	Number of Species
Vertebrates	4,591
Mammals	302
Birds	928
Reptiles	350
Semi-water Animals สะเทินน้ำสะเทินบก	137
Fishes	2,820
Invertebrates	83,000



Biodiversity, Tendency and Threats

Biodiversity in Thailand has long been threatened by the extension of agricultural lands and shifting cultivation. Many of water basins and wetlands have been transformed as a result of development projects, for instance, construction of mines, dams, the poaching of forests for wild orchids and wildlife, such as, bird hunting and its egg collecting. These activities share a crucial part in biodiversity devastation. Biodiversity of tourist attractions including coral reef is threatened by rubbish, pollution, anchors and a search for seashell and ornamental fish.



Threatened Species

In Thailand, threatened species consist of 121 mammals, 184 birds, 33 reptiles, 5 amphibians, 218 fishes and not fewer than 1,131 plants. Among them, Schomburgk's Deer (*Cervus schomburgki*) and *Schilbeidae* have been extinct in the world. Giant Ibis (*Pseudiis gigantea*), Grassbird (*Graminicola bengalensis*), Bala Shark (*Balantiocheilus ambusticauda*) and Siamese Tiger Fish (*Coilus Undecimrasiatus*) have been extinct in Thailand. Kouprey (*Bos sauveli*), Eld's Deer (*Cervus eldi siamensis*), Javan Rhino (*Rhinoceros sondaicus*), Sumatran Rhino (*Rhinoceros sumatrensis*), Eastern Sarus Crane (*Grus antigone sharpie*), White-shouldered Ibis (*Pseudibis davisoni*) and Gavial (*Tomistoma schlegelii*) are extinct in the wild.

Vertebrates which are critically endangered comprise 12 species of mammals, 43 species of birds, 11 species of reptiles and 18 species of fish as following;

Twelve mammals include Prevost's Squirrel (*Callosciurus prevostii*), Jungle Cat (*Felis chaus Guldenstaedt*), Flat-headed Cat (*Prionailurus planiceps*), Otter Civet (*Cynogale bennetti*), *Lutra Sumatrana*, Kitti's hog-nosed bat or Bumblebee Bat (*Crasoonyeteris thonglongyai*), Agile Gibbon (*Halobates agilis*), Ginkgo-toothed Whale (*Mesoplodon ginkgodens Nishiwaki and Kamiya*), Irrawaddy Dolphin (*Orcaella brevirostris*), Goral (*Naemorhedus goral*), Banteng (*Bos javanicus*) and Dugong (*Dugong dugon*). Forty-three birds are *Rhizothera longirostris*, *Arborophila charltonii*, Hume Pheasant (*Syrmaticus humiae burma-nicus*), Malaysian Peacock Pheasant (*Polyplectron malacense*), White-winged Duck (*Cairina scutulata*), *Sarkidiornis melelanotos*, Yellow-crowned Woodpecker (*Dendrocopos mahrattensis*), Black Hornbill (*Anthracoceros malayanus*), Wrinkled Hornbill (*Aceros corrugatus*), *Alcedo Hercules*, Dusky Eagle Owl (*Bubo coromandus*), Large Frogmouth (*Batrachostomus auritus*), Cinnamon-headed Pigeon (*Treron fulvicollis*), Masked Finfoot (*Helipais personata*), Great Thick-Knee (*Esacus magnirostris*), Beach Thick-Knee (*Esacus neglectus*), River Tern (*Sterna aurantia*), Chinese crested-Tern (*Thalasseus bernsteini*), Black-bellied Tern (*Sterna acuticauda*), Knot (*Calidris canutus*), Bat-eating Buzzard

(*Macheiramphus alcinus* Westerman), Grey-headed Fish Eagle (*Ichthyophaga ichthyaetus*), White-rumped Vulture (*Gyps bengalensis*), Slender-billed Vulture (*Gyps tenuirostris*), Red-headed Vulture (*Sarcogyps calvus*), Brown Booby (*Sula leucogaster*), Great-billed Heron (*Ardea sumatrana*), Milky Stork (*Mycteria cinerea*), Black-necked Stork (*Ephippiorhynchus asiaticus*), White-necked Stork (*Ciconia episcopus*), Storm's Stork (*Ciconia stormi*), Lesser Adjutant Stork (*Leptoptilos javanicus*), Greater Adjutant Stork (*Leptoptilos dubius*), Christmas Frigate bird (*Fregata andrewsi*), Bar-bellied Pitta (*Pitta elliotii*), Gurney's Pitta (*Pitta gurneyi*), Brown Dipper (*Cinclus pallasii*), Beautiful Nuthatch (*Sitta formosa* Blyth), White-eyed River Martin (*Pseudochelidon sirintarae*), Straw-headed Bulbul (*Pycnonotus zeylanicus*), Black and White Bulbul and Striped Wren Babbler (*Kenopia striata*).

Eleven reptiles are composed of Saltwater Crocodile (*Crocodylus porosus*), Freshwater Crocodile (*Crocodylus siamensis*), Green Turtles (*Chelonia mydas*), Hawksbill Sea Turtle (*Eretmochelys imbricata*), Olive Ridley Turtle (*Lepidochelys olivacea*), Leather Back Turtle (*Dermochelys coriacea*), Southern Salt-water Terrapin (*Batagur baska*), Painted-Batagur Terrapin (*Callagur borneoensis*), Southeast Asian Narrow-headed Soft Shell Turtle (*Chitra spp.*), Myanmar Narrow-headed Soft Shell Turtle (*Chitra vandijki*), Cantor's Giant Soft Shell Turtle (*Pelochelys cantorii*). Eighteen fish species cover Knife-tooth Sawfish (*Anoxypristis cuspidata*), Large-tooth Sawfish (*Pristis microdon* Latham), Green Sawfish (*Pristis zijsron*), Small-Tooth Sawfish (*Pristis pectinata*), Shark Ray (*Rhina ancylostoma*), *Cultrops siamensis*, *Trigonostigma somphongsi*, Giant Jelly Catfish (*Aptosyax grypus*), Red-tailed Black Shark (*Epalzeorhynchus bicolor*), *Ellopostoma mystax*, *Nemacheilus troglodactaractus*, *Schistura jaruthanini*, Yellow-headed Temple Terrapin (*Hieremys annandalei*), Dwarf Loach (*Yasuhikotakia sidthimunki*), Whisker Sheath-Fish (*Kryptopterus bleekeri*), Mekong Giant Catfish (*Pangasianodon gigas*), *Betta sp. Mahachai* and *Betta Simplex*.

In addition, 35 mammal species, 66 bird species, 5 reptile species (in 6 forms) and 42 fish species are in endangered state (Table....: Endangered Vertebrates).

The categorization of status of plant species in Thailand has shown that in Thailand there are endemic plants, rare plants, vulnerable plants, endangered plants and plants extinct in the wild in total at 1,957 species, tantamount to 15 percent of vascular plants found in Thailand. One among them in critically endangered status and extinct in the wild is Pride of Burma (*Amherstia nobilis* Wall).

Orchidaceae were mostly categorized at 362 species, of which 158 species are endemic orchids. Furthermore, since wild orchids are popular in the market, a large amount of them, especially, *Dendrobium* are poached from the forest for distribution. Accordingly, 101 species of orchids have been categorized, for example, *Dendrobium cruentum* Rchb. f., *Dendrobium fridericksianum* Rchb. f., *Dendrobium thyrsoflorum* Rchb. F. and *Dendrobium griffithianum*. All 15 species of *Paphiopedilum* have been

categorized in endangered status, for instance, *Paphiopedilum niveum* (Rchb. f.) Pfitz., *Paphiopedilum parishii*, *Paphiopedilum exul* (O' Brien) Pfitz., *Paphiopedilum villosum* (Lindl.) Stein, and *Paphiopedilum hirsutissimum* (Lindl. ex Hook.) Stein. 85 species of Plamae were categorized, including, *Kerriodoxa elegans* Dransfield, Litter-Collecting Palm (*Johannesteijsmannia altifron*), Lipstick Palm (*Cyrtostachys renda* Blume) and Sago Palm (*Maxuabaurettia* sp.). For Zingiberaceae, 75 species that were categorized include *Geostachys angustifolia* K. Larsen, Torch Ginger (*Etlingera elatior* (Jack) R.M. Smith), *Cornukaempferia aurantiflora* and *Scaphochlamys obcordata*. 32 species of Dipterocarpaceae were registered, for example, *Hopea avellanea* and *Sereya* (*Shorea assamica*).



Genetic Degeneration

Thailand is a sanctuary of world rice species. It is evidenced that growing rice in Thailand has existed for more than 5,500 years. Traditional indigenous rice species of Thailand are anticipated at around ten thousand. Nevertheless, Pathum Thani Rice Research Center, Bureau of Rice Research and Development, Rice Department had collected Thai rice accessions nationwide since 1937 up to 2001 in which there were 5,928 local rice species. At the moment, genetic erosion of rice is rapid because the collection of traditional local rice species becomes degenerating, rice paddies have been urbanized, and farmers prefer growing new prolific species and do not conserve the indigenous ones.

Likewise, a large number of indigenous cultivated plants have also disappeared since the farming areas were attacked by natural disaster, for instance, inundation, draught, urbanization, industrialization and dam construction. For example, the area of fruit gardens along the river in Nonthaburi Province used to be the production source of very important economic fruits, such as, Kampan Durian, Kanyao Durian, Kradum Durian, Kop Mae Tao Durian, Tap Tim Santol, Pui Fai Santol, E-la Santol, Mango, Banana, Mangosteen and others. During the economic boom, housing projects and residential areas have extended to these areas quickly so that fruit farms are almost vanished. As a result, genetic sources used for genetic improvement are also disappeared.

The Department of Agriculture conserves some accessions of Durian, Mango, Lichee and Longan at 175, 210, 19 and 68 successively. It is convinced that many of accessions have been terminated. A lot of crop wild relatives are left unattended because they have yet to be benefited. Many people do not recognize that apart from Rong-Rein Rambutant and Si Chompoo Rambutant popularly consumed at the moment, there are at least another 2 rambutant species-- one found at Yala Province and the other at Kud Bak District, Sakonnakorn Province which can be improved further. Moreover, there are also one more species of wild mangosteen found at Song-Kla Province and Yala Province, another 2 species at Chantaburi Province, and the other two species—one at Srisakes

Province and the other at Sakonnakorn Province. If these are not conserved and made use in sustainable fashion, Thailand will lose more species of which potentials have been unknown.

It is similar for livestock. Although there are many species imported according its productivities, Thailand has its own indigenous animals that suits local geography and environment for many hundred years, such as, local swamp buffalo, Khaolampoong cow, those indigenous to northern region and southern region, banteng, gayal, local goat, local pig, black Muscovy duck, white Muscovy duck, Pak Nam duck, Nakorn Pratom duck, goose and chicken. The local animals have good genetics, for example, high reproductive success and productivity; meanwhile, cows imported from abroad, namely, Brahman Cow has very low reproduction rate and gives birth in long interval of 3-4 years for 2 calves. The indigenous animals fit into the geography and the environment of Thailand for over a century.

The large import of alien animals results in an ignorance of indigenous animals, such as, local cows, Khaolampoong cow, cow indigenous to northern region and southern region, Rad pig, Hinan pig, local buffalos, Nakornpratom duck, banteng and golden-horned gaur. The animals are becoming extinct in Thailand. Besides, the population of local swamp buffalos is decreasing every year from previously around 5-6 millions to 1.5 millions. The number is reducing day by day. Moreover, they are also cross-bred with foreign species causing the loss or erosion of indigenous species.



Forest Ecosystem

Forests in Thailand consist of deciduous forest and evergreen forest which share 70 percent and 30 percent of the total forests nationwide consecutively. In the North, the area abounds with mountains where the forests are most abundant, equivalent to 54.27 percent of the region, including, hill evergreen forest, pine forest, mixed deciduous forest and dry dipterocarp forest. Five key forest groups encompass Pai-Salawin Basin forest group, the biggest group in the area of 7.39 million Rais, Doi Phuka-Mai Yom forest group at 6.15 million Rais and Sri Lanna-Khun Tan forest group at 5.62 million Rais successively (Pic.1 : Major Forest Groups in Thailand)

The West of Thailand is alive with lines of mountains without plane and ravine. There are a lot of limestone mountains and caves. It is a rain shadow of mountains in Myanmar so that the precipitation is not very high, and semi-tropical rain forests, dry dipterocarp forest, mixed deciduous forest and grass land exist. The main forest group in the West is Thung Yai Naresaun-Huay Ka Kaeng forest groups covering the area of 11.7 million Rais.

The North-East is a tableland slanting to the East. The precipitation is low and irregular because the land is locked by mountains from many sides. Deciduous forests

exist all over the plateau. A majority of forests are dry dipterocarp forests, and there are also hill pine forests, hill evergreen forests and dry evergreen forests. The important forest land is Dong Phrayayen-Khao Yai Forest in the area of 3.87 million Rais.

The Central of Thailand is a vast low land with a lot of swamps and wetlands but a little area of forests. The East has a rolling plain in the upper part, high mountains in the middle and a long coast of more than 470 kilometers. This supports the plant community which includes tropical rain forest, mixed deciduous forest, beach forest and mangrove forest. The major forest is situated in the connecting area of five provinces covering the land of 1.51 million Rais.

The South is formed of a peninsula where mountain stripe lie on as a backbone. Narrow coastal plains, archipelagos, tropical rain forest and lowland evergreen forest spread throughout, for example, Kao Luang evergreen forest, Klong Saeng-Kao Kok forest and Hala-Bala forest. Large pieces of mangrove forests can also be found in many areas, such as, in Pang-nga bay, Ngow estuary in Ranong Province. In addition, peat swamp forests are abundant, and the biggest one is located at Pru Toh Daeng, Narathiwat Province. Beach forests scatter along the coasts and islands.

Thailand in the past was the country where forests could be found all over. In 1961, Thailand had a lush forest covering 53.35 percent of the country. At the present, the terrestrial forest blankets only 32.1 percent of the country. Deforestation is mainly stemmed from lack of knowledge and awareness on the importance of forest ecosystem. In addition, both the force of socio-economic development and the necessity of anti-communist strategies made the large piece of forest land transformed into small isolated pieces of forests which could not protect the population of large-sized wild animals and economic plant species effectively (Fig.... Dong Phrayafai Forest and Panomsalakam Forest)

While the National Forest Policy, 1985 defines the forest areas shall be maintained at least 40 percent of the country, issues raised from statistics of forest lands, 19... include the following;

- Provinces without terrestrial forests were Bangkok, Nakhonratchasima, Nonthaburi, Pathumthani, Singburi, Angthong, Samutprakarn, Samut Songkhram and Samut Sakhon;
- Provinces with terrestrial forests lower than 5 percent of the province were Ayudhaya Province, Pichit, Chainat, Pattani and Mahasarakham;
- Provinces with terrestrial forests more than 5 percent but lower than 10 percent of the province were Roi-et, Nakhonsawan, Buriram, Nongkhai and Rayong;
- Provinces with terrestrial forests lower than 40 percent accounted for 62 provinces, equivalent to 81.57 percent of all provinces;

- Provinces with terrestrial forests more than 49 percent of the province were Lampang, Prae, Kanchanaburi, Lamphoon, Uthairat, Petchburi, Payao and Uthairat;
- Provinces with largest terrestrial forests in the country or more than 74 percent of the province were Mae Hong Son, Chiang Mai, Tak and Nan. (Fig.2 : Diagram of Forest Areas in Thailand in 2004 excluding mangrove forests)

In 2004, the statistical data of offences against forestry laws reveals that the forest area of 46168.16 Rais had been poached and deforested, higher than that during 2001-2003. The uninterrupted loss of forest ecosystem for a long time and the poaching of wildlife and wild plants lead to the decline of wildlife and wild plant populations, many of which are in endangered status. It is highly concerned that at the present in Thailand the number of wild elephants stays at approximately 1,975-2,380; wild buffalos remain at 50-70; tigers remain at 200-500; and Guars and Bantengs are left around 200. For Kuprey, Eld's Deer and Java Rhinoceros, they have not been reported found in the wild for a long time.

Enormous wild plant species have irretrievably lost in the wild, such as, those indigenous to Toe Daeng peat swamp forest. Furthermore, more than hundred thousands of wild orchids were poached for selling during 2003-2005 to orchid farms and orchid collectors in order to select good species for improvement or for culturing and further businesses. These wild orchids are, for instance, Dendrobium, Bulbophyllum, Vanda, Ascocentrum, Rhynchostylis gigantean, Aerides, Herbenaria and Paphiopedilum.



Coastal and Marine Ecosystem

Coastal and marine ecosystem in Thailand embodies brackish water and estuarine ecosystems, mangrove forest, beach forest, stone beach, sand beach, coral reef, Seagrass bed and high sea.



Mangrove forest

The forest flourishes in the mud, especially, around the estuary of bay or river, stream and flood plain. 74 perennial plants form 53 families are found in the area. In particular, the main trees include Red Mangrove (*Rhizophora mucronata Poir*), *Rhizophora apiculata Blume*, *Avicennia alba*, Cork Tree (*Sonneratia caseolaris Engler*), *Sonneratia alba Smith* and Portia Tree (*Thespesia populnea (L.) Sol. ex Correa*). Mangrove animals incorporate around 15 species of prawns, 7 species of fish, 32 species of crabs and 32 species of shells. Furthermore, the forest is also a residence of birds, monkeys, otters, wild cats, bats, snakes, turtles and copious numbers of insects.

Along the coastal line, mangrove forests take approximately 36 percent of the coastal length, tantamount to the area of 1,458,175 Rais. 14.8 percent and 85.2 percent of

total mangrove forests nationwide grow along the Gulf of Thailand and along the Andaman Sea consecutively.

Every coastal province has mangrove forests, and Pang-nga, Krabi, Trang, Ranong and Nakornsrihammarat are the provinces most abundant with mangrove forests, equivalent to 49.8 percent of the total area of mangrove forests nationwide. The most abundant and oldest forest is that of Mae Nam Ngao estuary, Ranong Province. Mangrove forests in Rayong, Chantaburi, Trad and Satoon are invaded for shrimp farm. The forests in Bang Khun Tien, Bangkok and Nakornsrihammarat are in critical condition due to the coastal erosion. Overall, currently mangrove forests are threatened by illegal wood cutting, shrimp farming, construction of residential areas and industrial factories. The rest of the forests also remain a source of food, woodcut for kindle and charcoal, spawning and nursery areas of water animals, crucial habitat for many of water birds and mangrove birds, including, those in vulnerable status and endangered status. The forests also stand as a fort protecting against strong wave and coastal erosion



Beach Forest

Beach forests thrive in the beach areas or saline soils and non-flooded areas. Plant species grown in the forest are well resistant to draught and saltiness. Those commonly found are

Casuarina equisetifolia, *Hibiscus tiliaceus*, *Derris indica*, as well as, *Excoecaria agallocha*. Ground plants often found include *Ipomoea pes - caprae* (Lin.X Sweet), *Premmo obtusifolia*, *Clerodendrum inerme* and *Scaevol taccada*, for example. On the beach, *Ipomoea pes-Caprae*, *Vitex trifolia* ไม้ตีนเป็ด *Wedelia biflora*, *Panicum repens* and *Canavalia maritime* are usually seen crawling over the sand dunes. The study of the Department of Marine and Coastal Resources conducted in 2008 found that the beach areas which were of high slope would be more blanketed by creeping plants.

Beach forests have been heavily devastated in order to develop tourist attractions, community settlement and ports. At the present, there are only few abundant beach forests in Thailand, most of which are located in National Marine Parks, for example, Tai Mueng Beach, Kao Lum Pi National Park, Pang-nga Province and Bang Kien Beach, Leam Son National Park, Ranong Province.



Coral Reef

Around 420 coral communities and coral reeves in Thailand root in the area around 96,357 Rais dispersing around remote coasts, river estuaries, seawalls and almost all islands. Coral reeves in the Gulf of Thailand prosper in the area around 45,545 Rais and in Andaman Sea around 50,812 Rais. 388 coral species are found in the Gulf and 645 species in the Andaman sea. Furthermore, 880 fish species, more than 100 species

of shrimps and crabs and more than 100 species of sea slugs are also found with the coral reefs.

The largest area of coral reefs is located at Suratthani Province, equivalent to 25.10 percent of the total coral reef area nationwide. Koh Samui is the island where most of coral reefs thrive. Nevertheless, Surin archipelago and Similan archipelago in Pang-nga province accommodate a variety of corals and a sanctuary suitable for the growth of *Acropora echinata* and stag horn coral (*Acropora spp*).

The survey conducted by the Department of Marine and Coastal Resources in 2007 found that only 5 percent of coral reefs around Koh Samui and other islands in Suratthani Province were in good condition, 24 percent were in fair condition which was not good but not poor, 52 percent in poor condition and 13 percent in very poor condition.

The Department also surveyed 80 percent of coral reefs in Andaman sea in 2007 in order to compare the findings with the data collected during 1995-1998. It shows that most of the reefs have become resilient continuously.

Based on the data of conditions of coral reefs along Thai Coasts in 2006, coral reefs at the Gulf of Thailand on the East were degenerating because the residue from construction along the beach was blown to accumulate on the reefs. Therefore, where there was a lot of hotel construction, there was damage to coral reefs in the area. Apart from that, the damage was also caused by sewage and garbage from local shops. Coral reefs in popular tourist attractions, essentially, Koh Samet in Rayong Province, Chao Lao Beach in Chanthaburi Province were also highly destroyed by anchors of tourist boats, tourists trampling over and flipping the corals. The reefs in Trad Province used to suffer from bleaching at medium to severe level in 1998. The reefs in the Gulf of Thailand on the West are threatened by fishing by using push nets and trawls, dredges from tourism activities and dredging. The reefs in Andaman Sea also have the impacts from anchoring, fish bombing, dredges from mines and construction along the coast. The Crown-of-Thorns used to be endemic during 1984-1986. Some reefs were damaged by the bleaching in 1995 and the Tsunami in 2004.



Seagrass Bed

Seagrass beds are found in the area of 94, 193 Rais in the Gulf of Thailand or about 35.8 percent of seagrass beds nationwide and 59, 653 Rais in the Andaman Sea or equivalent to 64.2 percent of the beds nationwide. Seagrass lives in the medium low tide to the depth around 3-8 meters. 12 species of seagrass are found. The bed is the habitat of dugong and marine turtle which are endangered species, around 230 fish species and 93 species of invertebrates.

The largest seagrass beds are in Had Chao Mai National Park, Koh Libong and Koh Mook in Trang Province. 2 families of seagrass and more than 93 species of

invertebrates are found. Other big beds are found in Pang-nga Bay around Koh Prathong in Pang-nga Province and Tha Noon in Phuket Province. The Department of Marine and Coastal Resources conducted a survey on seagrass condition in 2006 and found that in general the seagrass bed in the Gulf of Thailand were in poor condition at 40 percent and in the Andaman Sea at 20 percent as a consequence of erosion by current flow, fishing by net pushing and trawling, sewage from shrimp farms and residue from estuaries.

Large marine animals

Dugong, dolphin, whale, sea turtle and shark can be seen in Thai territorial water.

- **Dugong:** Dugong (*Dugong dugon*) is a mammals feeding mainly on seagrass. The population of 50 dugongs are found in the Gulf of Thailand at Makarpom Bay in Rayong Province, Ban Mai Rood, Trad Province, Sawee and La Mae Bay, Choomporn Province, Chaiya Bay, Suratthani Province, Ban Tha Rai, Nakornsrihammarat Province and Pattani Province. Among 200 dugongs found in the Andaman Sea, at most 150 dugongs are found at Trang Province, especially, at Koh Mook and Koh Ta Libong where seagrass is very abundant. Dugongs can also be seen in Ban Toong Nang Kam at Kraburi, Koh Ra, Koh Prathong in Pang-nga Province, Koh Cham, Koh Poo and Koh Sri Boh Ya in Krabi Province, Ranong Province and Satul Province. At the present, Dugong is a critical endangered animal. Each year, not less than 10 dugongs are hunted for meat and are trawled by accident. Moreover, the damage and degeneration of seagrass inevitably also have the effects on survival of dugongs since they eat 40 kilograms of seagrass per day.

- **Dolphin and whale:** Dolphin mostly found in Thailand is Irrawaddy Dolphin in which around 250 dolphins were recorded found in the Gulf of Thailand, 60 in Andaman Sea, around 20-25 at Kok Karm, Sumutsakorn Province, approximately 70 at Trad Estuary along Ban Mai Rood to Had Lek, a big school of 20-30 at Maklong Estuary and Bang Pakong Estuary, 60-80 outside the coast of Nakornsrihammarat to Narathiwat and around 20-25 at Songkla Lake. Currently, the number of Irrawaddy Dolphins plummets to very minimal because in each year around 3-5 dolphins die because of being caught in trawls. Now, Irrawaddy Dolphin is categorized as a critically endangered species. In addition, around 100 Indo-Pacific hump-backed dolphins are found at Bang Pakong Estuary, Sumutprakarn Province, 20-30 at Choomporn Province, a school of 15 found and another 20-30 regularly staying in Pa Lian Bay, and 32 from Ta Se Bay to Koh Mook.

Similarly, bottlenose dolphins are also found around 100 in the southern area of Koh Payam, Ranong Province and 5-6 in Pang-nga Bay. They used to be seen in a school of approximately 20-30, believed to migrate for food from Pang-nga Bay to PP Island. Another 30 dolphins used to be found at Koh Mai Ton, Phuket Province. At Pa

Lian Bay, Trang Province, around 20-30 dolphins are found always residing in the area. At the moment, the bottlenose dolphin is categorized as an endangered species. Around 90 finless porpoises are found at Ban Krood Bay, 1 at Bang Saparn, Prachuapkirikan Province and around 20-30 in Pang-nga Bay. Now they are in \endangered status. For spotted dolphin, striped dolphin and spinner dolphin, each of them are found around 30 in high sea of Andaman.

- Sea Turtle:
- Shark: in the Andaman Sea, 27 species of sharks are found and 4 of them are in endangered status and the other 23 are in vulnerable status due to a severe hunt.

Over-fishing and deconstruction of coastal habitats, such as, mangrove forest, a nursery of young animals have made the quantity of marine animals caught from natural sources in the past decade grow very marginally. Especially, the amount of shell fished in the past ten years declines at 70 percent. Mud crab caught from natural sources has gradually reduced in number. As a result, most of large marine fish, such as, shark, saw fish and ray are in vulnerable status.



Inland Freshwater Ecosystem

- Inland freshwater Ecosystem in Thailand is composed of river, stream, tributary, flood plain, bog, lake, pool, reservoir, swamp, marsh, wetland, freshwater swamp forest and seasonal flood plain grassland.

- Riverine system involves Sarawin riverine system, Mae Klong riverine system, Petchburi riverine system, riverine system in the South, riverine system in the East, Chao Praya riverine system and Mae Kong riverine system.

- Chao Praya Riverine system lying through the central part of the country is originated from the nexus of Ping River, Wang River, Yom River and Nan River in the North, and it ramifies to be Tha Jeen River in the lower part of the Central Region. The Chao Praya River and its tributaries accommodate highest diversity of fish species in the country. At the present, some fish species become extinct, and more than 20 species are in endangered status. The Pollution Control Department reported in 2007 that the quality of water in Tha Jeen River was critically polluted because of sewage from households and industry plants, and the same water problem was also found around the lower Chao Praya due to planting farms, ranches and industrial factories.

According to the survey conducted by The Department of Water Resources in 2008 disclosed that 4 rivers were in physically critical condition--

- Phichit River, Phichit Province : since the watershed is high-positioned, water from Nan River cannot flow into Phichit River. This causes the Phichit River to become

shallow and clogged by weeds. In addition, a number of trespassers settling down and making use of the river banks are also higher.

- Old Yom River, Sukhothai Province: there is some change in the flow of Yom River through Srisatchanalai District and Sawankalok District. This alteration makes the Old Yom River become shallow, and plants and weeds increase and blanket the river until the watercourse is almost invisible. Besides, people invade the river and grow crops in the area.

- Lower Moon Basin, Ubonrachathani Province: the Moon River running through Srisaket Province and Ubonrachathani Province becomes shallow because of the accumulation of sand residue. Moreover, there are a lot of people encroaching into and making use of the area.

- Loei River, Loei Province: a large number of people encroach into and make use of the area.

☞ **Pond and Lake**

Thailand has quite a few large ponds and lakes. Important and well-known ponds include Talae Noi at Pattaloong Province and Nong Han Koompawapi at Udonthani Province. Meanwhile, crucial lakes comprise Bueng Boraphet at Nakornsawan Province, Kwan Payao at Payoa Province and Nong Han at Sakonnakorn Province. Furthermore, there are lakes derived from the construction of dams in many places. These water sources are very essential in particular for species of migrating water birds.

☞ **Flood Plain**

Flooded forest exists in lowland along river banks or around lakes where water can overflow during rainy season or flood season. The forest is usually inundated for many months each year and covers not a large piece of land. It has been found spread in Chao Praya Basin. Currently, some large flooded forests still remain along Ta Pi riverbanks, such as, Nong Tung Thong swamp forest at Suratthani Province, Ta Lae Noi swamp forest at Pattaloong Province and seasonally flooded forest at Moon-Chi basin in the North-East.

☞ **Bog**

Swamp forest prospers in lowland where the flood persists all year round or almost. Most of soil found contains organic matter as a result of long accumulation of decayed plants. In the past, there were many hundred thousand Rais of the forest. At the present, based upon the official survey in 2007, it was found that at least 5 crucial swamp forests were found in the total area of 186,649 Rai mostly in the South of Thailand. The swamps found in highland in the North are at Ang Kalaung and at Tha

Ton grassland. The original swamp forests which still prosper include Toh Daeng swamp at Narathiwat Province, resilient Kantuli swamp at in Suratthani Province, and Sapchampa swamp at Lopburi Province.

Swamp forests are most damaged by the drainage, landfill, burn, landscaping for oil palm farming and construction of reservoirs. Although 42.7 of the surveyed forests were in very poor status, the rest of them remain a genetic source of many species including fish, shrimp and shell. Local communities make use of the forest for fishing at 33 percent, for water, for planting and for food consecutively.

Agricultural Ecosystem

The data on agricultural land in Thailand from the Office of Agricultural Economics unveils that during 2004-2006 the land was used to grow 6 main crops in agriculture, including, rice, cassava, vegetable, fruit plant, oil palm and rubber tree. In 2006, rice was grown in the area around 57.54 million Rais. Second in number, rubber, cassava, fruit tree, oil palm and vegetable were cultivated in the areas around 14.34, 7.48, 3.31, 2.37 and 0.63 million Rais successively. It was observed that the area of rice paddies tended to be stable. However, rubber plantation showed the extension of the land every year, so did cassava and oil palm. Other plant groups remained unchanged.

At the agricultural ecosystem of Doi Inthanon-Chomthong District, Chaing Mai Province, 77 species of wild plants 13 species of mammals, 32 species of birds, 17 species of reptiles, 12 species of amphibians, 291 species of crops in agriculture (most of which are vegetables, ornamental flowers and fruit plants; almost 100 percent of the crop species have been genetically modified; and the most various species was found with Lichee at 9 species), 6 species of animals in agriculture, 20 species of insect pollinators and 11 species of Benthic animals. Most system is occupied by plantation around farmland or rice field and residential area.

For the agricultural ecosystem of Petchaboon Province-Pisanulok Province, 21 wild plant species, 12 mammal species, 56 bird species, 28 reptile species, 25 amphibian species, 7 agricultural animal species, 180 agricultural plant species, 60 insect pollinator species and 53 Benthic animal species. The plant most vastly found was field corn. A majority of plant species in agriculture have been genetically modified. Mango has most diversified species found at 5 species. The system is mainly by plantation around farmland or rice field and residential area.

The agricultural ecosystem of the riverbank agriculture and Koh Kred, Nonthaburi Province : 66 wild plant species, 58 mammal species, 20 bird species, 58 reptile species, 10 reptile species, 32 insect pollinator species, 20 Benthic animal species, 9 agricultural animal species and 423 species of plants in agriculture. Most widely found is ornamental flower. Durain has the most variety of species at 26 species.

The system is mostly engaged in plantation around farmland or rice field and residential area.

The agricultural ecosystem of Trad Province : 14 wild plant species, 13 mammal species, 88 bird species, 38 reptile species, 21 reptile species, 81 insect pollinator species, 122 Benthic animal species, and 117 species of plants in agriculture. Most of the plants found are rubber tree, fruit plant, pineapple and oil palm. Rubber presents the most various species at 5 species. The system is mostly engaged in plantation around farmland or rice field and residential area.

Plantation system and management: since in Thailand monoculture of economic plants is promoted principally for commerce, management of agricultural lands becomes intensive, including, fertilization for higher productivity and use of pesticide which have immense impact on biodiversity of ecosystems. Furthermore, the monoculture in the high slope area often lacks effective conservation measures for soil and water. The land that is left unattended without crop rotation can cause a bush fire in draught season, such as, field corn areas in the agricultural ecosystem of Petchburi Province and Pisanulok Province.

The shrink of the habitat of local plants and animals due to change in forest ecosystem for agriculture causes the loss of indigenous plant and animal species because their habitats, food sources and sanctuaries have been destroyed and disturbed by human activities which are short of effective management and control.

Increasing continuous growth of urbanization and industrial sectors leads to critical decrease and deterioration of agricultural ecosystem. This is considered an important catalyst for the extinction of local plants and animals.



Mountain Ecosystem

In Thailand, mountains envelope the area of 150,322.45 square kilometers or 93,951,533 Rais, which is equivalent to 29.3 percent of the whole country area. Though the geography of Thailand is filled by a lot of mountains, the mountains are not very high. The forest type in the mountain ecosystem, if found not above 1,000 meters high, is usually not much different from that found in the lower area. This means that the type of forests growing on the mountain below 1,000 meters high can be found in the lower area. Although there are some different components between them, hill evergreen forest is hardly found at the height below 1,000 meters.

In Thailand, there are 15 mountain ranges dispersing throughout the country. Doi Inthanon at 2,580 meters high positioned in the middle of the eastern Thanon Thongchai Mountain Range is the highest peak in Thailand. Hydrography of main basin system incorporates 25 rivers flowing to Mae Kong River, the Gulf of Thailand and the Andaman Sea. It is regarded as one of areas of most abundant biodiversity of the World

because the area is a juncture of dispersal of various plant species, for example, temperate plant species, sub-alpine flora species from China and Himalayan Mountain, tropical plant species from Indo-China region and the northern part of Myanmar and tropical species from Asian Region.

On the high mountains, such as, Doi Inthanon, Doi Suthep-Pui, lower mountain rain forest at around 1,000-1,800 meters high and upper mountain rain forest at around 1,900 – 2,565 meters high can be found. In particular, the upper mountain rain forest has plant communities which are comparatively very vulnerable and fragile as a consequence of deforestation by hill tribes for shifting cultivation, especially, by slash and burn techniques occurred every year in the draught season and pavement of roads on the mountains damaging big trees. The big trees often stand dead in patches due to the said effects.

Ground plants like filmy ferns are rare and thrive only in tropical rain forest or hill evergreen forest where the ambience contains high moist and fog almost all the year round. It easily becomes extinct when the environment is only little afflicted. The fern is mostly found on trunks and twigs of the trees and rocks near the stream in the hill evergreen forest above 2,000 meters high like Doi Inthanon. Devastation of pleasant environment creates hole in the forest resulting in disappearance of this fern and many other ferns, orchids and plants.

Moreover, under the shadow of large trees in upper hill evergreen forest, a rare root parasitic plant or Sapria Himalayana (*Sapria himalayana-Rafflesiaceae*) can be found. This plant residing on the forest ground has no authentic leave and has attractive orange-red color. It usually grows on the root of host plants which can be only 2 types of vines-- *Parthenocissus Himalayana* and *Tetrastigma cruciatum – Vitaceae*. As a parasitic plant, Sapria Himalayan heavily relies on limited host plants in its indigenous natural habitat of hill evergreen forest. Nonetheless, nowadays the forests are invaded and transformed to shifting cultivation lands and for other land development projects, leaving the host plants in limited number. Besides, over-picking of the parasitic plant itself also results in vulnerable status.

Although at the present many conservation areas engulf many vital hill evergreen forest plants which are officially notified as national parks, for instance, Doi Inthanon National Park, Doi Suthep-Pui National Park in Chiang Mai Province, Doi Phu Ka National Park in Nan Province or as wildlife conservation areas, such as, Chaing Dao Wildlife Conservation Area, Chiang Mai Province and Doi Pa Chang Wildlife Conservation Area, Payao Province and Nan Province. Many of them are located in the Watershed Management Areas. Nevertheless, the encroachment in form of shifting cultivation of hill evergreen forests at the height of 1,000-1,800 meters still persists in many areas.



Current Status of National Biodiversity Strategies and Action Plans

Thailand has formulated national biodiversity strategies and action plans (NBSAPs), in accordance with obligations under the Convention on Biological Diversity (CBD), since the year 1994, even though the country has not ratified the Convention at that time. Since the national sub-committee on CBD agreed that the formulation and implementation of national policies, measures and plans on the conservation and sustainable use of biodiversity, 1998-2002 are crucial for the implementation on CBD and the preparation for ratification process.

National Policies, Measures and Plans on the Conservation and Sustainable Utilization of Biodiversity 2008-2012

Thailand has formulated three consecutive NBSAPs, which were entitled “national policies, measures and plans on the conservation and sustainable utilization of biodiversity”: the first NBSAPs covered the period of the year 1998--2002; the second NBSAPs covered the period of the year 2003-2007; and the third and the current NBSAPs covers the period of the year 2008-2012.



The third NBSAPs was formulated based on the 2010 biodiversity target, which was adopted by the WSSD on 2002, and developed policies, strategies and guidelines on implementation regarding the conservation and sustainable use of biodiversity, in

accordance with sustainable development concept, with the intention to achieve the target to significantly reduce the rate of biodiversity loss by the year 2010, and in accordance with CBD Strategic Plan, which was adopted by the Conference of the Parties at its seventh meeting in 2004.

The National Sub-Committee on CBD had considered draft substantive matters on status, obstacles, visions, objectives, overall target, thematic targets/indicators; coordinated, compiled and submitted biodiversity/related plans and projects from various organizations, institutions and departments, to be included in the action plans; and organized brainstorm meeting with relevant experts, organizations, institutions and NGOs. On January 15th, the Cabinet had agreed to the draft national policies, measures and plans, to be used as framework for the country's implementation during five-year period (2008-2012). The above-mentioned policies consist of 5 strategies and 17 action plans, in the total budget of 9,555.93 million Baht (app. 280.627 million USD)

Policy Statement

To conserve and sustainably use biological diversity in Thailand in order to achieve national ecological security and resource base, which are foundation of the country's sustainable development.

Vision

Thailand to become one of the world's leading countries in the field of biodiversity conservation and sustainable utilization, and to achieve significant progress in the study and research regarding biological diversity.

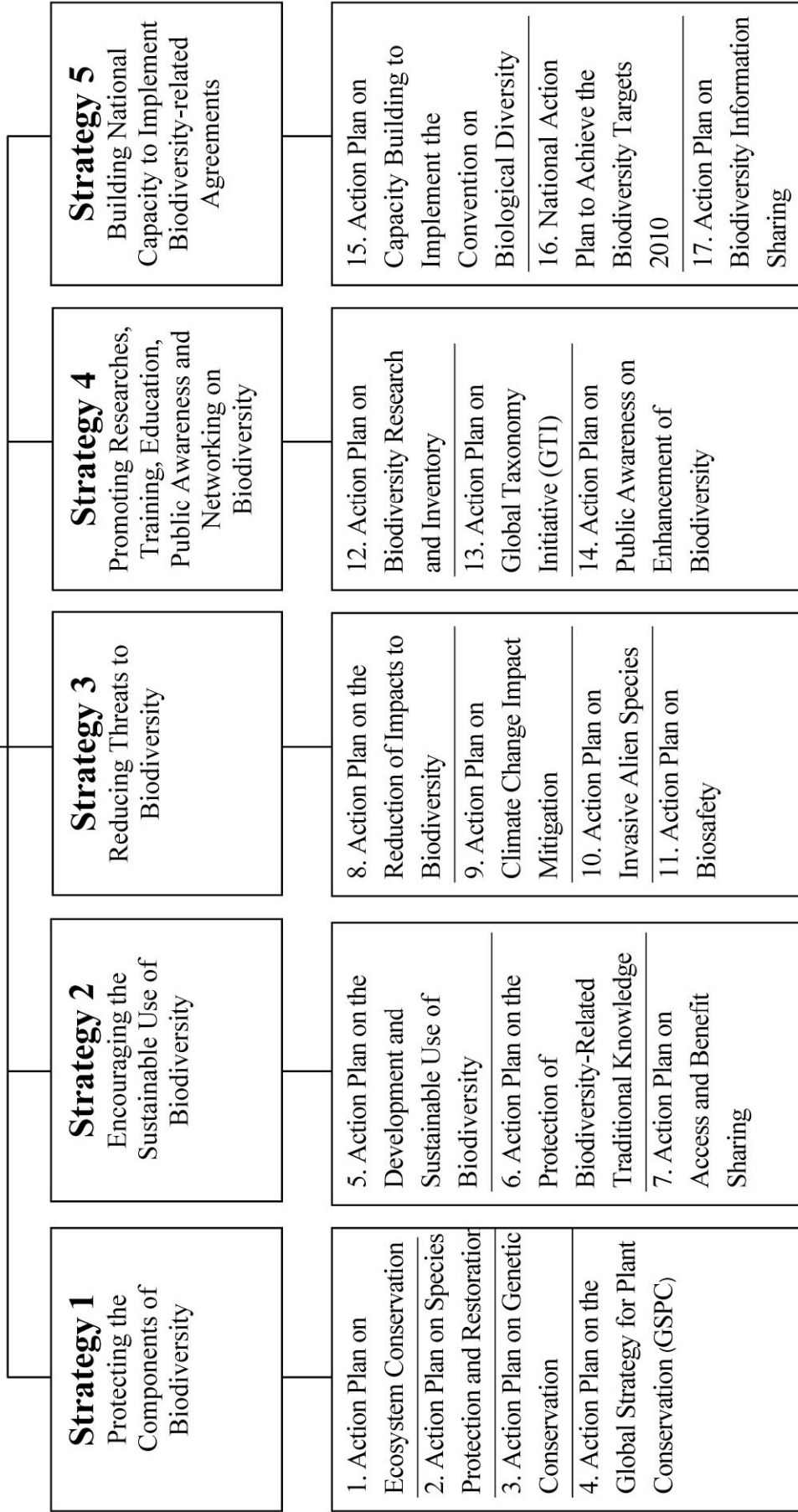
Objectives

To strengthen biodiversity's integrity for ensuring Thai people's livelihood, together with the study and research on the value of biodiversity in order to make economic use in a sustainable manner. And developing mechanisms to facilitate access, and to ensure fair and equitable sharing of benefits arising out of the development of biodiversity in the country.

Overall Target

To significantly reduce biodiversity loss while maintaining various types of ecosystems, species and gene pool and, amongst other things, to sustainably protect all components of biodiversity.

Thailand's National Policies Strategies and Action Plans on the Conservation and Sustainable Use of Biodiversity 2008-2012



Strategy 1 : Protect the Components of Biodiversity

The 2010 target had given first priority to the protection of biodiversity components as the first goal. This strategy had establish first priority to the protection of biodiversity components ; including ecosystems conservation, species and varieties/germplasms conservation and restoration, and the implementation on the Global Strategy for Plant Conservation (GSPC). The main implementing government agencies include the Royal Forest Department; the Department of National Parks, Wildlife and Plants Department; the Department of Marine and Coastal Resources; the Department of Fisheries; the Department of Agriculture; the Department of Livestock Development; and the Rice Department.

Action Plans/Measures	Output	Indicators
<p>ecosystems Conservation</p> <ul style="list-style-type: none"> • Conserving marine and coastal, and island ecosystems • Protecting wetland ecosystems and promoting their sustainable use • Strengthening protected areas systems • Restoring ecosystems to enhance the country's natural integrity • Conserving, protecting and safeguarding forest ecosystems • Conserving and restoring watersheds • Conserving mangrove forests and restoring integrity of aquatic animals 	<p>Biodiversity important areas in the country are effectively protected</p>	<ul style="list-style-type: none"> • Forest areas cover at least 33% of the country's total areas, which at least 18% are conserved forests • At least 20% of marines and coastal areas in Thai waters have been designated as protected areas • At least one site of seagrass beds and dugong habitats has been designated as protected area • At least 5 sites of wetlands of international importance have been designated as Ramsar site • 50,000 Rais (approx. 19,768. Acres) of mangrove forests exists

Action Plans/Measures	Output	Indicators
<p>Species Protection and Restoration</p> <ul style="list-style-type: none"> • Protecting and restoring endemic species and endangered indigenous species • Conserving and restoring rare and endangered species in protected areas • Conserving diversity of plant germplasm, microorganisms, insect and mite pests • Reduce biodiversity loss related to livestock development 	<p>Areas with natural ecosystems will be no longer decreased, and plants/animals diversity has been increased</p>	
<p>Varieties/germplasm Conservation</p> <ul style="list-style-type: none"> • Conserving diversity of plant germplasm, microorganisms, insect and mite pests • Reduce biodiversity loss related to livestock development 	<p>Threatened species have been protected and restored</p>	<p>At least 10 species of endangered/endemic species have increasing population, and have been protected and restored <i>in situ</i>.</p>
<p>Global Strategy for Plant Conservation (GSPC)</p> <ul style="list-style-type: none"> • Implementing the Global Strategy for Plant Conservation 		

Strategy 2 : Encourage Sustainable Use of Biodiversity

This strategy incorporates the Convention's objectives on the sustainable use of biodiversity components, and the fair and equitable sharing of benefits arising from the use of genetic resources, with emphasis on the development of biological use, and incentive measures for conservation and sustainable use of biodiversity, while protecting and maintaining traditional knowledge, and the access and benefit sharing, in accordance with related mechanisms and legal instruments.

Action Plans/Measures	Output	Indicators
<p>Development and Sustainable Use of Biodiversity</p> <ul style="list-style-type: none"> • Promoting the development of biological resources for commercial use • Creating incentives for conservation and sustainable use of biodiversity • Developing forest resources for economic use and alternative energy 	<p>Biological resources have been promoted/restored for further use as raw materials, source of alternative energy, and commercial use</p>	<p>At least 10 biological resources have been promoted/restored for further use as raw materials, source of alternative energy, and commercial use</p>
<p>Preservation of traditional knowledge associated with biodiversity</p> <ul style="list-style-type: none"> • Protecting and preserving traditional knowledge associated with the conservation and sustainable use of biodiversity 	<p>National inventory on traditional knowledge and/or local wisdom related to the conservation and sustainable use of biodiversity</p>	<p>National inventory on traditional knowledge and/or local wisdom related to the conservation and sustainable use of biodiversity completed, by the year 2012</p>

Action Plans/Measures	Output	Indicators
<p>Access and Benefit Sharing</p> <ul style="list-style-type: none"> Facilitating access and fair and equitable sharing of benefits arising out of the use of biological resources 	<p>Mechanism, practical guideline, criteria or regulation to facilitate sustainable use, access and benefit sharing from the use of biodiversity</p>	<p>At least one mechanism, practical guideline, criteria or regulation to facilitate sustainable use, access and benefit sharing from the use of biodiversity</p>

Strategy 3 : Minimize Threats to Biodiversity

This strategy encourages the implementation with focusing on reducing threats to biodiversity, and minimizing impacts on biodiversity, in particular from climate change, as well as measures on biosafety impact mitigation, and regulations on invasive alien species.

Action Plans/Measures	Output	Indicators
<p>Development and Sustainable Use of Biodiversity</p> <p>Reducing ecosystem and natural habitat loss resulting from development projects</p> <ul style="list-style-type: none"> Control and mitigate impacts from tourism to biodiversity <p>Climate change impact mitigation</p> <ul style="list-style-type: none"> Study on the changes in biodiversity components resulting from climate change and develop measures on climate change mitigation 	<p>Instruments/mechanisms and databases on threats to biodiversity and their mitigation</p>	<p>Practical guidelines on biodiversity impact assessment</p> <p>Long-term policy at the national level regarding climate change adaptation and mitigation to biodiversity</p>

<p>Biosafety</p> <ul style="list-style-type: none"> Control and prevent impacts from modern biotechnology to biodiversity 		<p>National Biosafety Framework, which facilitate the use and regulation of LMOs</p>
<p>Invasive Alien Species</p> <ul style="list-style-type: none"> Control and mitigate threats from invasive alien species 		<p>Mechanisms, criteria and regulations to control and mitigate threats from invasive alien species</p>

 **Strategy 4 : Promote Research, Training Education and Public Awareness and Network on Biodiversity**

Action Plans/Measures	Output	Indicators
<p>Research and Inventory of Biodiversity in Thailand</p> <ul style="list-style-type: none"> Develop national policy and guidelines or work plans on biodiversity research Allocate fund for biodiversity research and training Give first priority to biodiversity study and inventory Conduct survey, research and compile data of species at genetic level 	<p>Instruments/mechanisms and databases to promote biodiversity conservation, research and utilization</p>	<ul style="list-style-type: none"> Quantitative guidelines on the effective national biodiversity research Databases on biodiversity research to facilitate biodiversity conservation and sustainable use programmes/projects completed by the year 2010

Action Plans/Measures	Output	Indicators
<p>Global Taxonomy Initiative (GTI)</p> <ul style="list-style-type: none"> Implementing the Global Taxonomy Initiative (GTI) 	<p>Promote research, training, education and awareness to minimize rate of biodiversity loss</p>	<p>At least 2 networks of database on biodiversity and taxonomy</p>
<p>Promote Knowledge and Public awareness on Biodiversity</p> <ul style="list-style-type: none"> Develop and implement formal and/or informal education curriculum to promote learning process and knowledge on biodiversity Create partnership with private business sector to implement ongoing activities in awareness raising campaign and promote their participation in conservation and sustainable use of biodiversity Promote collaboration between government and NGOs in education and awareness campaign on biodiversity to local communities 		<ul style="list-style-type: none"> Formal and/or informal education curriculum to promote learning process and knowledge on biodiversity conservation

Action Plans/Measures	Output	Indicators
<ul style="list-style-type: none"> • Sustainable forest management to facilitate recreational activities and • Allocate fund to support NGOs, local schools and communities in implementing education and awareness campaign on biodiversity • Promote ecosystem assessment to support local communities and NGOs in the conservation and sustainable use planning 		<ul style="list-style-type: none"> • At least 10 projects of awareness raising campaign through various activities and media

 **Strategy 5 : Strengthen National Capacity for Implementing Biodiversity-Related International Agreements**

Action Plans/Measures	Output	Indicators
<p>Capacity Building for the Implementation on CBD</p> <ul style="list-style-type: none"> • Designate biodiversity committee at institutional level to govern /regulate the implementation in accordance with national committee • Promote CBD implementation and synergies between biodiversity –relataed conventions 	<p>Instruments/mechanisms to strengthen national capacity for implementing biodiversity-related international agreements</p>	<p>Committee on biodiversity in all biodiversity-related institutions/organizations</p>
<p>Implementation toward 2010 Target</p> <ul style="list-style-type: none"> • Implement to achieve 2010 biodiversity target 		<p>National report on Thailand’s achievement toward 2010 target</p>
<p>Biodiversity Data and Information Sharing</p> <ul style="list-style-type: none"> • Develop and maintain biodiversity clearing- 		<p>Biodiversity Clearing-House Mechanism</p>

Action Plans/Measures	Output	Indicators
house mechanism (CHM) <ul style="list-style-type: none"> • Develop and maintain biosafety clearing-house (BCH) • Promote technology transfer and cooperation 		(CHM) and Biosafety Clearing-House (BCH) fully operated and linked together



Marine and Coastal Ecosystems Conservation



Strategic plans and action plans on coral reefs management

Department of Marine and Coastal Resources has drafted the strategic and action plans on coral reefs management, with has vision to conserve, restore and enhance coral reefs, in order to facilitate sustainable use under well-balanced ecosystems, economy and society, by organizations and institutions with full participation of local community.

The overall target of the strategic plan is to have 96,000 rais (approx. 38,000 acres) of coral reefs effectively managed within 5 years period, with community's participation in good governance and integrated manner. The Strategic plans and action plans consists of 6 strategies and 19 workplans including 96 projects/activities, as follows:

Strategy 1 : Managing coral reefs according to their ecological and economic value (including 2 workplans on improving zoning and usage criteria of coral reefs, and their application)

Strategy 2 : Minimizing coral reefs degradation, through the efficiency improvement of the management process and the application of appropriate technologies (including 6 workplans)

Strategy 3 : Encouraging public participation in the protection and restoration of coral reefs, through the awareness raising campaign on value of coral reef resources (including 3 workplans)

Strategy 4 : Improving legislation, regulations and organizations to be used as framework for effective management of coral reefs (including 4 workplans)

Strategy 5 : Ongoing monitoring of coral reefs nationally (including 1 workplan)

Strategy 6 : Ongoing researches to develop technology for protection of coral reefs (including 3 workplans)

Strategic plans and action plans on seagrass and dugong habitat management

The overall target of the strategic plans and action plans is to have 93,000 rais (approx. 36,770 acres) of seagrass bed ecosystems and dugong habitats effectively protected and restored within 5 years period, with community's participation and fair and equitable utilization of natural resources. The Strategic plans and action plans consists of 6 strategies and 14 workplans including 48 projects/activities, as follows

Strategy 1 : Encouraging integrated research and monitoring of changes in seagrass bed ecosystems (including 3 workplans)

Strategy 2 : Promoting social/local network to improve efficiency of seagrass bed management (including 2 workplans)

Strategy 3 : Developing mechanism and improving environmental quality and efficiency of seagrass bed conservation (including 3 workplans)

Strategy 4 : Educating and awareness raising on seagrass bed conservation (including 2 workplans)

Strategy 5 : Conserving and restoring seagrass bed ecosystems and aquatic animals living in such habitats (including 2 workplans)

Strategy 6 : Encouraging and promoting alternative jobs and sources of income for related communities (including 2 workplans)

Mangrove Forest Reforestation for HRH the Queen Project

The Mangrove Forest Reforestation Campaign in Commemoration of HRH Queen Sirikit 72th Birthday Project comprises of 13 activities, and had been implemented between 2004-2008 including:

- Target areas for reforestation, with the total areas of 513,352 rais (approx. 202,963 acres), covering mangrove forests in 23 coastal provinces
- Public awareness campaign through various medias
- Fund-raising campaign for reforestation and public participation
- Reforestation in priority areas for the total areas of 19,940 rais (approx. 7,884 acres) between 2004-2007

- Maintenance and replenishment activities between 2005-2010
- Restoration activities for the total areas of 156,778 rais (approx. 61,985 acres) between 2004-2007
- Aquatic animals protected areas zoning for the total areas of 336,634 rais (approx. 133,095 acres) between 2004-2006
- Activities to safeguard and preserve mangrove forests and aquatic animals, by local villagers and communities for the total areas of 300,000 rais (approx. 118,610 acres)
- Activities to promote sustainable management of mangrove forests, with community's participation, implemented in 200 villages between 2004-2006
- Activities to breed and release 2,000,000 aquatic animals in every provinces with mangrove forests
- Activities to develop and implant artificial corals, by local administrative authorities, for 10 sites in 2004 and 30 sites in 2005, and 10 sites annually since then
- Monitoring, reporting and evaluating of activities, implemented by Department of Marine and Coastal Resources



Participatory Sustainable Wetland Management Project

The Department of Marine and Coastal Resources has implemented the participatory sustainable management project, since 2004, in five pilot sites, as follows:

- Mangrove forests at Bang Taboon Estuary in Phetchaburi, Samut Sakhon and Samut Songkram Province
- Mangrove Forests at Welu Estuary, Chantaburi and Trat Province
- Mangrove Forests at Ban Don Gulf, Surat Thani Province
- Mangrove Forests at Phang-Nga and Krabi Province
- Mangrove Forests at Pa-lian Basin, Trang Province

The Project has particular focus on cooperative activities between government officials and local communities. The project activities include : natural resources inventories and database development ; demonstration of mangrove forest management in cooperation with communities ; and establishment of “Mangrove Forest Study Center” to promote and disseminate knowledge and information on mangrove forest resources and their usage.

Activities and projects in fiscal year of 2007 include :

- Resources inventories and database : including field study and survey on environmental and social science ; application of geographic information system ; systematic data analysis and linkage to communities' livelihood, etc.
- Researches and management demonstration : including studies, demonstration and data collection ; activities regarding mangrove forest usage, demonstration sites for mangrove forest management ; and data dissemination to the other regions of the country.
- Promotion and development campaign to promote ecotourism in mangrove forests through : training, seminar, herbarium plantation establishment ; Mangrove Forest Study Center and Nature Trails ; and collaborative study and research with local communities.
- Activities to promote and develop mangrove forests usage : including study tour ; exchange of information and experiences between communities ; provision of forums and career opportunities for indigenous and local communities.
- Activities to promote and strengthen networks and community-base groups : including villagers' network to safeguard mangrove forests ; and site-based operational work plan.
- Mangrove forest study center, which will contribute a lot to the promotion and development of ecotourism in the areas, and linked to the other tourist attractions in Chantaburi Province

Marine Turtles Nursery and Breeding Project

The marine turtles nursery and breeding project, which aims to restore their population in the wild, is one of the key measures for marine turtles conservation. In this project, the turtles were raised in breeding ponds until entering maturity and can avoid their natural enemies, then they will be released to the sea, in cooperation with local communities, private sectors and the public, in order to raise awareness on marine turtles conservation among the youth and the public

In the fiscal year of 2007, the Marine and Coastal Resources and Mangrove Forests Research and Development Institute had bred 580 baby green turtles, 104 baby leatherback turtles, and 93 baby olive ridley turtles, and periodically released the grow-up turtles to the sea, from December 2006 to April 2007

At the east coast of Gulf of Thailand, marine turtles were bred at Munnai Island, Rayong Province. Furthermore, projects related to the breeding and reproduction of marine turtles include :

- Project to evaluate efficiency of reproductive system of marine turtles bred in Phuket Marine and Coastal Resources Institute
- Project on electroejaculation of marine turtle semen
- Project on the study of heavy metal level in blood and its relation to Corticosteroid and Sex steroid to indicate risks of reproduction in dolphins, dugongs and marine turtles.

The Eleventh Ramsar Site in Thailand

Thailand became a Contracting Party to the Ramsar Convention since 13 September 1998, with Khuan Khi Sian Peat Swamp in Thale Noi Wildlife Non-hunting Area, Phattalung Province designated as the first Ramsar site of the country. At present, Thailand has 11 Ramsar sites, with wetlands of Khao Sam Roi Yot National Park in Prachuab Khirikhan Province, as the latest and eleventh Ramsar site. On 14 January, 2008, the Ramsar Secretariat had agreed to designate Khao Sam Roi Yot wetlands as Ramsar site number 1734 in List of Wetlands of International Importance

Khao Sam Roi Yot wetlands has an approximately total areas of 68.92 sq.km. The two key ecosystems here are the natural fresh water swamp, and coastal wetland in the neighbouring area of Karst Tanaosri mountain the run north-south. The freshwater swamp is one of the most significant refuges of migratory birds in Asia. In 2007, 110 species of birds have been recorded, 82 species of resident birds, 27 species of migratory birds, one of the migrated bird come for breeding, the remainder are temporary visitors. Six endangered species of birds in the list of Thailand's Red Data 2005 found here are Malaysian Plover (EN), River Lapwing, Purple Heron (VU), White-bellied Sea-eagle, Little Tern, Baya Weaver (NT). Mammals include *Capricornis sumatraensis* (VU), *Macaca leonina*, *Prionailurus viverrinus* (VU). Approximate 150 species of aquatic plants were found include *Azadirachta xylocarpa* (EN), *Wrightia lanceolata* and *Burretiodendron esquirdii* (VU). The Biodiversity Division, under the Office of Natural Resources and Environmental Policy and Planning (ONEP), has cooperate with the Wildlife Fund Thailand in promoting and raising awareness among local communities and the public on the importance and value of Sam Roi Yot wetlands, since 2002. The outcome from ongoing efforts includes : the establishment of Sam Roi Yot Conversation Group ; network of schools in adjacent areas of the wetlands, which has formulated curriculum and learning courses with wetlands being used as “nature classroom” ; increased understanding of local villagers and all relevant stakeholders on value of wetland ecosystems ; and “World Wetlands Day” to be held at Sam Roi Yot as the annual celebration.

Wetlands proposed as new Wetlands of International Importance (Ramsar sites) are :

Eleven Key Ramsar sites

Presently, Thailand has 11 Ramsar sites, with another 4 sites that are actively being developed for designation as additional Ramsar sites

- Khuan Khi Sian Peat Swamp, Thale Noi Wildlife Non-hunting Area, Phattalung Province (the first Ramsar site in Thailand)
- Wetlands of Bung Khong Long Wildlife Non-hunting Area, Nong Khai Province
- Don Hoi Lot Wetlands, Samut Songkram province
- Wetlands of Krabi River Estuary, Krabi Province
- Wetlands of Nong Bong Kai Wildlife Non-hunting Area, Chiang Rai Province
- Wetlands of Princess Sirindhorn Wildlife Sanctuary (Phru To Daeng Peat Swamp Forest), Narathiwat Province
- Wetlands of Had Chao Mai National Park – Libong Islands Wildlife Non-hunting Area – Trang River Estuary, Trang Province
- Wetlands of Laem Son National Park – Kapoe Estuary – Kra Buri River Estuary, Ranong Province
- Wetlands of Ang Thong Islands National Park, Surat Thani Province
- Wetlands of Phang Nga Bay National Park, Phang Nga Province
- Wetlands of Khao Sam Roi Yot National Park, Prachuab Khirikhan Province

- Bung Boraphet Wetlands, Nakhon Sawan Province, as recommendation from the National Human Rights Committee
- Kudthing Wetlands, Nong Khai Province, as proposed by villagers of Bung Kan, Nong Khai Province
- Wetlands of Ra Island and Prathong Island, Phang Nga Province, as proposed by The Department of Marine and Coastal Resources
- Wetlands of Kra Island, Nakhon Si Thammarat Province, as proposed by The Department of Marine and Coastal Resources
- Wetlands of Kwan Phayao, Phaoyao Province, as proposed by the National Economic and Social Development Board



Varieties and Germplasms Conservation



Rice Seed Production Technology

At present, Thailand has areas of rice fields for the total areas of , and the demand for good quality rice seed with high germination rate (more than 80%) and Blast Disease resistant, is still increasing, The National Center for Genetic Engineering and Biotechnology (BIOTEC) has corporated with Ratchamangkala University of Technology, Lampang Campus, and the Department of Agriculture, in implementing the Project on Rice Seed Production Technology Transfer, with full participation of farmers in Sri Prachan District, Suphan Buri Province. “Kaew Kaset”, fragrance rice with high resistant to Blast Disease were used in the Project.

The outcome of the Project was satisfactory: 10 farmer families with rice fields for the total areas of 17 rais (approx. 6.7 acres) have good-quality rice with high yields to consume and trade at reasonable price, with the products of 13,000 kg. between the year 2006/2007 (average yield of 770 kg. per rais) and provide good opportunity for community-based rice seed business.



Germplasms Management and Varietal Improvement of Hot Chili

In the production year 2006/2007, Thailand has chilli plantation for the total areas of 474,717 rais (approx. 187,688 acres). Chilli is one of the most commonly used spices and ingredients in Thai Food, and five most important chilli species in the country are Small Bird Chilli, Large Bird Chilli, Paprika, (Garden Pepper), Bell pepper and Spur Pepper, with the northeastern eastern region is the major production areas. Data from Custom Department has shown that in 2006, Thailand has exported chilli and its products including dried chilli, chilli paste, and chilli powder which has created total income of 2,161 million Baht (approx. 63.3176 million USD), and the export of chilli seed has created total income of more than 181 million Baht (approx. 5.32 million USD).



Beside its main purpose for food production, “capsaicinoids” or the “hot substance” in chilli, also has many valuable medicinal properties, such as ability to kill some bacteria in stomach and cure Sinus. Each species of chilli/pepper has distinctive level of hotness, that is universally measured in Scoville Heat Units (SHU), Thailand Bird Chilli is one of the world’s hottest chilli, with SHU between 100,000-350,000. In addition, the electronic and electric industry has used chilli products in preventing wires and optic fibers from rodents.

In 2006, The National Center for Genetic Engineering and Biotechnology (BIOTEC) has corporated with Khon Khaen University, Ubon Ratchthani University, Ratchamongkol University of Technology Lanna Nan Campus, Phichit Horticulture Research Center, and Sri Saket Horticulture Research Center, in implementing the project on the management and improvement of hot chilli varieties. Presently, the project has compiled 752 species of hot chilli from various sources around the world, which has the hotness level from 50 to 500,000 SHU, and has completed identified 190 species. Then germplasms of selected 11 hot chilli species were improved and transferred to 5 government agencies and 19 private companies in 2007.



Biodiversity Data and Information Sharing



Clearing-house mechanism (CHM)

The ONEP has developed the Clearing-house mechanism (CHM) and the Biosafety Clearing-house (BCH) since 2005, through website <http://chm-thai.onep.go.th> and <http://bch-thai.onep.go.th>, which can be linked to the sources of information at the national and international level, and related implementing agencies, including Department of Livestock Development, Royal Forest Department, and Department of National Parks, Wildlife and Plants Department.

In 2008 and 2009, the ONEP has requested relevant organizations, academic institutions, and local implementing agencies to cooperate in the development of CHM at the institutional level, in mutually agreed format and types of data to be disseminated and shared through the CHM web page.

The biosafety clearing-house (BCH) has information on national biosafety framework, and the ONEP also provides training on the compilation and management of biosafety data and information for related organizations, to further develop corporation networks among relevant organizations and academic institutions, with financial support from GEF and UNDP for some parts of implementation.

Global Taxonomy Initiative (GTI)

Since 1995, the ONEP, as the national focal point for the Global Taxonomy Initiative (GTI), has corporated with taxonomists and experts from relevant institutions in compiling, documenting and publishing a series of 17 checklist books named “Biodiversity Series”, which has names and some information of important taxa in Thailand, such as forest insects, algae, bryophytes, crustaceans, mammals, amphibians and reptiles, pteridophytes and orchids.

In 2007, the ONEP had organized the meeting to evaluate the progress of implementation and taxonomic needs in Thailand, and had concluded that Thailand still lack of financial support and human resources in the taxonomic works, and capacity building for related personnels is also needed. Furthermore, taxonomic researches were not systematically compatible and did not respond to national policies, and lack of specialized taxonomists networks.

In the same year, the ONEP had held a brainstorm meeting with taxonomists to update the checklist of crustacean fauna in Thailand. Then in 2008, the ONEP has coordinated in the compilation and publication of mollusks in Thailand. And in 2009 the ONEP has conducted the process of the brainstorm to compile and develop checklists of fungi, algae and insects in Thailand, in order to enable the identification and development of Red Data and measures for the conservation and protection of Red Data species, by the year 2010.

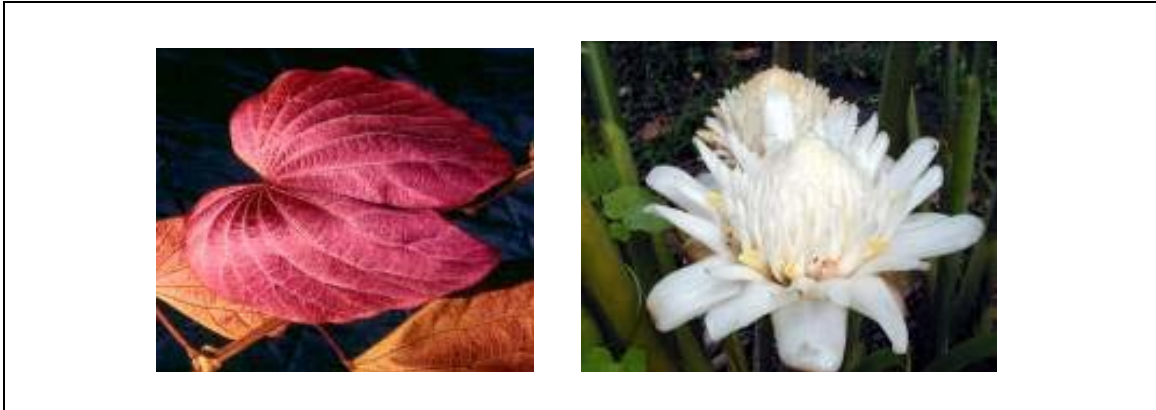


The Development and Sustainable Use of Biodiversity

Biotechnology for Development in the Southern Border Areas : “Development of Career and Livelihoods of Communities nearby Hala Bala Peatswamp Forests”

The National Center for Genetic Engineering and Biotechnology (BIOTEC) has corporated with the Department of National Parks, Wildlife and Plant Conservation in implementing the Project on the Inventory and Collection of Flowering and Ornamental Plants in the Forests of Southern Region, and established the “Cooperative Natural Research Center” at Hala Bala Peatswamp Forest, Narathiw Province, to facilitate researches and networks among all related organizations and networks, including Hala Bala Forest Fauna Research Station, the Project on the Inventory and Collection of Flowering and Ornamental Plants in the Forests of Southern Region, Sirindhorn Peatswamp Forest Research Center, relevant universities, and local communities networks such as “Bala Forest Conservation Group” “Friends of

Peatswamp” and “Hornbill Conservation Group” which consist of schools in the neighboring areas. The main purpose of the project is to facilitate sustainable development in the areas based on scientifically and technology sound study and researches.



The outcomes of the project include valuable knowledge and information which can be applied to other sectors such as agriculture and public health, and in particular, can create job opportunities and incomes for local communities, from the sustainable use of biological resources. One of the major products were plantations of medicinal herbs, food plants and flowering plants such as Torch Ginger, through the establishment of tissue culture laboratories, and provide training for relevant staffs and communities. At present, there has three large Torch Ginger plantations and small plantations scattered in rubber plantations and orchards at Ban Bala and Ban Jae Deng District, Narathiwat Province. The price of Torch Ginger flowers has been increased to 3-5 Baht per piece. The flowers of Torch Ginger and *Zingiber zerumbet* (L.) Smith have also been exported to Japan, with the demand of 100 flowers per week. Local communities have learned post-harvest technology to preserve the flower for longer period, the selection method to get the best quality flower, and develop genetic base and researches on varietal improvement. Furthermore, *Boesenbergia* sp., the new species of the world, were found. It is the fragrance plant species that has many medicinal properties, including for relieving fever, and has been used in making herbal tea.



Diversity of Insect Fungus in Thailand

Group of researchers from the National Center for Genetic Engineering and Biotechnology (BIOTEC) has implemented and supported Projects related to insect fungus including:

- Study on diversity of insect fungus in Thailand, which more than 400 species of insect fungus were found, combining with the ongoing researches and studies on insect fungus, these make Thailand has one of the most comprehensive collections of insect fungus in the world.
- The extraction of fungus and examine its chemical properties, in order to develop medicines, especially for curing tuberculosis and malaria
- BIOTEC has support Kasetsart University in the study on the use of insect fungus in producing nematode pesticides to eliminate invading nematodes in potato farms and flowering plants, and further studies on using insect fungus to eradicate pests of vegetables and asparagus.
- The successful outcome from the above-mentioned studies has been widely published through international science journals and websites. In addition, information and specimen of insect fungus from Thailand had been displayed at the Japanese National Museum of Emerging Science and Innovation in June, 2007. Further information on insect fungus in Thailand can be reached at <http://biotec.or.th>





Action Plan on Biosafety



Draft Act on Biosafety Concerning Modern Biotechnology

The Cabinet Resolution on 10 August, 2004, which agreed upon the accession to Cartagena Protocol on Biosafety, and Resolution on 31 August, 2004 to formulate laws and regulations on biosafety, to be completed before the use of genetically modified organisms (GMOs), both in testing grounds and commercial use. In response to the above-mentioned resolutions, the formulation of Draft Act on Biosafety concerning Modern Biotechnology has been implemented, to have domestic law to regulate the safe use of biotechnology, in accordance with international standards and procedures. Then, Thailand had acceded and became a Party to Cartagena Protocol on Biosafety since 8 February, 2006.

In formulating the Draft Act, the ONEP had implemented through the Drafting Working Group and the Drafting Committee since 2005, including brainstorm meetings with all relevant stakeholders, such as food processing industry, agriculture and consumer associations, foundations, researchers, social workers and legal experts. The final draft of the Act had been developed based on public hearing from all related government organizations, farmers, the press and the public. At present, the Draft Act had been agreed upon by the National Sub-Committee on Cartagena Protocol, National Committee on the Conservation and Sustainable Utilization of Biodiversity and the Cabinet, respectively, and have been in the consideration and interpretation process by the Council of State.

The Draft Act on Biosafety Concerning Modern Biotechnology comprises of 9 Chapters and 109 Articles, with provisions on regulations and control of genetically modified organisms (GMOs) , and the safe use of GMOs in every steps including the export, import, transit, researches in the lab and field test, handling, packaging and identification of GMOs. The Draft Act also has provisions on the contingency plans for unintentional release of GMOs, liability and redress, and sanctions, in order to reduce risks from the use of GMOs to the environment and human health, in accordance to the precautionary principle.



Action Plan on Access and Benefit Sharing



Draft Regulation on Criteria, Method and Terms for Access and Benefit sharing from Biological Resources

Since the Plant Protection Act (1999) is the only legal instrument that provides for benefit sharing from the use of biological resources in Thailand, and in many cases, relevant communities, government organizations do not gain benefits from such resources, the ONEP had formulated Draft Regulation of National Committee on the Conservation and Sustainable Utilization of Biodiversity on Criteria, Method and Terms for Access and Benefit sharing from Biological Resources, and had brainstorm meetings to

The Draft Regulation comprises of three parts: first establishes criteria for access to biological resources; the second part provides for terms, exemptions, timeframes, times of permissions and arrangements on access to biological resources; the third part provides for procedures in giving rights and benefits to local communities related to biological resources. The Draft Regulation also contains appendix on required documents, to provide standard practical guidelines for permission and negotiation regarding access and benefit sharing of biological resources in Thailand.



Action Plan on Invasive Alien Species



Draft Measures on the Prevention, Control and Eradication of Invasive Alien Species

In 2005-2006, the ONEP had cooperated with the Working Group on Alien Species in the compilation and updating information of alien species, in coordination with relevant government organizations, academic institutions, NGOs and traders of pets and ornamental plants. The outcome indicated that there are currently approximately 3,500 species of alien species in Thailand, with some species have well established and distributed in the wild, and became invasive species threaten other organisms, ecosystems and biodiversity, and caused significant economic loss. The important invasive alien species in Thailand include giant sensitive plant (*Mimosa pigra*), Janitor Fish (*Pterygoplichthys* spp.), Mexican sunflower (*Tithonia diversifolia* (Hemsl) A.Gray), and golden apple snail (*Pomacea canaliculata*).

The ONEP and the Working Group on Alien Species had developed Draft Measures on the Prevention, Control and Eradication of Invasive Alien Species, and the List of Alien Species to be Protected, Controlled and Eradicated in Thailand. The

Working Group on Alien Species had held brainstorm meetings with relevant experts, taxonomists, researchers, organizations and academic institutions to improved the above-mentioned Draft Measures and List, then the National Committee on the Conservation and Sustainable Utilization of Biodiversity has agreed upon the principles of the Draft Measures on 26 December 2007, and are in the preparation process for the consideration and approval from the Cabinet.

The Draft Measures on the Prevention, Control and Eradication of Invasive Alien Species comprise of 4 operative measures on the following issues

- Measures on the management of alien species
- Measures on the prevention and monitoring of alien species
- Measures on the promotion of studies and researches regarding alien species
- Measures on the education, communication and public awareness on alien species issues



Action Plan on Biodiversity Researches and Inventories



Biodiversity Data and Inventory

Thailand has been endowed with rich and diverse biodiversity in its various tropical ecosystems. Unfortunately, the country has faced threats from natural habitats loss, overexploitation, including lack of public concerns and inconsistent/non-systematic researches and studies on biodiversity. In order to solve the above-mentioned problems and to facilitate the achievement of 2010 target, the ONEP has cooperated with Kasetsart University in conducting survey and inventory of Biodiversity Important Areas (BIA) and Biodiversity Hotspots in Thailand, based on seven thematic ecosystems in the CBD Programmes of Work, and with particular emphasis on species listed in Thailand Red Data, and endemic species. The selected areas, according to thematic ecosystems, are as follows:

- *Forest Ecosystems* : Doi Inthanon Forest Complex, Chiang Mai Province
- *Mountain Ecosystems* : Phu Luang, Loei Province
- *Dry and Sub-humid Land Ecosystems* : Pha Taem, Ubon Ratchthani Province and Phu Pha Terb, Mookdaharn Province
- *Inland Water Ecosystems* : Mae Ping River Basin

- *Marine and Coastal Ecosystems* : Kuraburi coastal areas, Surin Islands, Phang Nga Province; and Ang Thong Islands, Surat Thani Province
- *Island Ecosystems* : Surin Islands, Phang Nga Province; and Ang Thong Islands, Surat Thani Province
- *Agricultural Ecosystems* : Riverside Garden, Koh Kred, Nonthaburi Province; and Highland Agricultural Areas, Doi Inthanon-Chomthong, Chiang Mai Province

In 2006 The BIA and Hotspot Project had been implemented in Phitsanuloke and Phetchaboon Province, at five thematic ecosystems: mountain ecosystems (Phu Soidao range and adjacent forests); forest ecosystems (Phu Hin Rong Kla range and adjacent forests); dry and sub-humid ecosystems (Thung Salang Luang and adjacent areas); agricultural ecosystems (Khao Kho and Nam Nao District, Phetchaboon Province); and inland water ecosystems (all of the above-mentioned areas)

In 2007 The BIA and Hotspot Project had been implemented in Phetchaburi and Prachuab Khirikhan Province, at four thematic ecosystems: marine and coastal ecosystems (coastal areas in Phetchaburi and Prachuab Khirikhan and Talu Islands); island ecosystems (Talu Island, Singha Island and Sungha Island); Agricultural ecosystems (Agricultural areas in Phetchaburi and Prachuab Khirikhan); and inland water ecosystems (inland waters in Phetchaburi and Prachuab Khirikhan)

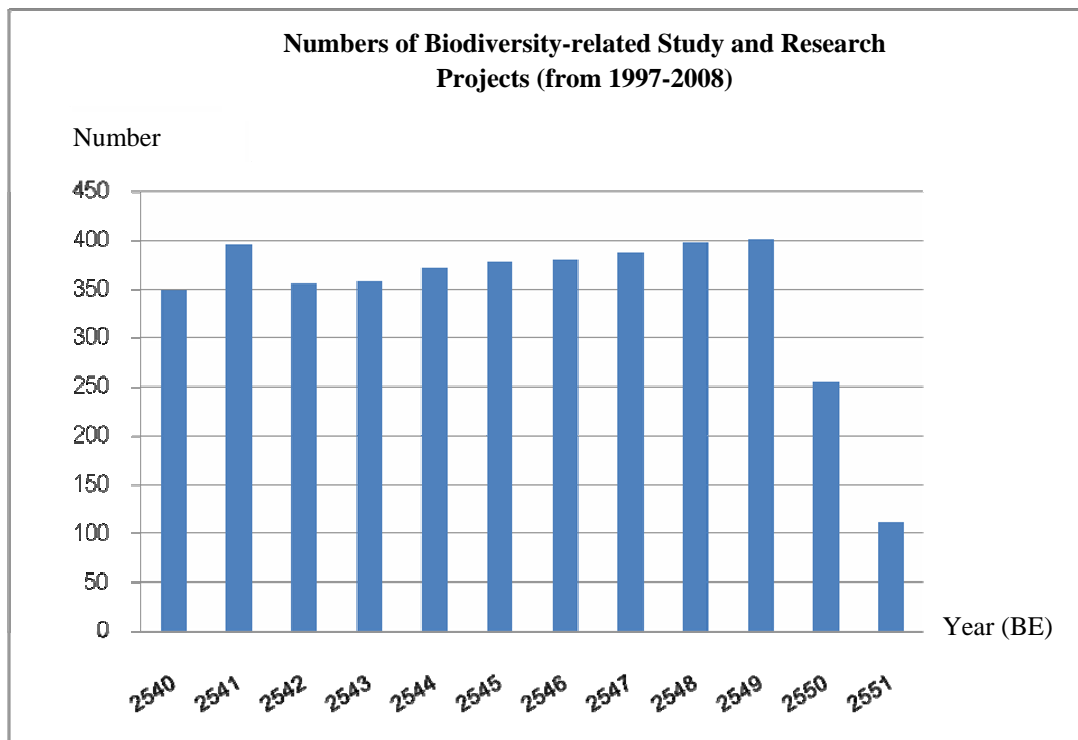
In 2008 The BIA and Hotspot Project had been implemented in Chum Phon and Surat Thani Province, at four thematic ecosystems: marine and coastal ecosystems (Thung Kha-Sawi Bay, Chum Phon Province, and Surat Thani Estuarine, Surat Thani); island ecosystems (Tao, Samui, Taen and Phangan Island, Surat Thani); agricultural ecosystems (agricultural areas in Ta Sae, Sawi and Lung Suan District, Chum Phon, and Chaiya, Phun Phin and Nasarn District, Surat Thani); and inland water ecosystems (Khlung Ta Tapao River Basin, Chum Phon, and Tapi River Basin, Surat Thani)

Further information and outcome of the BIA and Hotspot Project available at the website <http://chm-thai.onep.go.th>



Biodiversity Research in Thailand

The National Research Council of Thailand had compiled data on biodiversity studies and researches from relevant academic institutions and organizations, and concluded the amount of study and research projects between the year 1997 (2540) and 2008 (2551) in the following table



number of study and research projects between the year 1997 (2540) and 2008 (2551)

Biodiversity Research and Training Program (BRT)

The Thailand Research Fund (TRF) and BIOTEC has financially supported the researches under the Biodiversity Research and Training Program (BRT) project since 1996. During the year 2006-2008, 261 researches projects had been supported for the total budget of 83.1 million baht, 139 graduate thesis projects for the total budget of 22 million baht, 58 training programmes for the total budget of 3.8 million baht, 82 public relations and data management projects for the total budget of 20.4 million baht. Information and outcome of 257 projects were published in scientific journals (224 international journals and 33 domestic journals), and 53 new species of the world were found and identified under BRT projects

Examples of the BRT projects include Khao-Nan Clouded Forests Research Project, publications on various biodiversity-related topics, such as “Land Snails in Khao-Nan National Park”, “Newly Found Flora of Thailand”, and Thong Pha Phoom Biodiversity Series, were published and widely disseminated to the public. In addition, BRT project had cooperated with Petroleum Authority of Thailand [PTT] Group, in organizing the exhibition of “Dinosaur Expo: T.REX vs Dinosaurs in Thailand”, with full cooperation from Field Museum, Chicago, USA in renting Tyranosaurus Rex fossils

for show with dinosaurs fossils discovered in Thailand during July-September 2007 at the National Science Museum.



Action Plan on Education and Public Awareness



Mobile Exhibition on Biodiversity

The Science Center for Education, under Ministry of Education has implemented the Mobile Exhibition on Biodiversity Project to educate and raise awareness on the importance of biodiversity to the public, especially students and the youth in Bangkok and throughout the country since 2007. From July 2007-December 2008, the mobile exhibition on biodiversity had been shown in 9 provinces (10 districts) with more than 27,000 people participated in the exhibition



Science and Technology for the Public Center

The Science and Technology for the Public Center, under the National Science and Technology Development Agency (NSTDA), have implemented projects and campaigns to mainstream and raise awareness on biodiversity through various activities and medias, including technology transfer to students and interested persons in a number of provinces, including Sakon Nakhon, Ubon Ratchthani, Surin, Nakhon Ratchsima, Khon Kaen, Loei, Tak, Nara Thiwas, Phang Nga, Chiang Mai and Nan. Research and Development activities implemented includes:

- Learning process with local communities on the conservation and control of alates
- The conservation and sustainable management of forest nearby the rice fields in the pilot sites at Tambon Chumsaeng, Chom Phra District, Surin Province, including the study on cultural aspects, beliefs and livelihoods of local communities in which related to biodiversity and genetic diversity
- The conservation and sustainable management of endemic mushroom species, including the study and compilation of knowledge and information on the conservation and sustainable management of endemic mushrooms, focusing on participatory actions and application of traditional knowledge to integrated self-sufficiency management system in Bang Daeng Mor District, Ubon Ratchthani Province

- Local wisdom related to Organic Agriculture, including the compilation of communities' knowledge on organic agriculture for self-sufficiency economy, with particular emphasis on rice growing, planting salacca trees along with organic fruits and vegetables, in cooperation with local farmers and using methods that do not have negative impact on agricultural ecosystems
- Seminars and Trainings on the sustainable use of various organism, including the use of endemic earthworms to produce organic fertilizers, the compilation of sesame species for using in food and cosmetic industry
- Youth Camps for students, including Youth Camp for Endemic Mushroom Conservation, and Youth Camp in Forest Nearby the Rice Fields
- Medias and Publications related to biodiversity, including E-learning on earthworm usage, natural indigo dye product, and the TV show “Scientist and Villagers”





New and Emerging Issues

Action Plan on the Prevention and Control on the Avian Flu

In January 2004, highly pathogenic avian influenza (HPAI) virus of the H5N1 subtype was first confirmed in poultry and humans in Thailand, at Bang Pla Ma, Suphan Buri Province. Control measures, e.g., culling poultry flocks, restricting poultry movement, and improving hygiene, were implemented. Poultry populations in 1,417 villages in 60 of 76 provinces were affected in 2004. A total of 83% of infected flocks confirmed by laboratories were backyard chickens (56%) or ducks (27%). Outbreaks were concentrated in the Central, the southern part of the Northern, and Eastern Regions of Thailand, which are wetlands, water reservoirs, and dense poultry areas. More than 62 million birds were either killed by HPAI viruses or culled. H5N1 virus from poultry caused 17 human cases and 12 deaths in Thailand; a number of domestic cats, captive tigers, and leopards also died of the H5N1 virus. The Department of National Parks, Wildlife and Plants Department had surveyed and collected specimen of birds and poultry between 2004-2006, and established mobile Unit to test and monitor birds and poultry in the captive breeding in 2008. Furthermore, the Depart has produced various types of medias and publications, including brochures, booklets, posters, stickers, handbook on practices regarding avian flu pandemic preparadness. News and information on avian flu were publicized through radio spots, documentary TV Show, and training for relative staffs in studying flyway of significant migratory birds (1,156 birds were tagged for further tracking) to map their population and distribution in the GIS.



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ANNEX I

Global Strategy for Plant Conservation

Although in the past Thailand did not have a national policy and working plan for directing organizational missions in compliance with 16 targets of the Global Strategy for Plant Conservation (GSPC), plant conservation activities conducted in Thailand in the past has revealed practical guidelines similar to and congruent with the Global Strategy for Plant Conservation. Furthermore, other relevant initiatives have recently been operated by the cooperation among all pertinent agencies of which key roles involve plant conservation in pursuance of the GSPC's targets, for instance, Target 2 and Target 5.



Understanding and documenting plant diversity:



Targets 1 : A widely accessible working list of known plant species, as a step towards a complete world flora

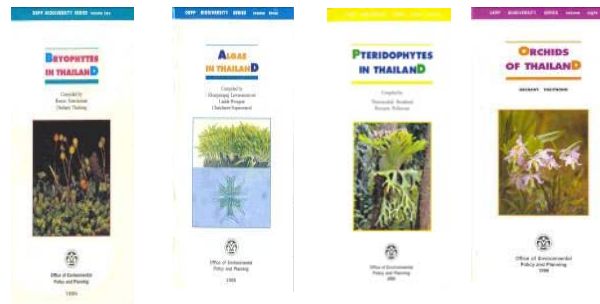
➤ The Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation (DNP) has been a leading agency in studies of national plant taxonomy under the project 'Flora of Thailand' from 1967 until now. The progress of the 'Flora of Thailand' project was assessed at 60 percent. (*For example, the book of 'Flora of Thailand'*)

- Research on 185 family, 4,410 species was completed (44% of vascular plant in Thailand)
- Publication on Flora of Thailand Covers 177 family
 - Fern (Pteridophytes) 35 family, 133 สกุล 659 species
 - พืชเมล็ดเปลือย (Gymnospermae) 6 family, 7 สกุล 25 species
 - พืชดอก (Angiospermae) 136 family
- วงศ์ที่ดำเนินการวิจัยเสร็จไปแล้วร้อยละ 50 - 80 1,597 species



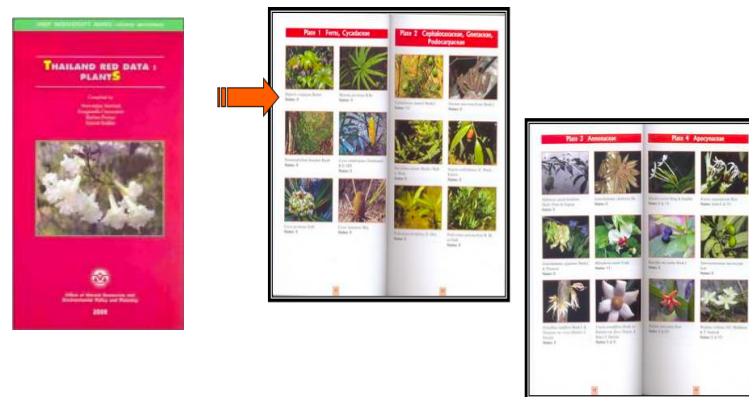
The book of 'flora of Thailand' (9 volumes 28 parts)

➤ Office of Natural Resources and Environmental Policy and Planning has made a check list of some non-vascular plants and vascular plants, for example, bryophyte, algae, pteridophyte and orchids.



🌿 **Target 2 :** A preliminary assessment of the conservation status of all known plant species, at national, regional and international levels


➤ In 2006 and 2007 the Office of Natural Resources and Environmental Policy in cooperation with the Forest Herbarium established a check list of rare and endangered plants and endemic plants by using the internationally verified criteria of IUCN 1994 and 2001. The compilation indicated 1,957 known species of endemic plants, rare plants, endangered plants and near-extinct plants of which 1,407 plant species from 137 families were published under the book name of ‘Thailand Red Data: Plants I (2006)’. In addition, ‘Thailand Red Data: Plants II’ is under way.



Thailand Red Data : Plants I


Table Summary on plant status in Thailand (2006 and 2007)

Plant Groups	Threatened species	Status									
		E	Semi-Endemic	R	RT	EX	EW	CR	EN	VU	NT
Pteridophytes	42	19	-	27	2	-	-	-	-	13	-
Gymnospermae	27	6	-	17		-	-	-	-	8	2/(1)
Dicotyledon	1,233	625	11	840	30	-	1	(19)	38/(8)	299/(5)	1
Monocotyledon	655	295	4	275	5	-	-	-	150	219	-
Total	1,957	945	15	1,159	37	-	1	(19)	188/(8)	539/(5)	3/(1)

 **Target 3 :** Development of models with protocols for plant conservation and sustainable use, based on research and practical experience

➤ The royally-initiated projects and higher education institutions have synthesized existing knowledge into practical models to be used as methodologies in plant conservation by which biotechnology is applied in propagation of plants that are rare and endangered and plants that are taken from nature for use and processed into a condition appropriate for a return to nature. For example, tissue culture technique is used for *in situ* and *ex situ* conservation with rare and vulnerable plants, such as, Lady's slippers (*Paphilopedilum*), Tiger Orchid (*Grammatophyllum speciosum* Blume), Moke (*Wrightia sirikitiae* Mid. & Santisuk), True Laurel (*Cinnamomum porrectum* Kosterm), Champri Sirindhorn (*Magnolia Sirindhorniae*), *Magnolia rajaniana* (Craib) Figlar, *Bauhinia siamensis* K. & S. S. Larsen, Bastard Teak (*Butea monosperma* (Lam.) Taub.), *Rauwolfia serpentina* (L.) Benth. ex Kurz, *Afgekia mahidoliae* Burt et Chermisir, *Kaempferia galanga* Linn., *Kaempferia larsenii* Sirirugsa, Monkey Cup (*Nepenthes mirabilis*), Hiptage (*Hiptage bengalensis* (Linn) Kurz.), Parrot Flower (*Impatiens pittaciana* Hook.f.) and Orchid Tree or Purple Bauhinia (*Bauhinia variegata* Linn).

 **Conserving plant diversity:**

 **Target 4 :** At least 10 per cent of each of the world's ecological regions effectively conserved

➤ At the moment, more than fifty percent of forest, mangrove and island areas in Thailand have been protected. Measure used in area management is in form of an official notification of protected areas, i.e., national park, forest park, wildlife sanctuary, no hunting area and others, including, botanical garden and arboretum enabling conservation of seven ecosystems according to the Convention on Biological Diversity (CBD). Nevertheless, the country still has insufficient data of areas which are categorized into seven ecosystems subject to the CBD, including, forest ecosystems,

mountain ecosystems, island ecosystems, agricultural ecosystems, dry and sub-humid ecosystems, marine and coastal ecosystems, as well as, inland water ecosystems for assessing national achievement in pursuing this target.

☸ **Target 5** : Protection of 50 percent of the most important areas for plant diversity assured

➤ In the past, Thailand had never identified the Important Plant Areas (IPA) so that it was impossible to assess whether or not 50 percent of IPA of the country was protected and if it were below fifty percent, what actions could have been taken in order to achieve a reduction of biodiversity loss by 2010. Accordingly, in 2008 and 2009, Thailand hosted three meetings to brainstorm ideas of experts and experienced practitioners on exploration of plants from all concerned agencies and higher education institutions to consider the identification of IPA of Thailand. As a result, 98 areas were identified as IPA. With regard to types of protection, the areas can be categorized as following;

Table IPA in Thailand

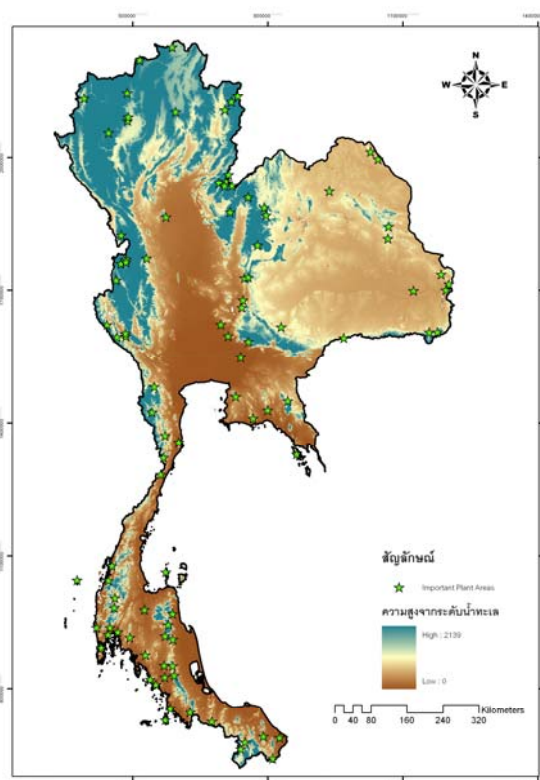
Type of area	National Park	Wildlife Sanctuary	Forest Park	Non-hunting area	National Forest Reserve	Area protected by local authority	Non-Protected area
Number of IPA	55	17	2	4	9	2	9

Among the 98 Important Plant Areas, 87 are located in forest areas which are legally protected by the National Park Act, Wildlife Protection Act, Forest Laws, and National Protected Forest Act, equivalent to 88.76 percent. Nine areas are not protected by laws, tantamount to 9.18 percent, and 2 of them are protected by local administration authorities according to local protocols, equivalent to 2.04 percent. The mentioned data indicates the achievement of the country in pursuance of Target 5.

Though 87 out of 98 Important Plants Areas are protected by laws, they encounter threatening factors as following.

Table IPA under various threats

Threatened factor	Decrease of forest area	Tourism activities	Development activities	Invasive alien plant species	Agriculture	Plant collection
Number of IPA	73	59	51	4	50	71



Brainstorming Meeting for the Identification of Important Plant Areas for Plant Diversity (IPA) of Thailand

➤ Moreover, in 2007 the Department for Development of Thai Traditional and Alternative Medicine devised a Conservation Plan for Herbs and their Origin and chose the location of Phu Pha Kood (Kood Cliff), Mookdaharn Province covering 15,000 rais of dry evergreen forest as a pilot project because there were 22 communities/villages utilizing resources from the area. The Department conducted a technical exploration in order to inspect rare or endangered herbs in the area and thereafter formulated a Management Plan for Herb Conservation in protected areas of Phu Pha Kood, Mookdaharn Province (2008-2010) (short-term plan) according to the Protection and Promotion of Traditional Thai Medicinal Intelligence Act, B.E. 2542. The plan is aimed at providing practical guidelines for conserving herbs and their native habitat and for creating regulations on public entry into protected areas by participation of relevant governmental organizations and local communities.

🌿 **Target 6 :** At least 30 per cent of production lands managed consistent with the conservation of plant diversity

➤ At the moment, production lands in Thailand which refers to lands where the primary purpose is agriculture, including, horticulture, grazing or wood production and others. At present they cannot be assessed whether or not they have been managed consistent with the conservation of plant diversity because related criteria has not been clearly set.

☸ **Target 7 :** 60 per cent of the world's threatened species conserved *in situ*

➤ In Thailand, there are 148 registered national parks covering the area of 32,988,873.53 rais and 69 registered forest parks accommodating the area of 520,501.51 rais in total. It is estimated that about 90 percent of threatened species inhabit conservation areas which are protected by laws and other existing protection procedures. Target 7 is regarded as an initial step towards a complete and effective *in situ* conservation of all threatened species (100 percent) in the future.

➤ The Rice Department conserved *in situ* wild rice by having conservation plots of wild rice *in situ* at Ban Srang Sub-District, Ban Srang District, Prachinburi Province in the area of 87 Rais and at Lao Poh Daeng Sub-District, Mueng District, Sakonnakorn Province in the area of 25 Rais.

➤ Furthermore, some threatened species are also propagated for a return to natural habitat, for instance, *Lilium primulinum*, *Impatien* spp., *Begonia* spp., and *Bretschneidera sinensis*.

☸ **Target 8 :** 60 per cent of threatened plant species in accessible *ex situ* collections, preferably in the country of origin, and 10 per cent of them included in recovery and restoration programmes

➤ Thailand has organized accessible *ex situ* living collections in forms of botanic gardens and arboretums which are currently grouped into 3 types according to their responsible agencies;

1. Botanic gardens and arboretums under the supervision of the Forest Herbarium, Department of National Parks, Wildlife and Plant Conservation, Ministry of Natural Resources and Environment are erected in all regions of the country. There are 16 botanic gardens and 55 arboretums with the total area of 96.73 square kilometers.

2. Under the supervision of the Bangkok Metropolitan Administration, there are a botanic garden located in Suan Luang Rama IX, Bangkok covering the area of 500 rais, an arboretum collecting approximately 5,000 herbarium specimens, a small library, a plant nursery and a greenhouse.

3. A botanic garden under the auspices of Office of the Prime Minister refers to Queen Sirikit Botanic Garden, The Botanical Garden Organization—a state-enterprise agency at Mae Rim District, Chiang Mai Province. Queen Sirikit Botanic Garden is the only place supporting laboratories for various fields of botanical researches, collects plant specimen, in particular, those indigenous to the Northern Region and North-eastern Region, makes a name list of threatened plants, especially, Palmae or Arecaceae, and studies the taxonomy of ferns, Balsaminaceae, Ericaceae and Orchidaceae.

Apart from the above-mentioned, there are many more *ex situ* collections found at governmental organizations, universities and academic institutions in which nowadays biotechnology is widely used in conservation, and researches on recovery and

restoration of plant species are also conducted. *Ex situ* living collections spread nationwide, including,

- National Unit for Rice Accession Collection at Pathum Thani Rice Research Center, Bureau of Rice Research and Development, Rice Department conserves Thai rice accessions to avoid the danger of extinction or degeneration and provides information exchange service and accessions to other agencies. At present, the Center has approximately 24,000 rice accessions which comprise about 17,000 indigenous rice accessions, 5 wild rice species, and the rest of foreign rice and genetically engineered rice.

- The National Genebank of Thailand is a sanctuary of plant genetic resources, at Science and Technology Research Institute of Thailand. Currently, the Bank contains more than 4,000 plant samples of 200 species and 50 genera of which legumes, corn, sesame, spinach, chilly peppers, fast-growing trees, and some herbs are organizational main focus.

- Research centers and experiment stations under Department of Agriculture located in 96 provinces throughout the country conduct researches and collect various species of rice, farm plants, garden plants, rubber and mulberry for sericulture. There are more than 1,000 varieties of rubber, more than 200 varieties of cassava, above 300 species of herbs, and no less than 320 species of fragrant plants collected.

- National Center for Genetic Engineering and Biotechnology (National Science and Technology Development Agency) conserves plant species for sustainable use by conducting an exploration, identification and classification of plant species inhabiting many types of forests in the country. Top apex and seeds are collected and then cultured by tissue culture techniques. At present, the Center is able to stock cultured callus of 501 plant species, 191 families and 105 genera.

- The Royal Chitralada Projects are agricultural demonstration projects which consist of a number of projects on plant conservation. This includes the Gene Bank established in 1996 under the Plant Genetic Conservation Project subject to the Royal Initiation of Her Royal Highness Maha Chakri Princess Sirindhorn. The Gene Bank is a depository of seeds and cultures. Plants cultivated in the Projects are from 392 species, 272 genera, and 94 families.

- Thailand Institute of Scientific and Technological Research operates a genetic conservation project of Magnoliaceae under the auspices of the Plant Genetic Conservation Project according to the Royal Initiation of Her Royal Highness Maha Chakri Princess Sirindhorn.

- Maejo University conducts a study and a compilation of rice species and Anacardiaceae.

- Mae Fah Luang University is in the process of building Mae Fah Luang Botanic Garden on the area of 5,000 rais and collecting rare species and orchids.

➤ Royal Forest Department has agroforestry research stations compiling economically valuable plant species, including, teakwood, brown salwood and eagle wood.

➤ Mahidol University carries on work of herb gardens, studies and collections of Orchidaceae, carnivorous plants, and Zingiberaceae and a plant reintroduction project.

➤ Prince of Songkla University conducts researches and compilation of Orchidaceae.

➤ The Royal Project studies and gathers species of ferns, assortment of rare and unique plants including Rhododendron.

➤ Chiang Mai University (Department of Horticulture) has a collection of local plants, ground orchids and fruit crops.

🌱 **Target 9** : 70 per cent of the genetic diversity of crops and other major socio-economically valuable plant species conserved, and associated indigenous and local knowledge maintained

Thailand has successfully attained this target because genetic diversity of crops and important species are maintained, collected and conserved at gene banks and plant genetic collection centers by Department of Agriculture, Department of Rice and higher education institutions nationwide. From the total size of 320 million rais of the country, it is shown that 130 million rais (40 percent) are agricultural lands and half of which (65 million rais) are used as rice paddy fields.

➤ National Unit for Rice Accession Collection was founded at Pathum Thani Rice Research Center and aimed at being a center of compilation and conservation of rice accessions. At present, the Unit collects around 24,000 rice accession specimens.

Local	> 17,000 specimen
Good species	> 1,300 specimen
Foreign species	> 3,000 specimen
Wild rice	> 1,000 specimen

In addition, many conservation activities are promoted by the Center, for example,

- Distribution of rice accessions
- Classification, identification and evaluation of rice accessions
- Conservation of *in situ* wild rice by having wild rice conservation plots *in situ* at Ban Srang Sub-District, Ban Srang District, Prachinburi Province in the area of 87 rais and at Lao Poh Daeng Sub-District, Mueng District, Sakonnakorn Province in the area of 25 rais.

- Collection of rice species has been continuingly conducted, in particular, in pristine or remote areas, such as, high mountainous areas in the Northern Region where native rice species of hill tribes can be found.



➤ Field Crops Research Institute, Department of Agriculture collects germplasm of 28 field crop species and of more than 10,000 strains in total, including, cassava, sugar cane, wild sugar cane, paper mulberry, rhea fiber (Chinese grass), Kapok or white silk cotton, field corn, specialty corn, soybean, mung bean, pigeon pea, peanut, sesame, cotton, cow pea, rice bean, earth pea, sorghum, sunflower, castor bean, kenaf, okra, white jute, tossa jute, Cuban kenaf, pearl barley and other beans . They are conserved and collected in forms of dry seeds, in collection plots, and in sterilized condition.

Number of Crop species collected at nationwide Crop Research Institute

Groups / types of crops	Total (sample)
<u>Group of nuts</u>	
green beans	2,250
Peanuts	2,030
Soy	1,510
Bush beans	85
<u>The fiber plant</u>	
Cotton	385
Cuba Corporation	120
Glass Corporation	200
Jute	160
<u>Vegetable oil group</u>	
Sesame	390
Lahueg	147
<u>The corn and sorghum</u>	
Corn farm animals	1,036
Fresh corn sheath	214
Sorghum	100

Groups / types of crops	Total (sample)
<u>Huge collection of breeding species in the conversion</u>	
Sugarcane	> 500
Cassava	> 800
<u>In aseptic conditions</u>	
Cassava	> 600

➤ Horticulture Research Institute, Department of Agriculture has compilation of fruit crops, ornamental plants, vegetable and industrial crops covering approximately 8,500 strains in 11 horticulture research centers, 8 Plant Production Technical Service Centers (PPTSC), and Office of Agricultural Research and Development, Region 3, Classification Section (Khon Kaen Province).

- 3,675 strains of important fruit crops, for example, durian, longan, longkong and langsat, rambutan and mangosteen.

- 12 species and 1,109 strains of ornamental plants, such as, Siam tulip (Paracuma), Torch Ginger (*Etilingera elatior* (Jack) R.M. Smith) and orchid (commercial dendrobium and vanda)

- 15 species and 1,430 strains of vegetables

- 9 species and 698 strains of industrial crops, for instance, coconut, coffee, and cacao.



☸ **Target 10** : Management plans in place for at least 100 major alien species that threaten plants, plant communities and associated habitats and ecosystems

➤ In 2006, the Sub-Committee on the Convention on Biological Diversity set up a new working group on alien plants. The working group has a responsibility to scrutinize the legal loopholes found in plant import and invasion of alien species. Based upon a collection of existing alien plant registration, there were approximately 3,000 alien species identified by concerted effort of relevant experts. A draft registration of alien species was devised in 2 meetings in which the meeting participants composed of experts and the general public. These 2 meetings resulted in definition of and a name list of alien species in form of the draft registration of threatening alien species. The threatening alien species are categorized into 4 groups.

(Draft) List of alien species in Thailand to be provided, control and eradicate

☸ **List 1: Invasive Alien Species**

1. *Ageratina adenophora* (Spreng.) R.M.King&H.Rob.
2. *Bidens pilosa* L.
3. *Celosia argentea* L.
4. *Chromolaena odoratum* (L.) R.M.King&H.Rob.
5. *Crassocephalum crepidioides* (Benth.) S. Moore
6. *Eichhornia crassipes* (Mart.) Solms
7. *Euphorbia heterophylla* L.
8. *Galinsoga parviflora* Cav.
9. *Hydrilla verticillata* (L.f.) Royle
10. *Hydrocotyle umbellata* L.
11. *Hyptis suaveolens* (L.) Poit.
12. *Imperata cylindrica* (L.) P.Beauv.
13. *Lantana camara* L.
14. *Leucaena leucocephala* (Lam.) de Wit
15. *Mikania micrantha* (L.) Kunth
16. *Mimosa diplotricha* C. Wright ex Suavalle
17. *Mimosa pigra* L.
18. *Pennisetum pedicellatum* Trin.
19. *Pennisetum polystachion* (L.) Schult
20. *Pennisetum setosum* (Sw.) L.C. Rich.
21. *Pistia stratiotes* L.
22. *Rottboellia cochinchinensis* (Lour.) W.D. Clayton
23. *Salvinia molesta* D.S. Miteh.
24. *Tithonia diversifolia* (Hemsl.) A.Gray

☸ **List 2: Potential Invasive Alien Species**

1. *Alternanthera bettzickiana* (Regel) G.Nicholson
2. *Alternanthera philoxeroides* (Mart.) Griseb.
3. *Amaranthus caudatus* L.

4. *Amaranthus spinosus* L.
5. *Arachis pintoii* Krapov. & W.C.Greg.
6. *Bidens alba* DC. var. *radiata* (Sch.Bip.) R.Ballard
7. *Cabomba caroliniana* Gray
8. *Eryngium foetidum* L.
9. *Gomphrena globosa* L.
10. *Gomphrena serrata* L.
11. *Muntingia calabura* L.
12. *Myriophyllum aquaticum* (Vellozo) Verdc.
13. *Oxalis latifolia* Kunth
14. *Panicum maximum* Jacq.
15. *Pennisetum purpureum* Schumach.
16. *Rivina humilis* L.
17. *Sphagneticola trilobata* (L.C. Rich.) Pruski
18. *Verbena officinalis* L., European verbena



List 3: Invasive Alien Species in Other Countries but not in Thailand

1. *Agave americana* L.
2. *Agave sisalana* Perrine ex Engelm.
3. *Anubias* spp.
4. *Baldelia ranunculoides* Parl.
5. *Citharexylum spinosum* L.
6. *Damasonium alisma* Mill.
7. *Echinodorus* spp.
8. *Egeria densa* Planch.
9. *Gymnocoronis spilanthoides* DC. Senegal Tea Plant
10. *Grevillea robusta* A. Cunningham ex R. Br. (Silk oak)
11. *Hyparrhenia rufa* (Nees) Stapf
12. *Lythrum salicaria* L.
13. *Macfadyena unguis-cati* (L.) A.H.Gentry
14. *Melinis minutiflora* P.Beauv.
15. *Myriophyllum spicatum* L.
16. *Psidium guajava* L.
17. *Pueraria montana* (Lour.) Merr.
18. *Schefflera actinophylla* (Endl.) H.A.T. Harms
19. *Spathodea campanulata* P.Beauv.
20. *Thalia geniculata* L.
21. *Ulex europaeus* L.



List 4: Invasive Alien Species not found in Thailand

1. *Acacia mearnsii* De Wild.
2. *Ageratina riparia* (Regel) R.M.King & H.Rob.
3. *Argemone ochroleuca* Sweet

4. *Arrhenatherum elatius* (L.) J.Presl & C.Presl
5. *Asphodelus fistulosus* L.
6. *Azolla filiculoides* Lam.
7. *Briza maxima* L.
8. *Carduus nutans* L.
10. *Cecropia schreberiana* Miq.
11. *Cinchona pubescens* Vahl.
12. *Cyperus eragrostis* Lam.
13. *Cytisus scoparius* (L.) Link
14. *Datura stramonium* L.
15. *Echinochloa polystachya* (Kunth) A.S. Hitchc.
16. *Eragrostis curvula* (Schrad.) Nees
17. *Erodium cicutarium* (L.) L'Hér. ex Ait.
18. *Euphorbia esula* L.
19. *Holcus lanatus* L.
20. *Marsilea macropoda* Engelm.
21. *Marsilea quadrifolia* L.
22. *Miconia calvescens* DC.
23. *Morella faya* (Ait.) Wilbur
24. *Oxalis pes-caprae* L.
25. *Polygonum cuspidatum* Siebold & Zucc.
26. *Prosopis glandulosa* Torr.
27. *Spartina anglica* C.E.Hubb.
28. *Typha latifolia* L.
29. *Undaria pinnatifida* (Harvey) Suringar (Asia Kelp)

The said name list of alien species and preventive measures have been submitted to the Sub-Committee on the Convention on Biological Diversity by Office of Natural Resources and Environment for its consideration to propose them for the Cabinet's Resolution subsequently.



Using plant diversity sustainably:



Target 11 : No species of wild flora endangered by international trade

➤ Thailand is a signatory member of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) by which Plant Varieties Protection Division, Department of Agriculture is in charge of monitoring, controlling, supervising import, export and transit of protected species (listed on Appendix). Until now, Thailand has been fully committed to the CITES, as shown by the following activities;

- Use CITES Permit, in addition to enforcing the Plant Act, B.E. 2518 and the Plant Act, B.E. 2535 (2nd Edition, Amendment) in order to control, monitor,

inspect and issue certificate of registration for nurseries of protected species to individual/company that conducts micro-propagation for trading. So far 178 nurseries have been registered covering plants like Orchidaceae, onion, cactus, eagle wood and monkey cup. Moreover, smuggle of wild plants and protected plants along borderlines of Thai-Lao PDR, Thai-Cambodia, Thai-Malaysia and Thai-Myanmar have also been strictly intercepted.

- Research and develop a control system for international trade of plants listed on Appendix not to damage existing population of protected plants *in situ*.

- Identify and classify types and number of rare and endangered species, particularly, *Cycad* which can be traded without any threats to its population in nature.

- In 2008, five trainings were provided to ‘competent officers’ according to the Plant Acts in order to strengthen knowledge and experience and improve capacity of relevant officers, including, officers at plant checkpoints, authorized signatures for CITES Permit and plant inspection officers in controlling and monitoring import, export and transit of protected plants and dead protected plants in accordance with the Plant Act, B.E. 2518, the Plant Act, B.E. 2535 (2nd Edition, Amendment) and commitments under the CITES

- Host meetings and promote coordination among expert groups on protected plants, Sub-Committee on Protected Plants and Committee on Plants to directly control and investigate the international trade of species listed on CITES Appendix. Furthermore, workshop seminar on the implementation of CITES on plants is also hosted annually in order to publicize the implementation progress and seek for practical guidelines of further cooperation.

- Gather statistical data on import and export of species listed on CITES appendix. In 2008, 9 cases of wild orchid were arrested, and a total weight of the exhibit was at 850.20 kilograms.

- Four forums were arranged for hearing opinions from individuals/companies receiving certificate of registered nurseries from Department of Agriculture in order to promote micro-propagation of protected species and conservation of biodiversity both in the Central and in the regions.

☸ **Target 12** : 30 per cent of plant-based products derived from sources that are sustainably managed

Currently, Thailand has plant-based products and wood-based products meeting relevant environmental standards at 2 percent. Classifying the products into categories, it shows that 10 percent of samples collected from many product categories met the verified standards. Therefore, the target aimed at 30 percent is considered attainable. Nonetheless, recognizing that for some categories, it is more difficult to monitor the progress and the target is hardly attainable. Implementation would require a combination of product-specific and sector-wide approaches, consistent with the Convention's programme of work on agricultural biodiversity.

This baseline is relatively problematic because sources from which the products are derived cannot be effectively traced. As a consequence, the country's achievement on this target cannot be accurately assessed.

☸ **Target 13 :** The decline of plant resources, and associated indigenous and local knowledge, innovations and practices that support sustainable livelihoods, local food security and health care, halted

➤ Thailand actively supports use of local knowledge found inherited in traditional indigenous livelihoods to develop products and services. Plant resources used to produce 'OTOP' or 'One Tambon (Village) One Product' originated from indigenous knowledge can be divided into food and drink, herb, cosmetics, basketry, kitchen utensils, apparel and house. Types of OTOP include Thai traditional music instrument, basketry, drink, herb, medicinal herb, Thai flower cologne, herbal compress ball, *Curcuma xanthorrhizoides* tonic for female, herbal candy, banana fiber paper, mulberry paper and naturally- colored cotton fabric, for example. There are 59,578 products from 1,774 manufacturers in total. Around 269 plants are found used as raw materials for production. These plants are considered indigenous knowledge resources which have been inherited from generation to generation in each of local communities. The products are made of crop plants equivalent to 74.55 percent, such as, fruits, herbs, bamboo and rubber, and of plants *in situ* equivalent to 25.45 percent, such as, rattan, crown flower, Siamese rose wood, True Laurel and vine.

🚩 **Promoting education and awareness about plant diversity:**

☸ **Target 14 :** The importance of plant diversity and the need for its conservation incorporated into communication, educational and public-awareness programmes

➤ In practice, Thailand implements these activities by all relevant agencies involving plant conservation, including, Plant Generic Conservation Project, higher education institutions, Department of National Parks, Wildlife and Plant Conservation, for example.

➤ Khon Kaen University provides training on botany and biodiversity to students at all levels and the public and implements the Understanding Natural Science Project including activities, such as, paving a nature observation route and labeling tree names to become knowledge sources for communities and the general public.


➤ Various universities also include plant conservation in courses taught at both undergraduate level and postgraduate level, for example, Plant Taxonomy, Field Course in Botany, Basic Botany

➤ Herbs, Aquatic Plants, Ferns, Economic Plants, Orchid Technology, Herb Conservation and Tissue Culture.

➤ Department of Agricultural Extension promotes importance of biodiversity and necessity of conservation by giving a lecture on laws related to orchid under the

Orchid Export Promotion Project in Orchid Production Development for Export Course to the public and relevant entrepreneurs.

Building capacity for the conservation of plant diversity:


 **Target 15 :** The number of trained people working with appropriate facilities in plant conservation increased, according to national needs, to achieve the targets of this Strategy

Capacity-building should be based on national need assessment on which capacity needs to be strengthened, and which capacity is priority. Thailand conducted the national need assessment on what capacity needs to be strengthened in 2001. It was unveiled that production of plant taxonomist did not meet the demand. However, capacity-building activities were found conducted at all concerned agencies. The common problems shared by all agencies encompassed shortage of workforce, facilities and assurance of infrastructure maintenance. Corrective actions taken for these problems include;

- The production of post-graduates aims for potential workforce with more well-grounded knowledge and expertise;

- The Botanical Garden Organization hosts training on local botany for following target groups—traditional doctors, high school teachers and all enthusiasts in order to create fundamental understanding on plant classification. The training happens once a year. It has been conducted for 13 times and can accommodate around 70 trainees per training.

- CITES provides training for ‘competent officers’ according to the Plant Acts in order to enhance knowledge and experience, as well as, to increase capacity of relevant officers in controlling and monitoring import, export and transit of protected plant species and dead plants in compliance with the provisions of the Plant Act, B.E. 2518, the Plant Act, B.E.2535 (2nd Edition, Amendment) and the commitments under the CITES.

 **Target 16 :** Networks for plant conservation activities established or strengthened at national, regional and international levels

At present, Thailand has conservation networks established at national level, for example,

- Algal and Plankton Society of Thailand: the Society was founded in 2000. Until 2007, a number of members have reached about 400 combining those interested in algae, phytoplankton and zooplankton. Around ten members are senior experts directly responsible for this field, including, fresh-water algae, marine algae and marine grass; nevertheless, most of them are specialized on plankton. The Society has implemented conservation activities as following;

- Technical meetings and taxonomy training on classification of microalgae culture and macroalgae culture were run on alternate basis.

- Taxonomy training on classification of zooplankton and marine algae was hosted in March 2007 and March 2008 at Prince of Songkla University.

- Local Biodiversity Information Networks established (Biodiversity Center and Mahasarakham University)

- School Botanical Garden Networks established (The Royally-Initiated Plant Genetic Conservation Project)

- Botany Clubs established

- Wildlife Enforcement Network (Thailand – WEN; CITES) established at Nakornpanom Province with the purpose of controlling the illegal international trade

The above-mentioned networks can facilitate communication and provide mechanism to exchange information, technology and body of knowledge or best practices beneficial to conservation. Moreover, the networks are considered crucial components of coordination among concerned agencies.

- The Botanical Garden Organization has signed Memorandum of Understanding (MOU) with Department of National Parks, Wildlife and Plant Conservation and worked with the Forest Herbarium in charge of botanical gardens and arboretums nationwide since 2005 in order to decrease duplication of work and optimize the efficient allocation of resources. Effective networks provide means to develop mutual approaches to plant conservation problems, to formulate policies and priorities and to help disseminate the implementation of all such policies at different levels. They can also help to strengthen links between sectors pertinent to conservation, e.g. the agricultural, educational, forestry and botanical sectors. The networks established should also provide a nexus between implementation, coordination, monitoring, and policy development at all levels. This target is agreed to cover capacity building and the broadening of participation in existing networks.

- At regional level, Queen Sirikit Botanic Garden took part in the construction of South East Asia Botanic Garden Network (SEABG) which transfers technology and information among countries in South-East Asia.

- At international level, many Thai organizations, such as, Queen Sirikit Botanic Garden, Nong Nooch Garden & Resort and Walai Rukhavej Botanical Research Institute are members of the network of Botanical Gardens Conservation International (BGCI)

For this target, efforts on conservation networks have been shown in various levels. With additional support, the implementation would be more effective.

