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Biodiversity

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Biodiversity



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FOREWORD

Thailand has been endowed with rich and diverse biodiversity in its seas, coasts, rivers, swamps, caves, forests, hills and mountains. From large wildlife such as elephants to tiny bats, giant forest trees to exquisite orchids, and from the relatives of domestic chickens to traditional rice varieties, the variety of life has sustained the Thai people in their daily lives. Thailand's economic development has been rapid but not without ecological costs, as was shown by the failure of many of the coastal areas cleared of mangrove forests to establish shrimp ponds, and the major loss of forest cover leading to a ban on logging in natural forests in 1989.

Thailand, as a party to the Convention on Biological Diversity, has implemented many measures to protect biodiversity and has allocated government budgets to the tasks of biodiversity conservation, awareness raising and research. In addition, Thailand has taken upon itself a regional leadership role in biodiversity research and commitment to control illegal trade in wildlife. At the recent Conference of the Parties to the Convention on International Trade in Endangered Species (CITES COP13) held in Bangkok, Prime Minister Thaksin Shinawatra proposed Thailand to be a coordinator for a regional network to combat wildlife trafficking. By the end of the meeting this had become an official ASEAN-wide declaration of intent to suppress the trafficking, with Thailand taking the lead in implementing it and training of the ASEAN partners.

The Thailand Environment Monitor Series seeks to present a snapshot of key environmental trends in the country. It seeks to engage and inform stakeholders of environmental conditions and changes, in an easy-to-understand format, and to provide benchmarked indicators for the subject they cover. Previous volumes have covered broad environment issues (2000), water quality (2001), air quality (2002), and solid and hazardous wastes (2003). The *Thailand Environment Monitor 2004* assesses the status, trends, lessons and challenges related to biodiversity and its conservation. The report is in six sections. Section 1 provides an overview of Thailand's biodiversity and why its conservation is a national concern. Section 2 looks at the biodiversity in the four major ecosystems of the country, especially at the threatened species, while Section 3 describes the ways in which conservation is both planned and executed. Section 4 focuses on awareness and interest in biodiversity conservation. Section 5 assesses biodiversity in the context of the legal framework, institutions, and current expenditures. Finally, Section 6 outlines the challenges faced by Thailand.

Information for this Monitor has been compiled from a variety of sources including published and unpublished data and reports by government agencies, universities, non-governmental organizations, individuals, the World Bank, and international partners.



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ABBREVIATIONS AND ACRONYMS

BRT	Biodiversity Research and Training Program
CBD	Convention on Biodiversity
DANCED	Danish Co-operation for Environment and Development
DANIDA	Danish International Development Assistance
DEQP	Department of Environmental Quality Promotion
DMCR	Department of Marine and Coastal Resources
DNP	National Park, Wildlife and Plant Conservation Department
DOF	Department of Fisheries
EC	European Community
GDP	Gross Domestic Product
GIS	Geographic Information System
GWF	Green World Foundation
IBA	Important Bird Area
ICDPs	Integrated Conservation and Development Project
JBIC	Japan Bank for International Cooperation
JoMPAs	Joint Management of protected area
MoE	Ministry of Education
MoNRE	Ministry of Natural Resources and Environment
MP	Marine Park
NBSAP	National Biodiversity Strategy and Action Plan
NGO	Non-Governmental Organization
NSO	National Statistical Office
NTFPs	Non-timber Forest Products
NP	National Park
ONEP	Office of Natural Resources and Environmental Policy and Planning
PA	Protected area
PTT	Petroleum Authority of Thailand
RTG	Royal Thai Government
TAT	Tourist Authority of Thailand
TBC	Thailand Biodiversity Center
TEI	Thailand Environment Institute
THB	Thai Baht
UNESCO	United Nations Educational, Scientific and Cultural Organization
WEFCOM	Western Forest Complex Ecosystem Management Project
WFT	Wildlife Fund Thailand
WS	Wildlife Sanctuary
WWF	World Wide Fund for Nature

SUMMARY

Thailand's natural endowment of biodiversity - the variety in genes, species, and ecosystems - is both rich and naturally abundant. The country stretches nearly 2000 km from north to south and boasts forested mountains, very wet and very dry climates (and great variety in-between), various types of wetlands, a complex coastline with crystal clear waters around teeming coral reefs, and turbid waters lapping productive mudflats.

The biodiversity of Thailand has significant economic value. While the direct values through agriculture, fisheries and forestry are obvious, the indirect values of biodiversity to climate regulation, water quality and quantity, erosion control, sediment retention, soil formation, and nutrient cycling have yet to be fully appreciated or integrated into development planning. Thailand's biodiversity also has value for future generations.

Many see the conservation of biodiversity as a responsibility which moves into the realm of spirituality and ethics. In Thai Buddhist culture conservation is increasingly an active and practical response to fundamental teachings. Despite all the good reasons to conserve biodiversity, biodiversity in Thailand is subject to attrition and loss, and its contributions to the well-being of Thai people at various scales are deteriorating.

After decades of heavy exploitation and loss, Thailand's area of natural forests is now quite stable. After a logging ban was imposed in 1989, the Thai timber industry has become reliant on imports, and extensive tree plantations have been established. Even though these are the merest shadow of the original forests in terms of biodiversity, careful planning and management can help plantation forests contribute to biodiversity conservation through their use as corridors between fragmented forest areas, or as areas of extended tree cover around national parks and other protected areas.

Limestone hills are slowly being recognized as having more value than just their rocks that supply the cement and construction industries. They are places with high endemism and unique assemblages of highly-adapted plants and animals. They also offer interesting and unique landscapes with both historic and aesthetic values for recreation and tourism. Initiatives by local people have already started to capitalize on the hills' broader assets and have thereby helped to conserve them.

Large areas of wetlands have been converted to rice fields and urban sprawl and suffer from pollution and other problems. Thai people have long known how to make intensive use of wetlands which provide food, fiber, water for drinking and bathing, and transportation routes. However, water quality is declining because of pollution, fish stocks are over-harvested, and invasive alien species of plants and animals have contributed to declines in local biodiversity. Pollution control programs now aim to restore the physical and chemical quality of the water, which can help biodiversity recover. Local people and NGOs in some areas manage water and fish resources, but they have limited power and authority to control the broader uses.

Thailand's abundant and diverse marine biodiversity has suffered from destructive fishing gears in the open sea and coastal areas. Conversion of coastal mangrove forests into intensive shrimp farms creates conflicts of interest among small-scale fishermen and between fishermen and shrimp farmers. Marine Parks have also led to conflicts with fishermen. The value and purpose of marine parks in conserving marine biodiversity must be clarified so that the practical benefits are understood.

A substantial number of Thai plants and animals are now threatened, but some successful site-specific pilot studies have been made to manage wildlife in an integrated manner. Lessons need to be learned from these because few species show any signs of recovery under current protection regimes, and most are steadily declining.



In the aftermath of the economic crisis in 1997, national parks are recognized as assets that generate tourism income. Entrance fees to parks have been greatly increased, nonetheless some of the parks now experience problems caused by too many visitors. Even so, national parks are expected to play a greater role in the economy, especially as the tourism industry is a major income generator for the nation. New projects are bringing fresh ideas and providing more management options that create conservation incentives for the local people.

The long history of biodiversity decline has stimulated efforts for biodiversity conservation. The Thai nation is increasingly aware of biodiversity issues thanks to the press, far-sighted government officials, NGOs, and provincial leaders. Universities are training more and more people in biodiversity-related subjects. Financial support is also being provided through programs such as the Biodiversity Research and Training Program, and by international NGOs, the Royal Family, the Danish government, and even local industries. However, the most critical support will be that from the general public, especially people living around protected areas, and efforts in those directions need to continue.

While this *Monitor* indicates that there is a great deal of positive news, significant challenges remain before conservation and sustainable use of Thailand's biodiversity can be achieved. Those major challenges are:

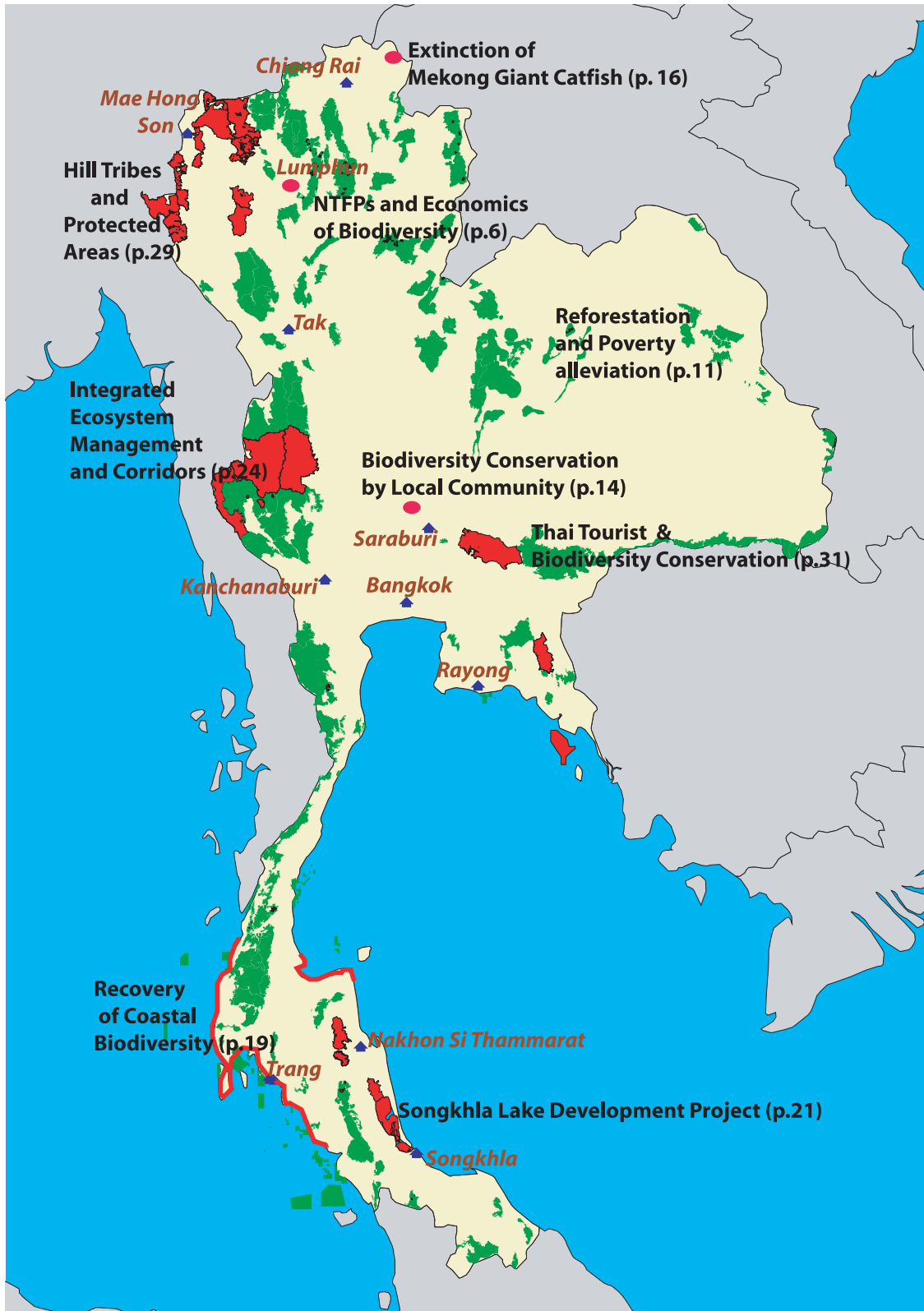
- **To integrate biodiversity conservation into economic planning and into production landscapes.** There is potential in the agriculture, forestry, tourism sectors to do much more to conserve biodiversity. For example, planning processes should account for larger areas and incorporate multiple land uses, and the potential for natural ecosystems to restore themselves if given time should be realized.
- **To improve protected area management.** Lessons learned from projects initiated by NGOs at individual sites should be incorporated into government policies and into new legislation giving authorities new mandates for participatory and decentralized management. Incentives for local people to participate fully and willingly in conservation management also need to be explored in the Thai context.
- **To improve enforcement of existing biodiversity-related regulations.** Better enforcement is needed to reduce poaching in protected areas, local and international trade in wildlife products, especially across the long and rather porous border with Myanmar. In order to address these issues there is a need for education of local people, improved detective and legal work, international monitoring, and the enforcement of treaties.
- **To improve research and monitoring on biodiversity.** Thailand has developed an impressive and regionally-significant research capacity, but research tends to be carried out in a fragmented and uncoordinated manner. There is a great need to make some research more policy-oriented and applied, and to encourage agencies to adopt recommendations.
- **To make plans for the medium- and long-term financing of biodiversity conservation.** Although the government has provided significant amounts of finance for biodiversity conservation, and has had some generous support from bilateral donors, it does not yet have a medium- or long-term plan for sustainable financing. In the context of sustained government support and strategic use of donor or private sector financing, a new challenge is to plan how it should access and apply different sources of funds for biodiversity conservation.
- **To harness markets and the private sector in biodiversity conservation and sustainable use.** There is potential to exploit certain elements of biodiversity in a sustainable manner provided that the following safeguards are put in place: target populations are strong enough to sustain any commercial use; effective regulations and enforcement mechanisms exist to curb unsustainable exploitation; and perverse incentives that promote biodiversity degradation, and regulations that prevent the private sector and local communities from profiting from the sustainable use of biodiversity, are eliminated. By effectively harnessing markets and private sector involvement, public resources could then be more efficiently allocated to supportive regulatory functions, and to certain biodiversity goods and services that markets alone are unlikely to supply.

BIODIVERSITY INDICATORS

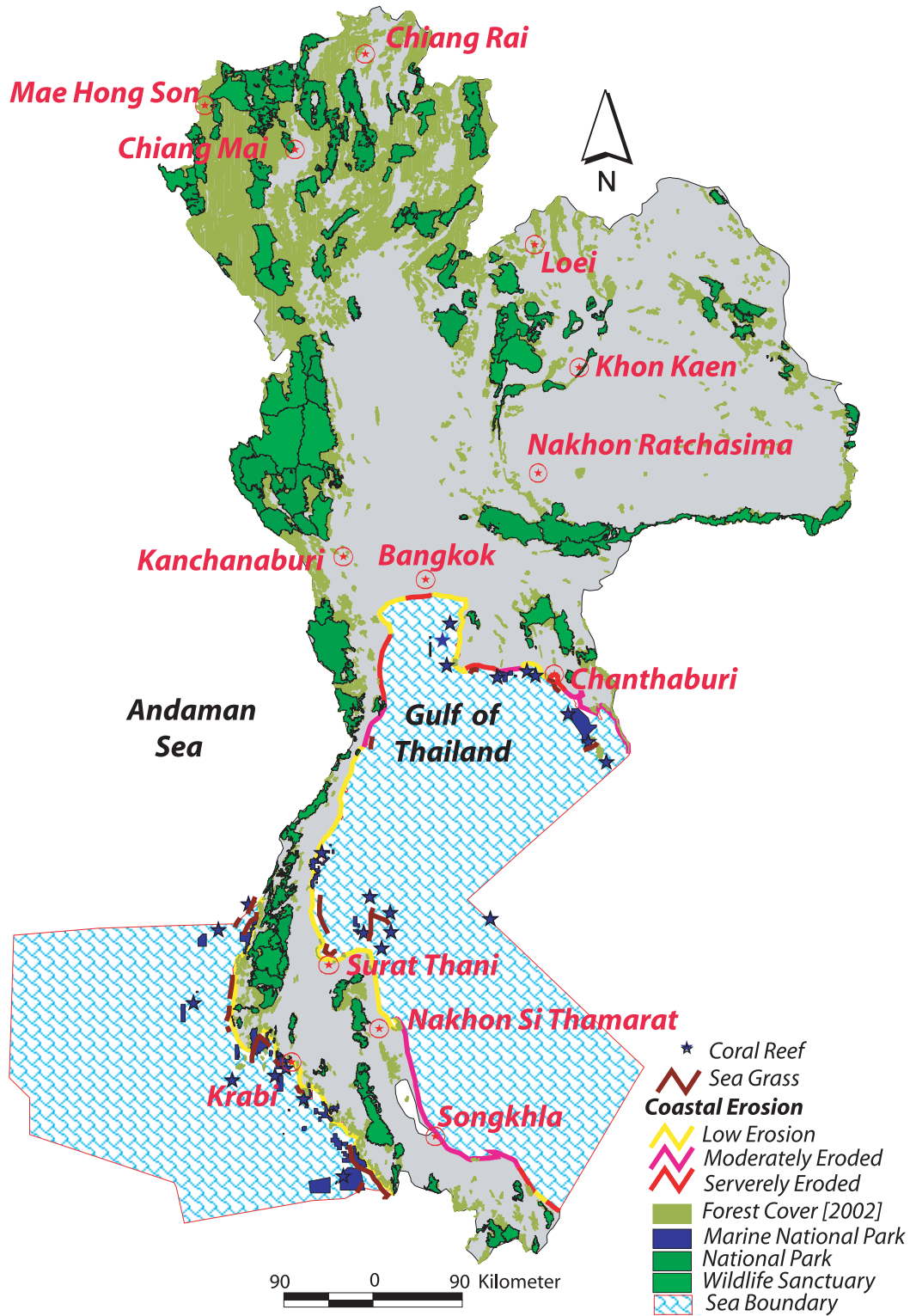
Agenda	Indicators		Period Covered
Land Resources	Cultivated land area (percent of total land area)	37	2001
Forest Resources	Natural forest area (as percent of total land area)	23	2002
	Rate of forest loss (hectares per year)	192,425	1982-2002
	Rate regrowth (hectares per year)	55,454	1991-2002
	Seagrass meadow area (hectares)	10,400	2003
Coastal and Marine Resources	Coral reefs (good quality reefs as percentage of total reef area)	11	2000
	National terrestrial PAs (percent of total land area)	18	2003
Protected areas	Total area within marine parks (km ²)	6,231	2004
	Annual government budget allocated to PAs (\$ million)	48.56	2004
	Number of corridors of tree cover designated or planted between pairs of PAs	0	2004
	Full government staff allocated to protected area management	15,362	2002
Institutional Capacity (Staffing)	Average full government staff per km ² of terrestrial national protected area	0.17	2002
	Average full government staff per km ² of marine national protected area	0.11	2004
Budget allocation	National level allocation for biodiversity (percent of total public expenditure)	1.5	2004
Environmental Education	Number of students enrolled for undergraduate environmental studies	72,770	2001
	Biodiversity papers with Thai lead author published in English-language peer-reviewed journals	256	1996-2004



HOTSPOTS MAP



FOREST COVER, MARINE AND COASTAL HABITATS, COASTAL EROSION, AND PROTECTED AREAS





THAILAND'S BIODIVERSITY - AN INTRODUCTION

NATURAL ENDOWMENTS

Thailand has abundant biodiversity ...

Thailand's natural endowment of biodiversity - the variety in genes, species, and ecosystems - is both rich and naturally abundant. The country stretches nearly 2000 km from north to south and includes forested mountains, a varied geology, very wet and very dry climates (and great variety in between), a complex coastline with crystal clear waters around coral reefs, and turbid waters lapping mudflats. The biodiversity of Thailand has substantial economic values, although they have yet to be fully appreciated or integrated into development planning.

There are six main ecological zones ...

North: a mountainous region with rivers which drain towards the Chao Phraya River which flows through the lowland plains. Large areas lie above 1,000 m, but the zone ranges from 200 m up to 2,565 m on Doi Inthanon, Thailand's highest mountain. Deciduous forests¹ were once prevalent at lower altitudes (but exist now only as remnants) and evergreen broad-leafed forests are found at higher elevations, often with native pine trees.

West: a hilly area mainly North-South along the Burmese border. It is mainly hot and dry, and has some of the most pristine forests, mainly of mixed deciduous trees.

Northeast: a dry, low plateau with very sporadic rainfall, which drains towards the Mekong. The western and southern sides of the plateau are bordered by mountains. The natural forests of open, dry dipterocarp deciduous woodlands are very susceptible to fire and have been almost entirely lost to agriculture.

Southeast: a lowland area with Cambodia to the East and the Gulf of Thailand to the South and West. This is one of the wetter parts of Thailand and evergreen forests but much has been lost.

Central Plains: the alluvial basin of the Chao Phraya, MaeKlong and Tachin. This region has been almost entirely deforested, with the swamplands converted to rice paddy and urban areas; the only remnant forests grow on the isolated limestone hills.

¹ Forests in which many of the tree species lose all their leaves at certain seasons

Table 1. Total number of species recorded in Thailand

Taxonomic Group	Number of species
Flowering plants	15,000 (estimate)
Mammals	292
Birds	938
Reptiles	318
Amphibians	122
Marine fishes	2,000
Freshwater fishes	606
Estuarine/seawater fishes	1,672
Marine mollusks	2,000
Marine invertebrates	11,900

Source: ONEP 2002b



Dry forest on the limestone hills of Mae Hong Son Province, Northern Thailand (Photo by S. Srikosamatara)



Evergreen forest in Khao Luang NP, southern Thailand (Photo by S. Sansuk)



Peninsular Thailand: an area sharing many characteristics with Malaysia to the south. Wet, largely aseasonal climate, with rainforests still present on the hill slopes. Mangrove forests, sea grass beds and mudflats are well developed in this zone.

With a great diversity of native species ...

The total number of species found in Thailand in each major taxonomic group is shown in Table 1. Thailand is not rich in endemic species (those found only in Thailand) because it shares many ecosystems with its neighboring countries, yet, there are 12 freshwater fish species thought to be endemic to Thailand, and 120 species which are endemic to mainland southeast Asia.

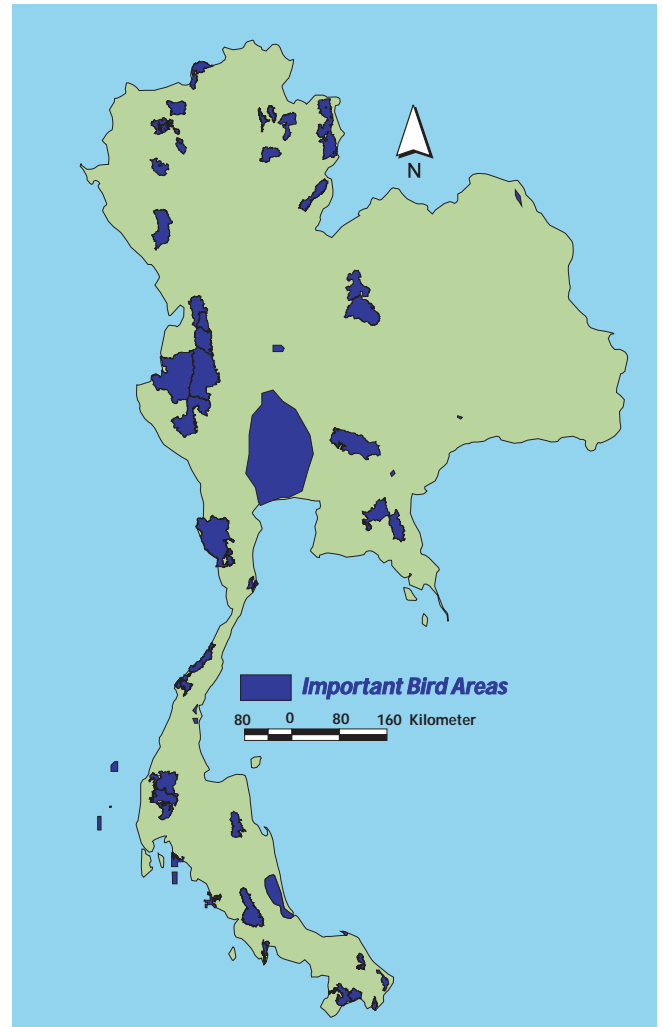
Important sites for biodiversity identified ...

The largest conservation NGOs have tried to identify areas of special interest for biodiversity; these include the 'hotspots' of Conservation International, and the 'ecoregions' of WWF. The most detailed program is the Important Bird Areas program of BirdLife International, which has been undertaken by their national partner organizations (Bird Conservation Society of Thailand). The selection of Important Bird Areas (IBAs) has been a particularly effective way of identifying conservation priorities. IBAs are key sites for conservation, small enough to be conserved in their entirety and often already part of a protected-area network. Sixty-two IBAs (Fig. 1) were identified, covering 9 percent of Thailand. While it is acknowledged that IBAs generally reflect important conservation areas other animals as well, they do not represent all species, as there are many groups of animals and plants whose distributions are quite different.

Invasive alien species cause problems ...

Thailand has a multitude of non-native animal and plant species that live and breed successfully. In most cases, like many garden plants they do no harm, but some find the environment so conducive that their numbers explode. Even so, few penetrate natural, undisturbed ecosystems, and are restricted to rural and rather degraded areas. Nevertheless, they can pose serious problems and are very hard to eradicate.

Figure 1. Thailand's Important Bird Areas (IBAs)



Source: Bird Conservation Society of Thailand 2004



Mexican sunflower at Nam Tok Mae Surin NP (Photo by S. Srikosamatara)

Box 1: Cultural icon – the Thai elephant

Surely few if any countries have such a strong link with one of their wild animals as Thailand has with its elephants. Their images are seen everywhere from business logos, postage stamps, advertisements, temple paintings and statues, tourist carvings, and hotel foyers. Wild elephants can be seen quite easily by flashlight in Khao Yai NP near Bangkok, and both wild and captive elephants can be seen at the extraordinary Surin Elephant Round Up in northern Thailand each November. As the forests have shrunk over the last 50 years, so too have the numbers of wild elephants. There are now only about 1,500 wild elephants with the main concentrations in Khao Yai NP, and Huai Kha Khaeng in the Western Forest Complex. The irony of this is that it was elephants under the command of their human mahouts (typically members of the Suay, Shan, Karen and other northern ethnic groups) which were so effective in dragging the felled trees out of the forests. About 150 years ago there were about 100,000 elephants used as beasts of burden and for human transport. Before the railway was built, the journey to Chiang Mai from Bangkok was made half on water and half on elephant. Since the logging ban in 1989, there are only about 2300 captive elephants, and half of these work in tourism.

The most famous of the Thai elephants are the rare 'white' (more correctly 'auspicious') elephants *chang samkhan* which to this day protect the reign of the Thai monarchs. The current King Bhumibol Adulyadej keeps eleven such auspicious elephants.

Box 2: The world's smallest mammal discovered in Thailand

30 years ago, during a trip to collect bats in the limestone caves of Sai Yok NP in western Thailand, Kittu Thonglongya found a tiny, tailless insectivorous bat species he had never seen before. At barely 2 grams and little bigger than a bumble bee, it is a good contender for the title of the world's smallest mammal (in competition with a shrew) but it is undoubtedly the world's smallest bat. Named as Kittu's hog-nosed bat or *Craseonycteris thonglongyai*, it was found to have no known close relatives and so it was put not only into its own genus, but also into its own family.



Kittu's hog-nosed bat (Photo by Suraphol Duangkhae)

4 One alien species that has had a major economic impact is the Golden apple or Mulberry snail *Pomacea canaliculatus*.² This large snail was introduced from its native South America in the early 1980s to produce 'escargot' (snail meat). However, within a few years it was the second most serious rice pest after the brown planthopper. Various chemical and mechanical controls are available but none, when used alone, is adequate. Integrated pest management offers better potential control, such as handpicking of adults and egg clusters; using stakes to attract snails for egg deposition; and applying commercial molluscicides only as and when necessary.

² ONEP 1997b

In the plant world Thailand has many invasive aliens but, as with the Golden snail, very few of them are successful in undisturbed natural ecosystems. One that has negative impacts around forests is the Mexican sunflower at Nam Tok Mae Surin NP which makes a spectacular display when in bloom. Unfortunately the sunflower smothers vegetation in forest clearings and hinders regeneration. Ironically the golden flowers draw many tourists to the park to see the spectacle, and proposals to try to bring it under control are not popular.



Box 3: Asia's last wild buffalo

In some of the remotest parts of the Western Forest Complex, in Thung Yai-Huai Kha Khaeng live the rarest of the four wild cattle species found in Thailand (although the Kouprey is likely to be already extinct). Along the rivers in this large area live about 50 truly wild Water buffalo *Bubalus bubalis*. Larger, faster and more aggressive than their domestic cousins, these animals are a priceless resource given the importance of the domestic water buffalo to farmers across all of Asia and beyond. They are threatened primarily by interbreeding with domestic stock.



A herd of wild water buffaloes in Huai Kha Khaeng WS (Photo by T. Prayurasiddhi)

Box 4: Rice genetic diversity – an invaluable resource

Something like 3500 varieties of rice are known from Thailand, indicating the enormous genetic wealth of this important agricultural crop. The advent of large areas planted to modern high yielding varieties (HYVs) since the Green Revolution in the 1970's in Thailand has threatened this diversity. As farmers turned over their land as well as their traditional cultivation practices to these varieties that require high inputs of fertilizer and pesticides, concern grew that HYVs have a low genetic base from which to fight off diseases and pests. Such seems to be the case with one insect, the rice brown planthopper (or BPH), whose feeding damages rice plants in a manner called 'hopper burn' and markedly decreases their productivity. Although long known as a rice field insect, pest outbreaks of this hopper were not recorded on traditional rice varieties in Thailand. As HYVs progressively increased, losses due to BPH increased, with the earliest outbreak being recorded in 1975. Since then, rice breeding efforts have resulted in new rice HYVs that are BPH-resistant. However, this is probably a temporary measure because the insect can change genetically and overcome plant resistance. A new strategy is needed to cope with BPH and other rice pests and diseases. Rather than use genetically homogeneous rice stocks over large areas, the use of mixtures of varieties shows promise as an ecologically-effective approach to disease and pest control.

Box 5: The Thai chicken industry and bird 'flu

Despite being the ancestral home of the domestic chicken, as well as having a large factory population, broiler and layer chickens raised in Thai intensive poultry farms are imported from a few overseas breeding companies. The genetic diversity of these stocks is extremely low, and may have a profound impact on the ability of chicken factory flocks to resist disease.

At the end of 2003, the Thai poultry industry made world headlines because of the spread of a 'flu virus, called H5N1 which has proven deadly not only to chickens but also to people. The resultant publicity and culling of poultry in Thailand in an effort to control the disease caused the collapse of an industry that has still not fully recovered. Although the origin of the virus cannot be ascertained, it is clear that once it establishes within a domestic population, it can be highly contagious, especially in dense populations such as those in Thai poultry farms. It is perhaps not surprising that a virus disease had such a major impact on the poultry industry. The high genetic diversity present in wild and in village chickens is an underutilized resource in Thailand and could contribute towards genetic diversification of the Thai poultry farm population, to help ensure that epidemics such as bird 'flu do not happen again.

Value

People care about biodiversity and its conservation for a variety of reasons, one of which being that it has significant economic values.

Some values of biodiversity are economic ...

Biodiversity has various economic values. For example, it has direct use values such as consumption of non-timber forest products and ecotourism. It also has indirect use values as in the case of ecosystem services such climate regulation, hydrological functions³, erosion control and sediment retention, soil formation and nutrient cycling. Moreover, biodiversity has an 'insurance' value, since it is believed that the more diverse an ecosystem the more resilient it is to shocks (e.g. natural disasters and human disturbance), which in turn may generate economic losses in the future (see Box 4 and 5 for Thai examples)⁴.

Even the considerable direct use value of biodiversity to rural communities are rarely factored into standard economic calculations such as the Gross Domestic Product (GDP). Such uses include collecting food from natural ecosystems for self consumption, shelter and medicine used extensively by local village communities, even informal trading. For example, it has been estimated that villagers obtain ecosystem products equivalent to 1-4 million baht per village (Table 2). With 73,467 villages in the country, that portion of biodiversity value may therefore contribute as much as 75-300 billion baht per year or 1-5 percent of GDP⁵. Uses described above may also benefit people who are away from the forests, reefs, etc., it is often the relatively poor people living adjacent to them that rely the most on those functions and thus directly suffer biodiversity degradation.

The value of PAs in terms of ecosystem services and tourist revenue can be considerable. For example, it has been estimated that Khao Chamao NP contributes about 1.6 billion baht per year through the contribution of its forests and streams, coastal fisheries and mariculture including shrimp farming⁶. Many such 'hidden' economic

Table 2. Value of NTFPs collected over one year by villagers from the forest-edge village of Ban Thung Yaw, Lumphun Province, northern Thailand.

NTFPs	Value (Baht)	NTFPs	Value (Baht)
Weaver ant eggs	282,300	Opillaceous shrubs	80,020
Frogs-toads-fish	46,340	Earth star mushrooms	164,940
Snakes	1,000	Other mushrooms	80,000
Edible flying termites	4,000	<i>Termitomyces</i> mushrooms	38,200
Scorpions	20,000	<i>Pu Lo</i> mushrooms	30,877
Spiders	20,920	Greenish mushrooms	63,170
Centipedes	33,600	<i>Kha Min</i> mushrooms	22,800
Butterflies	43,790	Bamboo shoot	940
Wasps	11,880	Wild fruits	17,825
Vegetables	34,000	Teak leaves	1,890
Total Value (Baht)		998,492	

Source: Ms Phakee Vanasak in Chaitup 2003



NTFPs collection at Ban Tung Yaw, Lamphun Province

³ These relationships are complex, see Bruijnzeel 2004

⁴ OECD 2003, Perrings 1995 and OECD 2002

⁵ Srikosamatara 2004

⁶ ICEM 2003



contributions, although not the sole reason to take conservation seriously, are worthy of greater attention because they are typically far higher than most people expect.

But some values of biodiversity are intangible ...

Another reason that people care about biodiversity is because it has some elusive - yet very important - values. Some people see these as being related to the spiritual sphere which in Thailand relates to Buddhism, the faith of about 95 percent of the population. Buddhism profoundly influences everyday Thai life; besides sustaining monastic communities, Thai temples have traditionally served other purposes – from being a seat of education to providing information on health and the environment.

In his own lifetime the Buddha came to understand that the notion that people exist as an isolated entity was an illusion. He concluded that all things are interrelated, everything in life arises through causes and conditions. Many Buddhists believe that the reality of the interconnectedness of human beings, society and nature will reveal itself as people cease to be possessed by anxiety and fear. In order to effect this change, people must restore themselves by seeking the kind of lifestyle that is free from the typical destruction of humanness.

The relationship between Buddhist ideals and biodiversity should be with biodiversity or nature as Teacher of both spiritual force and of lifestyle. Buddha taught that respect for life and the natural world is essential. By living simply one can be in harmony with other creatures and learn to appreciate the interconnectedness of all that lives. This simplicity of life involves developing openness to our environment and relating to the world with awareness and responsive perception.

Although monks in many parts of Thailand are becoming increasingly active in forest conservation, the best known are the monks of Doi Suthep-Pui NP near Chiang Mai, where monks of the ancient Wat Pratat temple, have ordained trees by wrapping robes around their trunks to dissuade people from cutting the forest.



An innovative Buddhist ceremony for protecting forest (photo by Suraphol Duangkhae)

Box 6: The World Bank engages with Thai Buddhists

The World Bank has engaged with Buddhists in Thailand by supporting the Khorat Initiative based in Thailand's largest province, Nakhon Ratchasima, which is now spread across four zones encompassing 47 small forest blocks. Sixteen temples now form the core of the community management project, and their compounds and monastic lands are used for education and health centers, tree nurseries, meeting places for forestry and heritage groups and training centers on forest management skills. The conservation message inherent in the Buddhist Dhamma underpins this project and the traditional respect and authority given to the monastery has enabled this initiative to be particularly effective.

Amongst many of the activities, are forums on the Buddhist teachings in environmental education. One of these focuses on forest issues and includes members of the Royal Forest Department who increasingly work with monasteries. Activities for the development of community forestry include the training of forest volunteers from local villages who are taught by forester monks or by lay forestry trainers. Advice is given on germination, seedling management, planting, organic fertilizers, irrigation, agro-forestry, and forest and water.





STATUS AND TRENDS

FOREST ECOSYSTEMS

The natural vegetation of most of Thailand is forest which, under proper management, is able to yield a range of benefits. Poor management resulted in a ban on logging in 1989 and since then management of all forest types has improved.

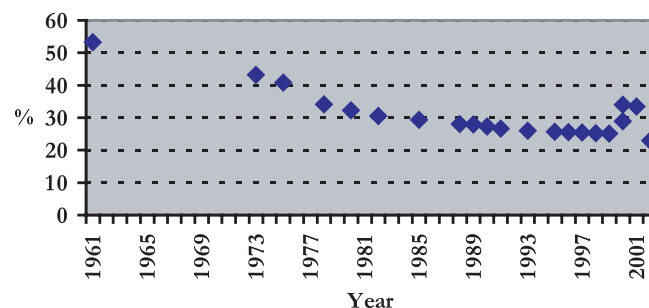
A variety of forest types ...

There are two main types of forest found in Thailand: the deciduous forests found in the drier (<1500 mm of rain), seasonal areas, and the evergreen forests in the wetter (>1500 mm), aseasonal areas. Further subdivision is possible with deciduous forests being found as mixed and dry dipterocarp⁷ forests. Evergreen forests encompass the rainforests of the south, the monsoonal evergreen forests of the south and southeast, dry evergreen forests, montane forests above about 1000 m, and the specialized mangrove, peatswamp and limestone forests.

With forest cover stabilizing...

Giving a precise description of forest cover in Thailand is fraught with problems. Figure 2 shows the decline and apparent stabilization of the forest area between 1990 and 2002, but not too much should be made of the precise points in the most recent years because of the different definitions, approaches, and maps used. The available data indicate that cover of closed forest in 2002 was about 23 percent of Thailand's land area of 511,770 km², whereas in 2000 the forest cover was reported by FAO to be 29 percent. The official Forest Department figure of 34 percent in 2000 is not directly comparable because the map scales used in calculating the figures were different, with smaller patches being included. Nevertheless, it is likely that the forest area is quite stable at this time because any losses through encroachment in remote areas are more or less balanced by regeneration and regrowth of disturbed forest areas. The 7th 5-year National Economic and Social Development Plan adopted 40 percent as the national target for forest cover, and 25 percent as conservation forest.

Figure 2. Decline and stabilization of forest cover over the last 40 years



See text for caveats on interpretation.

Sources: Charupatt 1998, Henderson 2003; Alpha Research 2004.

Forest Area Assessment 2000, Forestry Department. Landsat7 2002, UNDP release scale 1:250,000.

Since 1989, there has been no legal logging of natural forests in Thailand because all the concessions were revoked. Wood production declined dramatically, and wood consumption, which had increased up to 1994, declined rapidly because of the economic turndown. Most construction wood is now imported but the environmental impacts of this outside Thailand are not fully understood.

During the 1997 economic crisis hundreds of thousands of people who lost their city jobs returned to their rural family homes and in desperation some of these encroached or poached in the Kingdom's natural forests and protected areas.⁸

Regrowing trees does not necessarily help...

Reforestation areas have been increasing dramatically since 1995. The main impetus for this was the reforestation project which was part of the commemoration of the Royal Golden Jubilee of the King's Coronation, under which an ambitious 8,000 km² of trees were planted. Due to the economic crisis, however, the expected rate of reforestation slowed. The project has been extended and it is

⁷ A dominant family of trees

⁸ World Bank 2000



expected that the goal will be met by the end of 2004 (Fig. 3). The consumption of paper for packaging, newsprint and other media (e.g. books) has increased, which has stimulated the expansion of fast-growing, high-yielding plantation areas to support the pulp and paper industry.

Reforestation projects often have unclear aims, but from a biodiversity perspective it is important to assess how increases in the area of forest plantations impact the landscape, its biodiversity, and the local people. Forest plantations that increase the supply of NTFPs⁹ to rural communities will help to alleviate poverty, for example, it is clear from Figure 4 that the incidence of poverty is often high in the remoter areas where forest remains, especially in northern Thailand. These benefits will reduce the ultimate costs of government projects designed to help the poor. However, it seems that most plantations have limited ecological benefits and are designed almost exclusively to supply industrial needs, or to produce goods for export. Yet biodiversity benefits could be increased if plantations were planned at the landscape level (i.e. considering the wider context and different land uses). For example, different combinations of trees and under-storey plants (designer forests) could be devised to link protected areas (PAs), extend the forest cover around a small protected areas, or established a relatively biodiverse island of created 'forest' in a sea of arable agriculture. The Forest Restoration Research Unit at Chiang Mai University is developing techniques to restore natural forests on degraded land specifically to enhance biodiversity¹⁰, and it is hoped that this and other research will contribute to a richer and more diverse tree cover under future plantation investments.

Natural regeneration processes should be allowed to restore areas that have become over-utilized, polluted, or degraded. So long as sources of seeds are close enough, forests (and indeed other natural systems) have great capacity to restore themselves if given the chance, and to do so without heavy investment. As the His Majesty King Bhumipol Adulvadej remarked after visiting a project in

Figure 3. Growth in reforestation area over the last 15 years. (RGJ is Royal Golden Jubilee Project, see text).

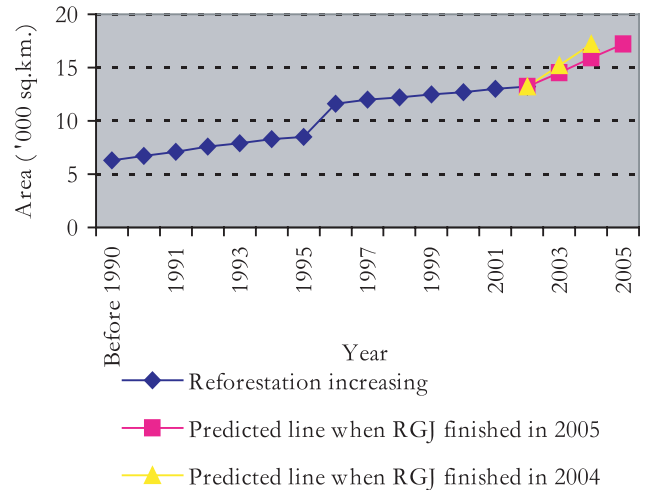
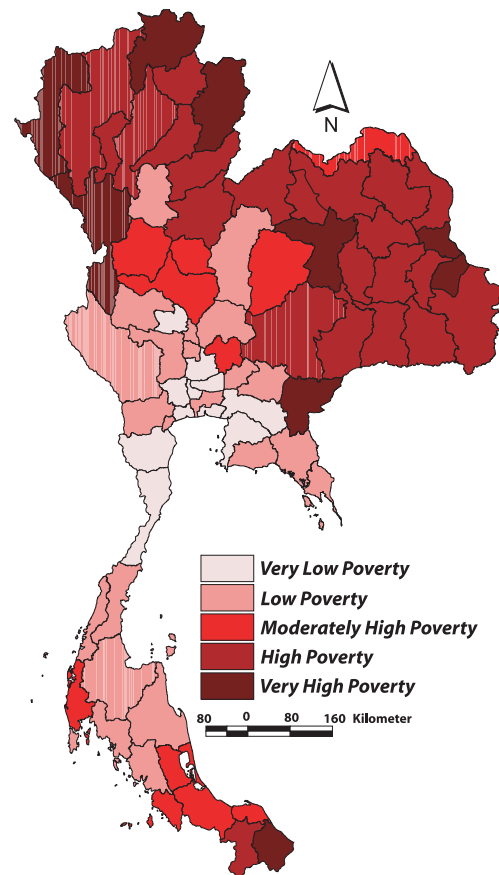


Figure 4. Distribution of poverty across Thailand



Source: UNDP 2002

⁹ RECOFTC 2001

¹⁰ Elliot et al. 1998

Rajburi Province: “That project was begun about seven years ago. I went to see it about two years ago, after the forest had been left on its own for five years. There, nothing has been done, but the forest had regenerated and become a luxuriant forest. Not a single new tree had to be planted. That means that reforestation can be done mainly by leaving the forest alone; the trees will grow by themselves. In other words, don’t disturb the trees; don’t ill-treat the trees. Just give them some protection and they will grow by themselves”.¹¹ This approach is already part of the management rationale behind the WEFOM landscape and should be pursued in other PA clusters.



Reforestation program executed by the private sector for the King (photo by PTT)

LIMESTONE ECOSYSTEMS

Often disregarded, limestone ecosystems - both caves and hills - are in fact important biodiversity hotspots which are under pressure from small- and large-scale quarrying for cement, lime and hardcore. Increasingly, people from villagers to planners are recognizing their values.

Small hotspots of biodiversity ...

Limestone hills occupy less than five percent of Thailand’s land area, and are found in 16 major clusters across the country. Limestone supports an intriguing flora and fauna which has adapted to demanding habitat conditions. The vegetation has evolved the ability to withstand long periods of drought and an almost complete lack of soil. Plants acquire a tenacious foothold in small crevices where moisture and small quantities of nutrients from decomposing leaves are available. As the roots and stems grow so they often sheer off parts of the rock face. Plants thus help carve away at the rock in much the same way that water expanding into ice splits rock in colder climates.

Among the many plant species that grow on limestone are primitive cycads, slipper orchids, begonias, and fan palms (at least one of which is endemic to Thai limestone hills). Thailand’s endemic limestone flora also includes 34 species of ferns, and 28 species of flowering plants. There are even some species of figs which are able to colonize limestone environments and these provide an abundance of small fruits for numerous species of birds and primates.

Among the endemic animals found in or on limestone hills are two rats (Neill’s rat *Leopoldamys neilli* and Limestone rat *Niviventer hinpoon*), and at least seven cave fish. These exhibit different degrees of extreme adaptation to the pitch blackness in the caves such as no eyes, no pigment, and long appendages. All but one of these fish species appear to be restricted to a single cave system, and one of those, *Cryptotora thamicola*, crawls out of the water and over rocks beside waterfalls. But the richest,

¹¹ From an address given to well-wishers on the Royal Birthday Anniversary at Dusit Palace, December 4, 1994



most diverse animals with the highest rates of endemism are the snails. For example, the small pupillid snails are easily found living on limestone walls but some unusual species occur in the total darkness of caves. Recently nearly 100 species were reported from a number of Thai caves, and half of them were new to science.

Threatened by quarrying ...

The Department of Mineral Resources has shown that more than 20 percent of limestone hills in Thailand have been quarried for cement, lime, and hard core for roads, and some of them have disappeared from the landscape. The precise impacts of these activities on biodiversity have not been systematically measured but it seems as though at least the critically endangered cycad *Cycas tansachana* has declined precipitously in numbers and populations at its only known site in Saraburi, and the rarest endemic snail species occurring in lowland limestone hills in central Thailand, *Antroapiculus pendulus* and *Montapiculus proboscidea* have become endangered.



A quarry site in Saraburi Province (Photo by Somsak Panha)



Two endemic crown snails found only in southern Thailand (Photo by Somsak Panha). The two crown snails, *Macrochamys diadema* and *M. asamurai*, are beautiful in both shell structure and color. These two species are endemic to a few small limestone areas in southern Thailand, but they are not yet threatened.

Box 7: Minimizing impacts of limestone quarrying on biodiversity

Experience has shown that sites for limestone quarrying should¹²:

- avoid isolated limestone hills (remote from other limestone hills) since such hills are usually rich in site-endemic species;
- be located in the largest limestone areas, and leave a substantial part of it untouched;
- be located in limestone deposits that have already been impacted by other use, or by accidents;
- be dolomitic limestone and/or limestone with limited natural erosion if possible;
- where one large quarry affecting part of a limestone area can replace a number of small quarries throughout the area;
- be at the foot of limestone massifs to avoid unnecessary damage.
- avoid sites with caves, small voids, underground streams and springs.
- be placed to control sedimentation in stream and local drainage systems.

¹² Vermeulen and Whitten 1999

Box 8: Values of limestone ecosystems

1. **Mineral products:** aggregate for concrete construction, cement, marble, filters, animal feed supplement for poultry, lime dressing for acidic soil improvement etc.
2. **Natural products:** birds' nests, guano, ornamental plants and medicinal plants;
3. **Clean water:** Source of freshwater for small scaled and medium size agriculture.
4. **Scientific:** flora and fauna, much of which remains to be investigated;
5. **Scenic and tourism:** landscapes inspire and promote tourism notably in Krabi, Loei, Doi Chieng Dao at Chieng Mai;
6. **Cultural:** religious sites and festivals at the caves, and legends associated with particular hills;
7. **Historic:** paleontological and archeological sites, extending into the historical period in Mae Hong Son areas and 23 sites of cave art, rock art or pictographs throughout Thailand, dated roughly about 5,000 to 3,000 years ago.

Box 9: Local communities and the conservation of limestone hills

Limestone hills close to Bangkok are under pressure for quarrying. However, in 2002, villagers in Saraburi Province, protected Pra Put Ta Bat Noi limestone hill from being destroyed - a landmark achievement. Four villages with a total of about 1,000 households formed a network to protect 960 ha comprising the hills and its surroundings, using the traditional cooperation between villages, temples, and schools. As a result, endemic flora and fauna have been protected, such as the Limestone Wren-babbler *Napothera crispifrons*, Serow wild goats, Dragon plant *Dracaena loureiri*, and a slipper orchid *Paphiopedilum sp.* The villagers see not only the value of their unique flora and fauna; they also evaluate the benefits they receive from the limestone hill. They obtain food, herbal medicine, and water from the hill; it has been estimated that at least 13.5 million liters of spring water with a value of 54,000 baht per year were provided to 50 households living next to the hill. The local community has decided to protect the hill, and to stop burning, cutting trees and collecting rare plants from the hill. They are also using water from the hill for commercial drinking water, and are promoting local ecotourism.



The Limestone wren babbler *Napothera crispifrons* is confined to limestone hills. This race, *calicola*, is confined to Saraburi, Lopburi and a small part of Nakhon Ratchasima Provinces (Photo by Kanit Khanikul)



FRESHWATER ECOSYSTEMS

Thailand's freshwater ecosystems – rivers, swamps and ponds - provide livelihoods for millions of its citizens. The range of their products used by people is remarkable, as is the diversity of species that live within them. However, all but the most resilient of species are under pressure from land use changes and changes to waterways.

Thousands of wetlands ...

There are six major river systems in Thailand: the Salween and MaeKlong in the west, the small rivers of the southern Peninsula, the southeastern rivers, the Chao Phraya of the central plain and north, and the Mekong River. A total of 42,653 wetlands have been counted (Table 3), the majority of which are riverine habitats and tributaries. Sixty-one major wetlands are considered to be of international importance, and 208 of national importance. The most famous freshwater wetlands are Phru Khuan Khi Sian in Phattalung Province, Bung Khong Lon in Nong Khai Province, and Nong Bong Khai in Chaing Rai Province.

With hundreds of fish and other animals ...

There are about 606, 63, 50 and 12 species of freshwater fish, crabs, shrimps and turtles known from Thailand, although further surveys would doubtless reveal more. The Mekong harbors one of the world's most diverse and rich fish faunas with about 570 species known (see also Table 4). Loss of forest cover in the foothills resulting in loss of organic inputs and overly warm water, damaging fishing methods, agricultural chemicals and overfishing have caused the abundance of many fish to decline over the last few decades, with inevitable economic, health and social impacts on the riparian villagers, especially among the poorest segments of the communities who rely on these 'free' goods.

Table 3. Number of different wetlands.

Wetland System	Number
Rivers and tributaries	25,008
Lagoons	14,128
Lakes and flooded plain	1,993
Coastal wetlands	1,256
No classification	268
Total	42,653

Source: ONEP 1999

Table 4. Fish species richness in selected river systems.

River system	Number of species
Salween	110
Southeast Thailand	120
Chao Phraya	250
Mekong (Thai portion)	289

Source: Vidthayanon et al. 1997



Wild capture fisheries are very important to people living along larger rivers (Photo by Zeb Hogan)

Box 10: The (terminal?) decline of the Mekong giant cat fish population

The sight of fishermen at Chiang Khong district, Chiang Rai province, capturing Mekong giant catfish (*Pangasianodon gigas*) of up to 3 m in length and 300 kg was very popular among Thai people. The total number of these enormous fish captured between 1981-1999 was 450, with a peak of 69 in 1990¹³ - but numbers have declined and there have been none captured since 2001. Spawning adults migrate up the Mekong river each year and arrive in northern Thailand in April or May.

Since 2003, their IUCN Red List status has been raised from 'endangered' to 'critically endangered'¹⁴. It has also been listed as an Appendix I ('no trade') species under CITES. Due to their transboundary migratory behavior, their conservation requires international cooperation. In 1994, Wildlife Fund Thailand initiated a project to raise public awareness of the fish's plight among countries where they are found. Representatives from Thailand, Lao PDR and Cambodia got together to find out about what is known about the fish and their conservation needs.

The main issue that arose was how very little is known about their natural migratory activities and spawning behaviors. Due to limited technical ability and little interest among various stakeholders, very little happened until 2000 when a catch-and-release project was initiated, mainly in Cambodia which is now the last place in the world where the giant catfish is captured on a regular basis¹⁵. To maintain the natural breeding pattern, the connectivity between spawning grounds and nursing areas is absolutely vital. In the meantime, the Thai Department of Fisheries has concentrated on artificial breeding, cryo-preservation and *in vitro* fertilization, and they have successfully released fry in various places since 1983. Unfortunately, there is no evidence that artificially-reared catfish have ever bred.



A Giant Catfish being taken to market. (Photo by Zeb Hogan)

Bangkok's Chao Phraya has biodiversity value ...

The 380 km Chao Phraya is the life blood for northern and central Thailand including Bangkok. Despite its socio-economic value and the very large agricultural area which it serves, the Chao Phraya basin has maintained a high diversity of fishes from which local communities can earn an average income of 88-134 baht per day. At least 329 fish species can be found in the Chao Phraya and its tributaries, among them ten threatened species, one of which, the freshwater 'Batfish' (*Oreoglanis siamensis*) is endemic. When ONEP conducted the National Inventory of Wetlands in Thailand Project in 1995, the Chao Phraya River was listed as one of 48 wetlands of national importance.

Within the Chao Phraya basin are a number of significant wetlands. Bung Boraphet, Nakhon Sawan Province, is a large (212.38 km²) freshwater lake which is in the flight path of various migrant birds and some 20,000



Bung Boraphet is a potential candidate to be designated as a Ramsar Site of International Importance (Photo by P.D. Round)

¹³ Meng-amphan 2002

¹⁴ IUCN 2003b

¹⁵ Hogan et al. 2004



birds of more than 187 species nest here. About 150 fish species are recorded from the lake¹⁶. Not surprisingly, Bung Boraphet is a potential candidate to be designated as a Ramsar Site of International Importance. Bung Boraphet also has a high economic value to villagers who live around it. Fishers have an average annual income of 11,460 baht, and the annual catch of fish reaches 400-500 tons.

Watershed management tends not to consider biodiversity ...

Watershed management needs to incorporate more biodiversity elements than just forest cover, and more needs to be understood about biodiversity, ecosystem function, and their role in peoples' livelihoods. Water is obviously very important for various human activities, and serious conflicts in water use can arise among the various stakeholders within any given watershed. Large projects in Thailand are typically planned in a relatively top-down fashion with inadequate consideration of how villagers' lifestyles depend on traditional uses of water. Success stories of sustainable and people-centered projects tend to be found in small-scale community-led projects that involve participatory planning and management. Even in these, however, biodiversity management tends not to be addressed.



Even traditional water management systems such as this wooden dam in northern Thailand give little thought to biodiversity, but their replacement with concrete equivalents have greater impact (Photo by S. Srikosamatara)

COASTAL AND MARINE ECOSYSTEMS

Thailand's long coastline, sizeable sea areas and varied habitats are home to a host of species (Table 5) many of which are of considerable economic importance either through direct exploitation or through the tourism that is attracted to coral reefs and beach habitats. However, past exploitation has compromised the capacity of these areas to produce generous sustainable yields of a range of products (Table 6, 7).

Table 5. Number of Thai species in four groups of marine life

Taxonomic group	Number of species
Sponges	50
Hard Corals	270
Soft corals	15
Sea fans	16

Source: Thumrongnavasawat and Tipanan, 1998

Table 6. Area (sq. km.) used for coastal aquaculture

1985	1995	2000
374	716	715

Source: NSO

Table 7. Number of households in each year dependent on marine and coastal resources

Major activities	Number of households		
	1985	1995	2000
Marine fishery	51,702	52,116	56,859
Coastal aquaculture	5,889	28,588	37,045
Total	57,591	80,704	93,904

Source: NSO

¹⁶ ONEP 2002c, Jintanukul 1993

Many types of habitats ...

The Gulf of Thailand and the Andaman Sea, have total areas of 304,000 and 116,280 km², respectively. The total coastline in Thailand is about 2,600 km, with 1,650 of this being in the Gulf of Thailand. In the peninsular South, the western coast has been submerged while the east coast has been uplifted. Less regular shorelines, more bays and more islands are found in the west, and there is a considerable range of coastal habitats - head lands, marine terraces, tidal flats, mud flats, sand dunes, runnels, estuaries, deltas, lagoons, marshes, swamps and off shore bars – each of which harbors a different suite of biodiversity.

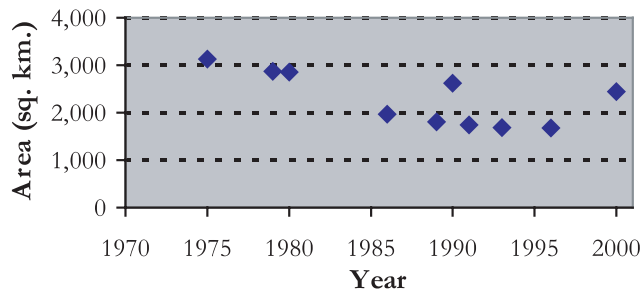
Mangrove forests are under pressure ...

Mangrove forests comprise up to 35 species of plants – about 25 of them trees - but the species composition depends on the soil type, tide characteristics, distance from the sea, salinity and degree of disturbance¹⁷. They are thus relatively simple communities and are able to exploit the ever-changing dynamic of the interface between the marine and terrestrial worlds. They have high productivity, as shelters and nurseries for many aquatic animal species, as important food sources for commercially important species, and as physical protection for coastlines against strong winds and waves. Coastal communities can earn income from mangrove forests by gathering charcoal, poles for scaffolding, fuelwood, medicinal plants, tree bark for tannin production, fish, shrimps, crabs, mollusks, and honey. These special forests used to cover about 3,680 km² in 1961, but by 2002 there were only 2,400 km² (and possibly less) remaining, and much of that was poor quality. The major causes of loss of mangrove forest in Thailand are timber and charcoal industries while some areas were converted for urbanization, agriculture and – between 1985-1990 in particular – aquaculture (Figure 5).



Large areas in the coastal zone have been converted to aquaculture (Photo by P.D. Round)

Figure 5. Decline in the area of mangrove forest



Sources: Royal Forest Department and National Statistical Office, 1980 and 1990 data from <http://www.fao.org>



Mangrove reforestation by PTT.

¹⁷ Aksornkoe 1993



Economic value of mangrove forest high ...

High financial returns have attracted people to convert mangrove forest to intensive shrimp farms. Thailand earns more than \$1.2 billion annually from exporting frozen shrimps, and so commercial shrimp farming is expanding by about 6,000 ha per year, with serious impacts on coastal communities, mangrove forest and its wildlife. An interesting study in Surat Thani Province, southern Thailand, showed that the economic benefits of conserving mangrove forest are significantly higher than the economic returns of intensive shrimp farming¹⁸.

The tide is turning for mangroves ...

After some major reforestation projects the area under 'mangrove forest' is increasing, although the original levels of biodiversity do not seem to be regained, perhaps because of the small range of species planted. In 2003 a broad mangrove project was initiated to commemorate the 72nd birthday of Queen Sirikit. The project has the goal of managing 115,000 ha of mangrove in 23 provinces, including reforestation and the setting aside of 48,000 ha of good quality mangrove as PAs. In late 2004 a five-year Action Plan for Mangrove Management in the Gulf of Thailand was established. This has five main elements¹⁹:

- Conservation and restoration to increase the area under mangrove trees,
- Promotion of sustainable use of mangrove resources,
- Coordinated participation in the development of the mangrove resources
- Databases and research to help conserve, restore, and use mangroves sustainably
- Evaluation and monitoring of the results of mangrove management.

Responsibility for different sets of actions fall to DMCR, local government organizations, academic institutions, schools and communities which will be judged against a set of performance indicators.

Seagrasses, productive underwater meadows ...

There are about 104 km² of seagrass meadows in Thailand comprising some 12 species in seven genera. They are highly productive and serve as a feeding and nursery area for many marine animals, some of which also provide food for humans. Most seagrasses are found in rela-

Table 8. Coastal zone affected by coastal erosion generally as a result of the loss of mangrove forests, seagrass meadows or coral reefs. More than 5 m loss/year is considered as very severe while 1-5 m loss/year is less severe.

Severity level	Coastal length (km)	
	Gulf of Thailand	Andaman Sea
Very severe	180.9	23
Less severe	305.1	90.5

Source: DMCR 2004

Table 9. Abundance and percentage cover of seagrasses around Thailand's coasts

Status of seagrass	Percentage cover	Area (km ²)	Percent
Very healthy-healthy	>60 - 100	62	60
Fair	40 - 60	21	20
Degraded	5 - <40	21	20

Source: Data from PMBC

tively shallow water (1-7 m), although they can grow down to 30 m depth in the offshore islands where water is clearer. Dense seagrass meadows, mangrove forests and coral reefs can provide protection against shore erosion (Table 8).

Although most seagrass meadows are in good condition (Table 9), these meadows have suffered from inshore pushnets and trawlers as well as from pollution and eutrophication from tourist resorts. A recent campaign on seagrass conservation included the following:

- Building public awareness and giving education on seagrass conservation to various stakeholders including local people and fishermen so that they appreciate the importance of seagrass ecosystems as nursery grounds, shelter and feeding habitat for marine life;
- Eliminating all fishing methods which degrade seagrass beds and promoting fish traps and gill nets;
- Zoning seagrass areas to preserve feeding habitats for dugongs and sea turtles and also reduce conflict between small scale fisheries and commercial push nets and trawlers; and
- Improving law enforcement and participatory management between government officers and local volunteer for coastal resource watchers.

¹⁸ Sathirathai & Barbier 2001

¹⁹ UNEP/GEF/SCS 2004

Coral reefs – ‘rainforests of the sea’ ...

Coral reefs are sometimes called the ‘rainforests of the seas’ because of the profusion of different life forms in staggering abundance. All these species interact with each other to form extremely complex and little-understood communities. Coral reefs are made up of the compacted and cemented skeletons and skeletal sediment of sedentary organisms which are then smothered by other organisms – up to seven phyla of both sessile and mobile invertebrates (such as corals, worms, mollusks, sea squirts, sea stars and bryozoans) - in a single area of reef. The outermost layer of a coral reef is living tissue comprising primarily hard corals and algae with their tissues impregnated with limestone.

As is well known, the exquisite beauty of undisturbed reefs can be marketed and this has made them extremely, and increasingly, valuable to the tourist industry. Indeed, Thailand promotes the excitement, wonder and fulfillment of diving or snorkeling over reefs as one of their major attractions for domestic and foreign tourists. The diving off Thailand is world class, and thousands of people, including many internationally-respected experts, go there each year solely to dive, having no interest in other aspects of Thailand or its culture. But it is not just their beauty which is notable because they protect coasts from erosion, and many of the larger animals and plants associated with them have major direct and indirect economic value.

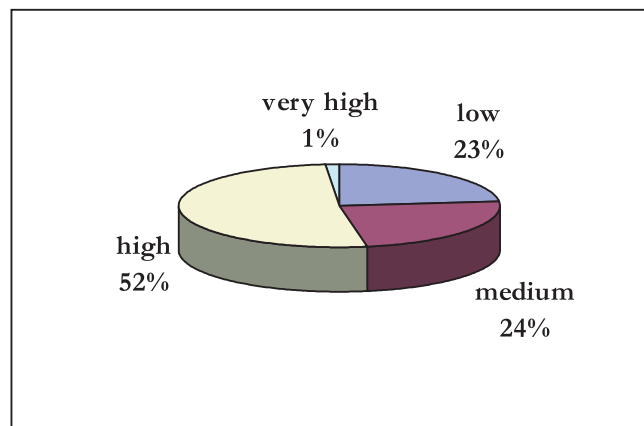
There are 154 km² of coral reef in Thailand divided into 79 km² around 130 islands and a few mainland locations in the west, and 75 km² around 250 islands in the Gulf of Thailand.

Like forests, coral reefs are under pressure ...

The status of coral reefs west and east of Thailand in 2002 is shown in Fig. 6. From 1992 to 2000, reef conditions deteriorated, especially in the Andaman Sea. Coral reefs in the western part of the Gulf of Thailand have fared better (Fig. 7). Both natural and man-made factors damage the reefs. The natural factors include:

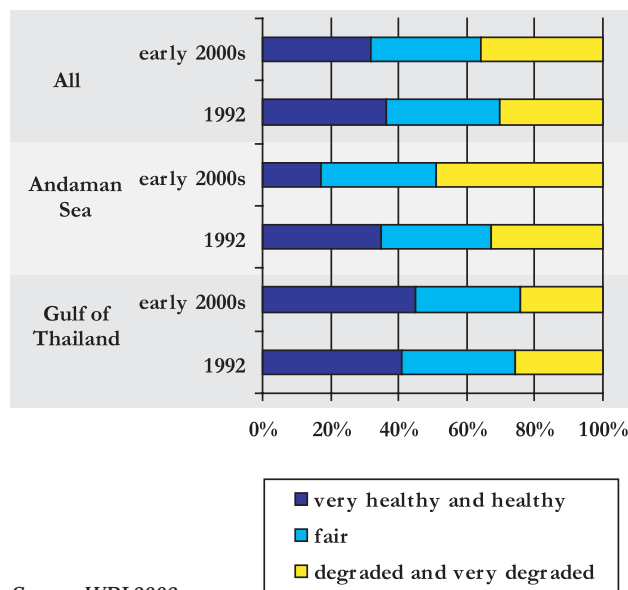
- Catastrophic storms such as the southwest monsoon in the Andaman Sea in 1986, and Typhoons Gay and Linda in the Gulf of Thailand in 1989 and 1997.

Figure 6. Thai reefs at risk in 2002. (Total reef area = 1,787 km²)



Source: WRI 2002

Fig 7. Change of coral reef area and status in Thailand during 1992 and the early 2000s.



Source: WRI 2002



- Periodic outbreaks of the crown-of-thorns starfish (*Acanthaster planci*) in the Andaman Sea during 1984-1986.
- Increases in sea temperature in 1991, 1995, 1998 and 2003 which caused coral bleaching in the Andaman Sea and the Gulf of Thailand. Coral bleaching in 1991 and 1995 caused 10 percent coral mortality in the Andaman Sea while the reefs in the Gulf of Thailand were severely damaged by coral bleaching in 1998.

The human factors include:

- Sedimentation, such as at Phuket Island in the Andaman Sea in the 1980s, caused by off-shore tin mining.

- Damage caused by anchors of tour boats. Mooring buoys have now been installed in most tourist sites. This has effectively reduced the impact from anchoring. Trampling on corals in shallow water by snorkelers and boat groundings are still major factors causing reef damage.

Dynamite blasting for fish was common in the past but it is now illegal and rare. However, fishing for trash-fish (for animal feed), nets covering coral reefs and coral trampling by fishermen searching for shellfish are still common.

Box 11: Songkhla Lake Development Project

Songkhla Lake in the south of Thailand was formed by the natural enclosure of an off-shore sand bar in the Gulf. It is 80 km long and 20 km at its widest with a total area of 974 km², and actually comprises a series of four interconnected lakes called Thale Noi, Thale Luang, Thale Sap and Thale Songkla. Freshwater flows into the northern end, and changing tides bring sea water into the outlet at the southern end. The lake drains a basin of 8,495 km². Forty species of fishes, 30 species of freshwater and marine shrimp, and Irrawaddy dolphin occur in this shallow (about 4m) lake. A new species of small crustacean *Pagurapseudopsis thailandica* was recently been discovered here. About 1.3 million people live around the lake, many of them fishermen using traps and push nets. Over-fishing, industrial development and pollution are harming the lake.

In 2002 the Thai Government initiated a mega-project to improve the lake by deepening it, and also initiated a major tourism project around it. The controversial action of blocking the tidal flow through the lake to make it more fresh has adversely affected fishes and the endangered Irrawaddy dolphin. The deepening of the lake floor is disturbing the demersal animals e.g. a crustacean: *Apsueudes sapensis*, which are important in the food chains of the lake, and it is clear that the production of fishes and other animals adapted to the daily and seasonal flows of water and living things will fall.



Part of Songkhla Lake is becoming shallower (Photo by S. Srikosamatara)



This new species of small crustacean *Pagurapseudopsis thailandica* was recently discovered in Songkla Lake (Photo by S. Aungsupanich)

Box 12: Coastal Habitats and Resources Management (CHARM) Project

The use of coastal habitats for capture fisheries, aquaculture and tourism has intensified in the last two decades of rapid economic growth. Activities tend to be carried out in a largely unrestricted manner, with free access to habitats and resources, a lack of regulatory supervision and enforcement, and an extensive but non-integrated legislative framework that hampers effective management. As a result, Thailand's coastal biodiversity is being rapidly degraded and social conflicts over resource use have increased. Urgent action was needed to support and encourage environmentally sustainable coastal resource use and habitat conservation. It was within this context that in 2003 the Coastal Habitats and Resources Management (CHARM) Project of the Thai Department of Fisheries (DOF) was developed, with financial support from the European Commission (EC).

CHARM seeks to develop a co-management approach to coastal resource management among the RTG, the private sector and local communities in two areas of southern Thailand: Ban Don Bay in the Gulf of Thailand, and Phang Nga Bay in the Andaman Sea. However, unlike traditional sectoral projects, which address only fragments of the issues, CHARM integrates all important aspects of coastal management. This comprehensive project aims to integrate science with policies, bottom-up with top-down resource management approaches, large- with small-scale management, and short- with long-term time scales, and to enhance integration among the different sectors and disciplines, which have a stake in coastal resources. The project works at building a core group of professionals that can sustain a coherent co-management process into the future. The goal of CHARM is to promote a process that involves all stakeholders in managing the biodiversity and other coastal resources of these two areas, a process that could in due course be extended to other coastal areas of Thailand.

Source: Henocque & Tandavanitj 2004

THREATENED SPECIES

The loss of habitats and the continued pressure on them, together with hunting and gathering of specific species of animals and plants has resulted in large numbers of Thailand's animals and plants becoming threatened with extinction. One large mammal, the endemic Schomburgk's deer *Cervus schomburgki*, has already become extinct, mainly because of uncontrolled hunting.

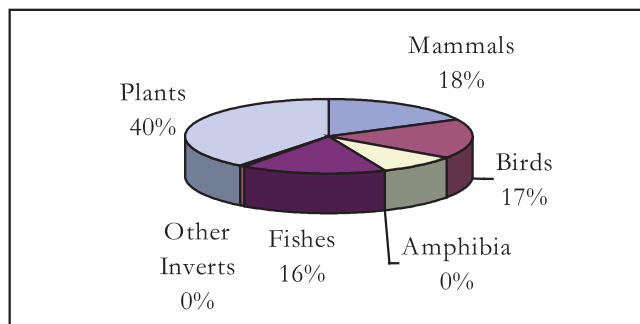
Increase in number of threatened species ...

In 2003, the list of threatened²⁰ species of Thai plants and animals included 84 plants, 37 mammals, 37 birds, 19 reptiles, 35 fishes, and 1 mollusk²¹ (Fig. 8). The number of threatened and endangered species has greatly increased during the last decade (Fig. 9). Perhaps the saddest news is that illegal shipments of pangolins to China from south Thailand and Indonesia seem to continue almost unabated. However, there is good news as well as bad news for wildlife conservation in Thailand.



Antlers of an extinct species, Schomburgk's deer, in a private museum (photo by S. Srikosamatara)

Figure 8. 2003 Threatened plants and animals (Total species = 213)



²⁰ 'Threatened' species are those whose populations are under some pressure and causing concern. 'Vulnerable', 'Endangered', and 'Critically Endangered' define levels of threat.

²¹ IUCN 2003a



For example, the gaur, a large forest ox, has recovered in areas where poaching has stopped, and this shows how, if pressures are reduced, many species' own natural resilience can help build new populations.

Populations of pileated gibbons continue to decline ...

Pileated gibbons are found mainly in SE Thailand and Cambodia, although a small population can be found in southern Lao PDR. In 1987, the total area of Pileated gibbon habitat, closed canopy forest, in Thailand was about 6,258 km², which was estimated to be 30-40 percent of the original area available to them. It was estimated then that within this reduced area there were 7,500 breeding groups. Since 1987, the area has been further reduced to 2,000-3,000 km² (Fig. 10). The hunting pressure has also been high, as NTFP collectors often trap and shoot them while camping in the forests. This affects serious impacts on gibbon populations because of their slow reproductive rate and monogamous habit.

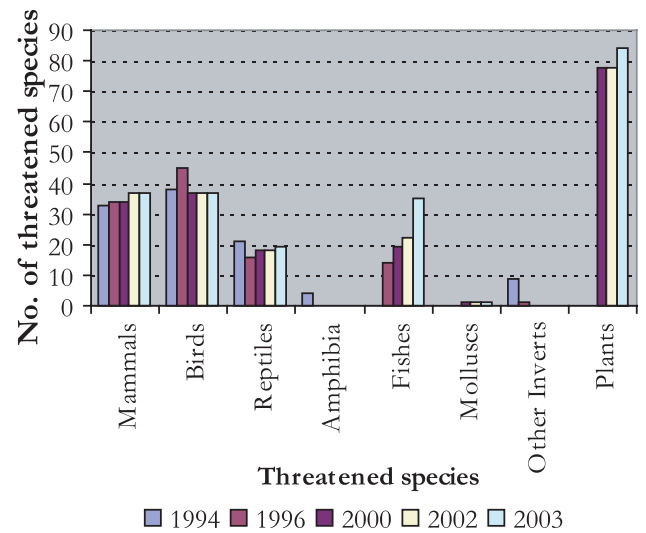
Wildlife for economic gains – but ...

The decline in wildlife populations has made some people think about captive breeding and reintroduction as possible solutions. The idea of captive breeding of animals and cultivation of plants for commercial purposes has been advocated as a strategy to reduce the hunting/collecting pressure on wild species, and has been stimulated by the success of a few wildlife breeding programs, e.g. crocodiles and orchids (both of which have high direct-use economic value) for commercial purposes. However, there are no clear indication of gains for conservation in these programs. Nevertheless, the idea of breeding programs has been supported by government officials, who see them as a possible source of income for villagers living close to PAs. The present policy now is to permit certain species to be bred for commercial purposes but, again, there is little indication that wild populations benefit.

Wildlife is still traded illegally across borders ...

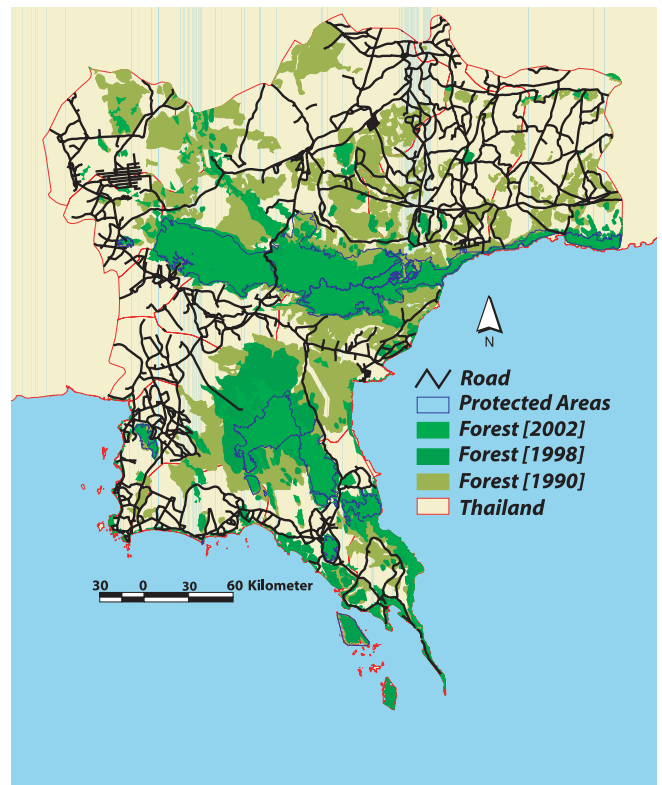
Wildlife used to be a major export of Thailand, for example, there are historical records of a major trade in deer skins. This intense exploitation is likely to have been a major factor in the decline of three species of deer in Thailand: Schomburgk's deer (now globally extinct), Eld's deer and hog deer (both still found in small num-

Figure 9. Numbers of threatened species in Thailand



Source: IUCN 2003a

Figure 10. The dramatic reduction of forest cover in SE Thailand has had serious consequences for lowland forest species such as the pileated gibbon



Source: UNDP 2002

bers outside Thailand). Thailand has for a long time been a trans-shipment country, and a direct consumer of wild-life products from neighboring countries. A recent example of the size of this trade is given by the numbers of Asian anteaters or pangolins having been confiscated, 21,654, in the three years up to March 2004 (Fig. 11).

But gaur population is recovering at Khao Yai NP ...

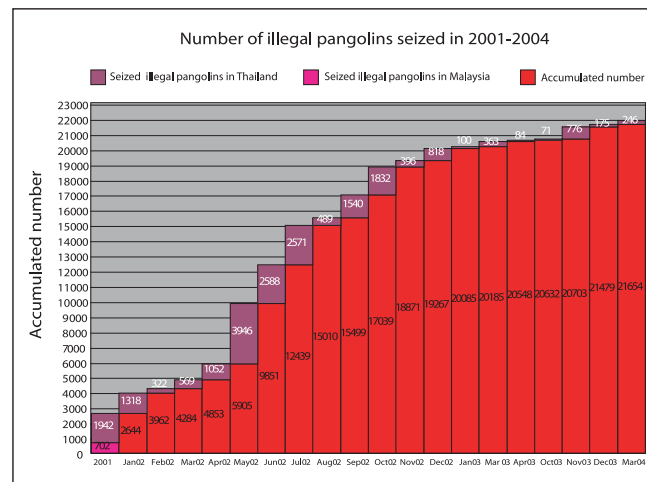
Asia's largest wild cattle, the gaur *Bos gaurus*, number around 1,000 in the whole country. The species is classified as 'Vulnerable' in the IUCN Red List. The Thai population is highly fragmented, with major herds in Thung Yai and Huai Kha Khaeng WSs, and in the surrounding PAs that comprise the Western Forest Complex. In 1991 Khao Yai NP was home to only about 100 gaur, but the NP is currently estimated to support a gaur population of 100-200. As the secondary growth areas they favor were better protected so the population increased. Although they are occasionally reported to be poached, the recovery of the herd at this northeast corner of Khao Yai marks a success of the joint management of PAs (JoMPA) by government, locals, and NGOs.

World Heritage Site ecosystem management ...

The Western Forest Complex is the last major stronghold for viable populations of globally threatened and endangered fauna and flora in mainland southeast Asia. With 17 contiguous PAs totalling over 18,000 km² and a total forest cover of over 80 percent, the Western Forest Complex is one of the largest protected area systems in the region. The core area, Thung-Yai and Huai Kha Khaeng WSs, has been a UNESCO World Heritage Site since 1991.

In 2000 the Western Forest Complex (WEFCOM) Ecosystem Management Project was launched as a collaborative project between the Thai and Danish Governments, local academics, local communities, and NGOs. The aim is to encourage Complex-wide planning and collaboration among stakeholders sharing a common concern over the long-term status of the region. The project has produced first-rate tools such as comprehensive GIS maps with reliable distributions of fauna and flora and human settlements, and has stimulated the formation of

Figure 11. Numbers of pangolins confiscated in Thailand during the past two years (Data compiled by S. Srikosamatar). The purple indicates annual confiscations, the red the cumulative totals.



the provincial conservation forums for stakeholders to discuss matters related to WEFCOM conservation and management.

Marine species also under threat ...

Several fishes, spiny lobsters, giant clams, sea turtles, dugong, dolphins, and whales are among the threatened marine species for which Thailand shares responsibility and concern. The main threats are local and commercial fishing activities. The total population of the vulnerable dugong in Thai waters is about 200, but about 12 animals are found dead each year, mostly as a result of accidents with nets and propellers.

Twenty-three species of dolphins and whales have been recorded in Thai waters. Rare species include Indo-Pacific Humpbacked dolphin, Bryde's whale and Pygmy killer whale. The popular Irrawaddy dolphins are threatened by a number of pressures, including gill nets, fish traps and marine theme parks (as display animals). One of the proposals by the Thai government during the recent Conference of the Parties to the Convention on the International Trade in Endangered Species (CITES), which was approved by the other delegates, was a ban on trade for display.



3

CONSERVATION PLANS AND PRACTICE

CONSERVATION PLANNING

National Biodiversity Strategies and Action Plans ...

Two National Biodiversity Strategies and Action Plans (NBSAP), have been produced by the Biodiversity Section of ONEP, for the periods 1998-2002 and 2003-2007²². The first five-year plan contained 446 proposed projects with a total cost of \$140 million to be implemented by 67 agencies using internal funding. Unfortunately, due to the economic crisis in 1997, almost nothing of the first plan was implemented. For the second plan, the estimated budget is 7.54 billion baht (or \$188.5 million) and the status and success of NBSAP is to be monitored by the National Committee is emphasized. Its priorities are:

- Building capacity of institutions and their staff,
- Enhancing the efficiency of PA management,
- Improving the incentives for conservation at the local level,
- Conserving species, populations and ecosystems,
- Controlling and monitoring processes and activities that threaten existence and richness of biodiversity,
- Promoting management of biodiversity in urban, rural and traditional cultural environments, and
- Promoting cooperation between international and national institutions.



Two NBSAPs published by ONEP in 1997 and 2002.

National Wildlife Management Master Plan 2004–2013

Over its first year MoNRE has prepared a number of plans to address biodiversity conservation, as well as forest management and restoration, PAs, comprehensive water management, and wildlife (below).

In 2003-2004, the government set up a broad committee to draft the '*National Wildlife Conservation Master Plan*'. Previously wildlife conservation in Thailand had been executed under the 'Wildlife Preservation and Protection Act', no master plan had ever been available to guide national activities, set targets, and evaluate results. The duration of the plan was set for 10 years and the proposed budget was estimated to be \$450 million. The plan contains four approaches, 18 strategies, and 40 proposed projects. The 'approaches' are, 1) wildlife study, research, and databases; 2) integrated wildlife conservation and management; 3) conservation of diverse wildlife species and habitats; and 4) sustainable wildlife utilization. At the project level, each activity is specified with respect to objectives, duration, budget, evaluation indicators, and involved agencies. The Master Plan will be presented to the Cabinet for approval in late 2004.

What could be BETTER as a result of the master plan?

If the plan is followed it should ensure:

- **better** wildlife management based on research and technology both in situ and ex situ,
- **better** collaboration by strengthening joint research and management among government agencies, academics, NGOs at national and international levels,
- **better** administration and law enforcement by reforming wildlife conservation agencies' structure, amending the wildlife laws, improving welfare of law enforcement officers and guards,
- **better** expertise by improving technical capacity of wildlife managers, researchers, and NGOs' members
- **better** welfare for wildlife by launching population and habitat rehabilitation, restoration, and re introduction programs for threatened and endangered species,
- **better** wildlife farming systems by approving and supporting qualified, large and small scale enterprises for certain species, and

²² ONEP 1997, 2002d, Vivajsirin et al. 2002



- **better** local utilization by promoting wildlife population management by local communities outside PAs.



Various drafts of National Wildlife Management Master Plan 2004-2013.

MANAGING PROTECTED AREAS

Protected areas (PAs) are the cornerstones of conservation without which the fullest possible range of biodiversity has little chance of enduring.

A solid foundation of staff ...

Thailand's PA system was created by legislation in 1961, and has developed a high degree of professionalism and growth. The system was modeled according to IUCN guidelines, and its officials must have university educations and pass competitive civil service exams. Many officials have had graduate training abroad. Guards and rangers also receive special technical training to assist them in their duties, although greater professionalism could be developed in conservation crime investigation and law enforcement.

A solid foundation on land ...

Thailand has 102 national parks, 55 wildlife sanctuaries and 55 non-hunting areas covering 48,000, 36,000 and 4,450 km² respectively totalling just under 18 percent of

the total land area. Between 1997 and 2003, the number of terrestrial national parks increased from 82 to 102 as more regenerating forest and watershed areas were reclassified. In the near future, it is expected that an additional 47 national parks, 4 wildlife sanctuaries, and 6 non-hunting areas covering an additional 21,760 km² will be added to the conservation estate. The total area of national parks is expected to increase significantly more in the future, consistent with the policy of promoting increased tourism in the Kingdom.

By 2003, about 100 management plans for PA units had been drafted, including for 60 national parks. Their implementation has been carried out by the Land and Forest Resources Division of RFD with collaboration from Kasetsart and Mahidol Universities, the Thailand Institute of Scientific and Technological Research (TISTR) and private companies.

And in the marine and coastal realms ...

As of 2004, Thailand's 24 MPs protect coastal and marine areas that encompass 6231 km² and include six percent of the coastline. Most (17) of these are located in the Andaman Sea, the rest are in the Gulf of Thailand²³. These PAs contain diverse and important biological resources, including habitats such as mangrove forests, coral reefs, seagrass beds, soft sediment communities and beaches. Thailand's marine PAs not only provide homes for many important marine species; they also give subsistence benefits to the local people and contribute to the valuable tourism and fishery industries. Whereas more than 50



Conservation Mobile unit of TEAM Project managed by WFT during 1987-1992.

²³ Chettamart & Emphandhu 2002

percent of all coral reefs in Thailand are included in existing MPs, substantially less of other marine and coastal habitats occur in the MPs. For instance, only about 15 percent of the remaining mangrove forests are included in coastal MPs. Furthermore, even where MPs are in place the biodiversity of many areas is being degraded through overuse by the tourism and fishery industries.

Major threats to marine biodiversity include encroachment for resorts and shrimp farms, illegal fishing within prohibited zones, as well as infrastructure development within parks that is incompatible with conservation practice.

PTT engages in conservation ...

The Petroleum Authority of Thailand (PTT) constructed the first gas pipeline from Myanmar to the Gulf of Thailand and became involved in forest rehabilitation efforts along the route. With the participation and support of the Biodiversity Research and Training Program (BRT), PTT agreed to broaden their sponsorship to include small-scale PA management²⁴. The focus is Thong-Pha Phum NP, a strategic area where three major ecoregions converge, and part of the important WEFCON complex that serves as an important corridor between the forests in the north of Thailand with those on the peninsula.

Monitoring the effectiveness of protected area management ...

While it is widely believed that the management of protected areas in Thailand (and elsewhere) is improving over time, there have been no objective means of showing trends. In order to deal with this issue the IUCN, the World Bank and WWF produced a *tracking tool* (a series of questions with scored answers)²⁵. This tool has been translated into Thai and, it is hoped, will soon be applied across the country. Its use in Thailand would allow individual PAs to track improvements over time, as well as seeing how Thai PAs in general are faring relative to other countries.

WORKING WITH FOREST COMMUNITIES

Despite rarely being particularly suitable for agriculture, PAs almost always face the problem of encroachment from farmers. The relationships between people and PAs is complex and demanding, requiring flexible approaches together with effective enforcement.

Rights and responsibilities of forest communities ...

It has been estimated that there are at least 10,400 community forests country-wide. Within these, three categories are recognized:

- those managed by traditional practices which are handed down through generations;
- those recently set up by local communities to meet conservation needs for natural resources; and
- those initially set up by outsiders such as government agencies or NGOs to help strengthening community management of forest resources.



Scenery of a village within a protected area in Northern Thailand (Photo by S. Srikosamatara)



Forest community movement (Photo by Suraphol Duangkhae)

²⁴ Srikosamatara & Thanthalakha 2004

²⁵ Stolton et al. 2003



The Community Forest Bill, which has not yet come into force, is designed to secure legal recognition for community forest management, an issue that has remained unresolved for some time.

In 1998, there were 460,000 households – mainly hill tribes in northern and western Thailand – living inside PAs. They use the forests for food, herbal medicine, fuelwood, and construction materials, and practice rotational cultivation of different intensities and hunt wildlife to different degrees. According to the law, harvest of these products in NPs and WSs is illegal, and the policy of the RFD has steadfastly been to resettle hill tribes outside of PAs. This is largely because experience has demonstrated that the hunting of wildlife by such ethnic groups is not sustainable. There is a move to have the Community Forest Bill allow the right of such people to continue to use the forest under certain conditions. This is controversial, however, and has divided the conservation community. Opposing opinions on the ability of the local people to sustainably use forest resources, and on the inviolability of protected area legislation, has caused the Bill to stall in Parliament.

Piloting joint management of PAs shows promise ...

2004 marked the beginning of an innovative program on PA management in Thailand. DNP launched a project entitled 'Joint Management of PAs' (JoMPAs) supported by the Danish government through the Danish International Development Agency (DANIDA) during 2004-2008. The goal is for DNP to work with local communities and NGOs to seek suitable mechanisms to establish integrated conservation and management of selected PAs based on ecosystem concepts. DNP has chosen pilot PAs that include six NPs, two MPs, and a WS (Fig. 12). Furthermore, work on the WEFCOM project will continue with implementation of management strategies in collaboration with the Sueb Foundation and DNP. These projects are experimental and their experiences – good and bad – will help to determine future directions of policy and practice.

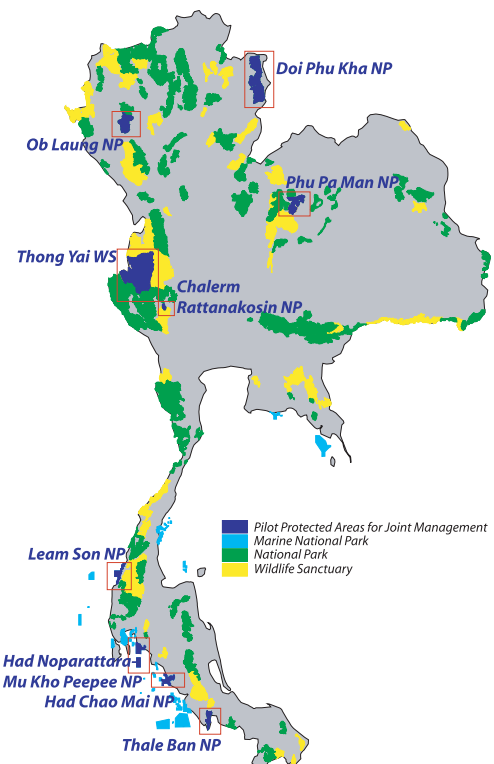


Consultative meeting among local community representatives and Senators on the draft Community Forest Bill in 2003 (Photo by WFT)



The Lisu are one of the hill tribes living in protected areas in northern Thailand (Photo by S. Srikosamatara)

Figure 12. Location of JoMPAs



TOURISM FOR CONSERVATION

Thailand is well endowed with fascinating and educational experiences for tourists seeking new sights of culture and wild nature, and it is not surprising that tourism has grown rapidly since the 1970s.

Tourism is a large and growing sector ...

The numbers of international tourists visiting Thailand have increased from 7.22 million in 1997 to 12 million anticipated for 2004. Government projections show that this figure should reach 20 million within a few years. While the number of Thai tourists declined slightly after the economic crisis of 1997, it quickly recovered and in 2003, Thais took 65.1 million trips (Fig. 13). International and Thai tourism together contribute about 10 percent of GDP at country level and 37 percent in Chiang Mai. The Thai government increasingly recognizes that its biodiversity and wild places could be a major resource to encourage and sustain a niche market in tourism.

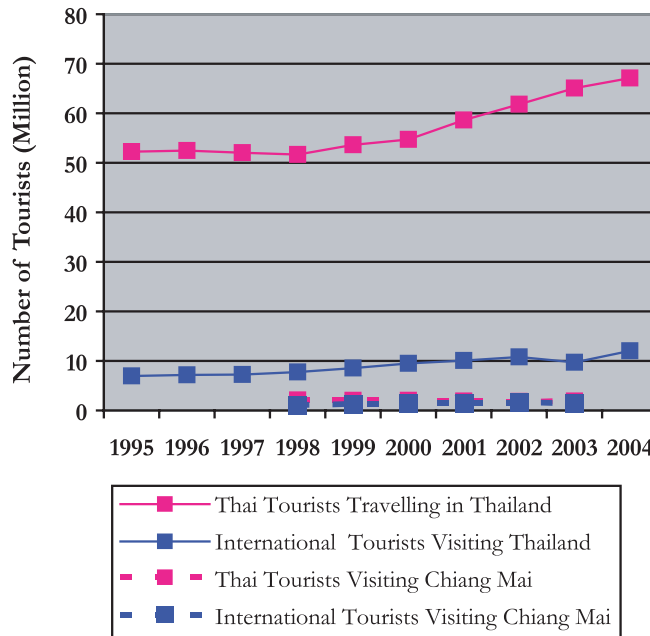
While Thailand's beaches may be the greatest single magnet for tourists, most visitors also seek cultural attractions and natural environments. About 100,000 people per year visit northern Thailand to trek in the mountains, raft on rivers, and visit the hill tribes.

What is ecotourism? ...

IUCN-The World Conservation Union defines ecotourism as "*Environmentally responsible travel to natural areas, in order to enjoy and appreciate nature (and accompanying cultural features, both past and present) that promote conservation, have a low visitor impact and provide for beneficially active socio-economic involvement of local peoples.*" It is clear that much of the travel under the name of 'ecotourism' does not really fit the definition because it has little emphasis on conservation, education, traveler responsibility or active community participation. 'Ecotourism' tends to be used loosely for any tourism to any wild or natural destination.

Tourism to such places without appropriate planning and management can become a threat to the integrity of both ecosystems and local cultures. Large numbers of

Figure 13. Numbers of Tourists in Thailand and Chiang Mai, 1995-2004



Source: TAT, 2004



Students from a nature conservation club visiting a national park (Photo by S. Srikosamatara)



people can lead to damage to infrastructure such as paths, and disturbance to wildlife. However, appropriate tourism creates significant opportunities for both conservation and for the people who service it. Such ecotourism can provide revenues which can be fed back into the PAs, and can offset restricted access to resources borne by people living around the PAs.

Trends towards better environmental management ...

Thailand's 'ecotourism' began in the 1970s with adventurous trekkers, mostly foreigners, seeking unusual natural and cultural experiences in the highlands of the north around Chiang Mai. This type of tourism has saturated (and increasingly despoiled) many of the previously favored undisturbed areas. There are still remote, under-visited areas, but the most accessible areas are now 'overcrowded' by ecotourism standards of this sector and create negative impacts on the physical, biological and social environments. To a degree this tourism is self-limiting but over time the clientele becomes less discerning, and now rather tame activities such as elephant-riding and calm river-rafting are offered by the numerous tour agencies in Chiang Mai. Even so, the tourism industry can charge a premium for opportunities for tourists who wish to be relatively 'alone', away from crowds in wild and beautiful nature, and it is important that visitor numbers and routes are managed to allow for this.

National parks – significant tourism resources ...

Most NP managers know little about the desires of foreign hikers and campers, and most officials still regard trekking overnight in the forest as too dangerous for visitors, especially as there are few suitably trained bilingual guides. Relatively few parks offer visitors more than a one-day hike through the forest. Only a few, such as Kaeng Krachan NP, have promoted trekking and nature tourism in wilderness areas. Also, the relative scarcity native tribal peoples who live in national parks and lack of guides with an intimate knowledge of the forest, this type of tourism faces serious constraints. Once this has been addressed, tourist activities will need to be carefully planned and zoned to stay within local carrying capacities.

PAs attract tourists (and money) ...

In 2003 there were about 12.5 million tourists who visited 118 terrestrial national parks, and 1.8 million tourists who visited 27 marine parks. Doi Suthep-Pui NP was the most intensively used with 4.1 million visits, although this figure may be misleading as many locals visit this famous mountain to worship at the temple on Doi Suthep. After Doi Suthep-Pui, Khao Yai NP was the next most-visited park with 0.76 million visitors. For MPs, Khao Laem Ya – Mu Ko Samed MNP is the most popular with 0.265 million visitors. The peak months for visiting terrestrial NPs are December and April, and April is the only one peak for MPs. The number of national parks with accommodation has increased from 52 before 2004 to 94 now, and rooms for visitors increased from 306 to 697. If all the accommodation space were filled, total income would reach 1,555,250 baht per day. The total value of recreation in certain national parks was estimated in 2003; 1.9 billion baht per year for Ko Samed NP; and 0.427 billion baht per year for Khao Chamao NP.

Five percent of park revenue (mainly from entrance fees) is sent to Sub-District (*Tambon*) Administration Organization through the Ministry of Interior's Department of Local Administration. Of the remaining revenue, 10 percent goes back to the park to improve visitor facilities, 50 percent returns to the park for protection and capacity building, and 40 percent is sent to the NP Revenue Fund and is distributed to NPs according to project proposals managed by the DNP Revenue Committee.

How many tourists can national parks serve? ...

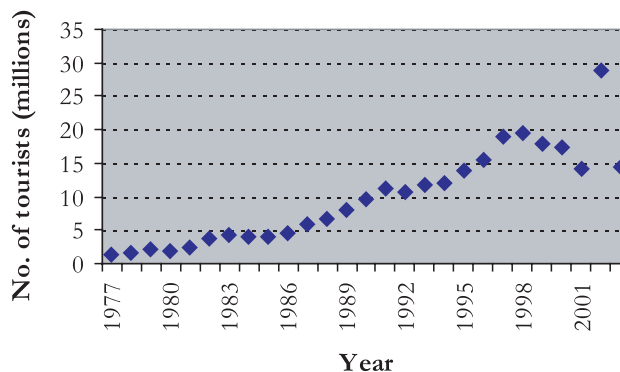
There have been several studies on the carrying capacity of PAs. Decisions can be made to limit number of tourists, but the main problem is actually management of tourist activities. For example, at the Thi Lo Su Waterfall in Umphang WS (the 'Niagara of the East'), the number of tourists has increased dramatically from just a few thousand a year to 15,000. Managers now try to limit the numbers of tourists visiting the waterfall to 500-700 tourists during the peak holiday periods, but numbers can exceed 1,000. Some space (32 hectares) was prepared for camping, but the grounds soon overflowed and became

covered with litter during the high season. More needs to be done to limit the number of tourists and control uncooperative tour operators. DNP is currently conducting carrying capacity studies in five national parks.

Thai tourists becoming a vital constituency ...

Ecotourism is becoming increasingly popular among Thais, especially student groups (Fig. 14). Camping areas in the few parks that have them, such as Khao Yai, are full of tents on weekends. Another sign is the popularity of magazines featuring parks, other natural areas, and outdoor activities such as camping, biking, and bird- and butterfly-watching. Local ecotourism is sure to grow rapidly and will become more of a challenge for management authorities to regulate because of its much greater volume. These people will increasingly become a vital constituency for the support of biodiversity conservation in Thailand.

Figure 14. Rising numbers of Thai tourists visiting their national parks



Box 13: Solid waste disposal is a biodiversity issue ...

DNP is endeavoring to tackle the increasing volume of solid waste created by visitors in NPs because it is unsightly, dangerous to wildlife, and deters other visitors. Through a JBIC-funded study, six parks: Doi Suthep-Pui, Chae Son, Khao Yai, Erawan NPs and Sirinat and Kao Lam Ya-Mu Ko Samet MPs, formulated Operational Guidelines for solid waste management. In Samet Marine NP waste separation was initiated to reduce the amount of waste to be landfilled; in Sirinat MP the existing dumping site within the park was closed and the waste disposal was contracted out to the local administration. DNP is making efforts to increase environmental awareness of tourists as well as their staff and is encouraging all NPs to prepare their own operational guidelines for solid waste management.



Garbage management in Mu Ko Surin MP (Photo by Nario Saito)



AWARENESS AND CONSERVATION ACTION

GROWTH OF AWARENESS AND KNOWLEDGE

Conservation is the enduring responsibility of the whole nation, not just of PA managers²⁶. Indeed, maintaining PAs over the decades and centuries ahead will require commitment from all sectors of society. Moreover, sustaining the ecosystems and biodiversity in the other 80 percent of the nation outside PAs will require more commitment and capacity than is now present.

The media has played a significant role ...

Most Thais are certainly aware of their natural heritage, and are aware of many of the benefits to humans of saving it. It is of course difficult to measure growth in awareness, although the increasing attention that newspapers and feature magazines give to the environment is an encouraging sign. Thailand has an active and professional press, especially as concerns environmental issues, and this has been a major factor in increasing public responsibility and awareness. However, the readership of Thai newspapers and magazines are still quite low by international standards, and very few people buy them in the countryside.

Television has also become more effective in presenting conservation and natural history to the public. Reporting, photography and information content have all rapidly improved over the past few years because new technology is incorporated much more rapidly now than it was in the past. Even so, the dynamic relationship between awareness and the willingness to take action on a conservation issue is not straightforward.

34 Growing environmental education programs ...

Much interest has been given to environmental education (EE) in Thailand during the past ten years, and there have been a number of efforts to develop and strengthen it, both by government agencies and NGOs. Projects range from national interventions, such as the Dawn Project by the Thai Environment Institute (TEI) in cooperation with the Ministry of Education (MoE), to small local efforts at the community level.

Success varies, but the overall impact at the national level is still far from satisfactory. This is evident in the results of 'Nam Sai Tau Thai' project ('Clear Water All Over Thailand') organized by the Thai Farmers Bank in cooperation with the MoE to commemorate Queen Sirikit's 72nd birthday in August 2004. As part of this project, schools throughout Thailand were asked to propose EE projects for the conservation of local water sources. From almost 5,000 proposals, very few showed any understanding of active EE and sustainable development, and these tended to be from schools which had direct links with either an NGO or a university.

Promoting 'Stream Detectives' ...

One EE program initiated and developed by the Green World Foundation (GWF) in 1997, has developed simple techniques for the bio-monitoring of stream water quality. With funding from DANCED in 1998-2003 on a project known as 'RiverSPY', GWF worked with 50 secondary schools in the Upper Ping River Catchment around Chiangmai and Lampoon Provinces to make the first 'People's Map' of river water quality. Empowered with their new skills, the schools then linked with local communities to promote awareness in their respective localities. The project has generated wide interest, leading to further applications of the techniques in education at all levels, including local research, and conservation of local water courses. In some cases, such as in Rayong Province in the east, the technique and approach of Stream Detectives have involved the whole of civil society, including small local NGOs, to the local municipality, and the private sector.

Box 14: Thai Society of Environmental Journalists

This society was established in 1994 through the initiation of the Thai Journalists Association with the financial support of Private Agency Collaboration in Thailand. Its primary aim is to strengthen networking of environmental journalists from various media. Since 2001, DEQP has supported its annual report of important environmental issues. Members of the society have reported environmental issues regularly, and they also cooperate when some issues require campaigning. They also publish stand-alone pieces such as 'A Land on Fire: The Environmental Consequences of the Southeast Asian Boom'.

²⁶ Srikosamatara & Brockelman 2002



A solid base of taxonomists ...

Although it is difficult to know how many taxonomists a biologically-rich country such as Thailand requires, it is clear that there are not enough. Some comfort can be taken in knowing there are 277 taxonomists in 49 institutions and 217 para-taxonomists in 39 institutions, but there are not nearly enough to catalogue and monitor all of the country's biodiversity. Most of the taxonomists have received master's degrees, and half are female. Eighty-two taxonomists work on plants, 70 on invertebrates, 47 on vertebrates, 51 on micro-organisms, 10 on plankton, 9 on algae, 6 on parasites and 2 on protozoa (Fig. 15). The different types of biodiversity collections held in Thailand are shown in Figure 16.

Professionalism in research is increasing ...

In 1995 the, government-supported, Thailand Research Fund (TRF) and the National Center for Genetic Engineering and Biotechnology (BIOTEC) jointly set up the Biodiversity Research and Training (BRT) Program. This body almost immediately became the dominant granting agency for studies in ecology and systematic biology. It has funded both graduate student and senior scientist projects, and also educational and local community activities related to projects that have been carried out utilizing a total of several million dollars. The administration of these projects has been highly professional and efficient, and pressure is put on grant recipients to publish results in English-language journals. The results have been impressive compared with what was published previously, but there is still room for improvement.

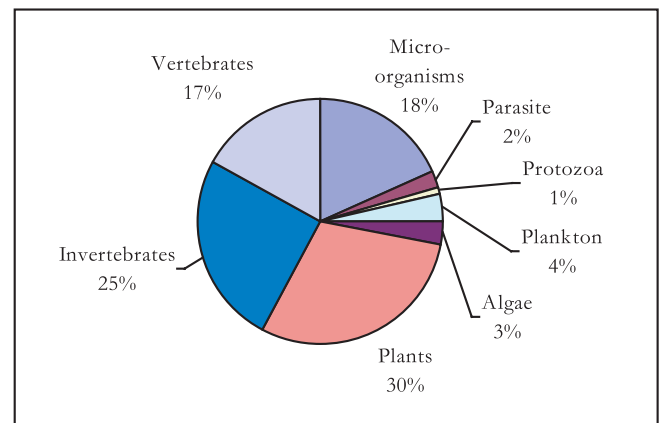
University-based research is strong – but ...

Biodiversity research capacity in universities is strong in a regional sense, but it has to compete (as in other countries) with other fields such as medicine and biotechnology. Biodiversity field work has been mainly directed toward environmental management and pollution studies. Limited manpower and low institutional support for field work has hindered the development of the necessary capacity for biodiversity studies and conservation. More and deeper area-based, action-oriented research which emphasizes training and capacity building at national and local levels is needed²⁷. A small project organized by BRT at Thong Pha Phum may extend to other areas, e.g., Khao Luang Ecosystem in Southern Thailand.



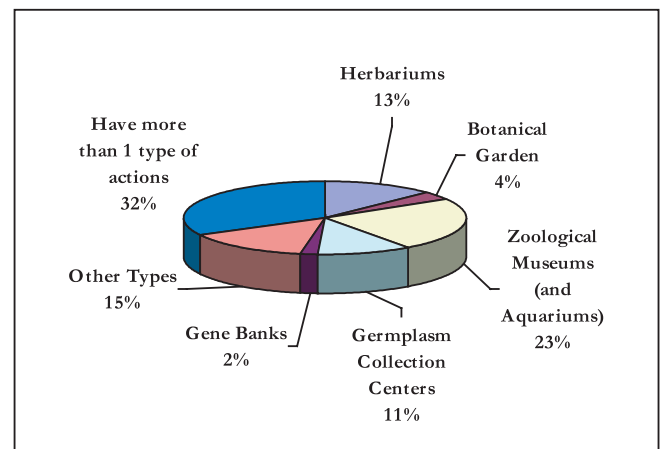
Student activities during a RiverSPY session (Photo by Oy Kanjavanit)

Figure 15. Percentage of active Thai taxonomists in by major taxon



Source: ONEP 2002a

Figure 16. Different types of biodiversity collections in various national institutions



Source: ONEP 2002a

²⁷ Srikosamatara & Thanthalakha 2004

The research can extend area-based concepts from the top of the mountain to the sea.

Most ecological studies in Thailand are simple natural history studies and surveys by systematists. For ecosystem studies, forest ecologists are the strongest group followed by marine and then freshwater ecologists. Foreign collaboration can be seen in most projects (Fig. 17). Given the high diversity of ecosystems and complexity of ecological work at multiple scales, Thailand still needs many more ecologists²⁸.

Research capacity of local people is being developed ...

The Social Investment Fund (SIF) has supported 500 community networks with a total of 2 billion baht. TRF has also supported more than 400 research projects for local empowerment or community-based research since 1998. In 2003 alone, 131 projects in 121 local communities within 35 provinces received funding totalling 47.44 million baht²⁹.

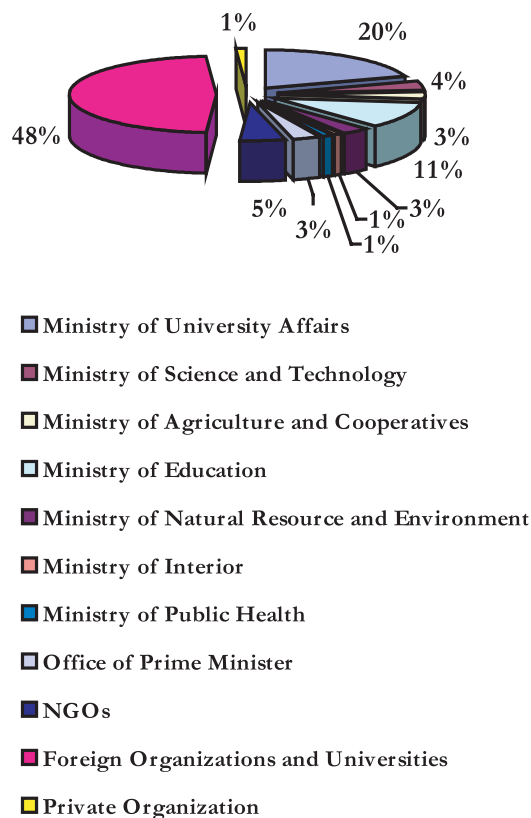
Local knowledge of biodiversity is being captured.

There have been attempts to use more local knowledge to manage biodiversity. Most successes have been seen where tacit knowledge is pooled together. As there is no written tradition embedded in Thai society, the oral communication is the dominant means for spreading knowledge. The Knowledge Management Institute (KMI) was set up in 2003 with funding from the TRF and other Thai sources. Professional social scientists have been used to recording tacit or implicit ecological knowledge of local communities. Combined with explicit knowledge, some good examples of environmental and biodiversity management principles among local communities have been revealed, such as management of the Nan River, Mae Ta Chang Watershed in Chiang Mai, the Mae Lao River in Chiang Rai, and Mae Hong Son Province.



Some annual reports and publications by BRT.

Figure 17. Ministries and organizations involved in biodiversity research in Thailand (2003)
(Total projects = 784, Total agencies = 100)



Source: Hutracharern and Cunningham (2003)

²⁸ Brockelman 2003, Srikosamatara 2000a

²⁹ Sitthisantisuk 2004



THAI LANGUAGE MATERIALS

English is not yet widely understood in Thailand. English language materials on biodiversity from abroad are not incorporated into the local curricula or knowledge unless they are translated into Thai. While this is occurring quite rapidly, and the situation is better than in most East Asian countries, the number of titles of relevance to Thai biodiversity is limited. Examples of original and translated biodiversity titles are shown in the accompanying photos.

Fieldguides are essential tools ...

While new guide books to plants and animals of Thailand are produced each year, most of these tend to be popular introductions to very common species, or repackagings of previous works. Accurate and comprehensive illustrated identification reference books are still too few, and there is no coverage at all, in English or Thai, for many groups of animals and plants.

The late Dr. Boonsong Lekagul was the pioneer in this field. Over 30 years ago, he co-authored a number of English-language identification guides which are still highly regarded today, especially his classic *A Guide to the Birds of Thailand*³⁰. Unfortunately, disputes over copyright after Dr. Boonsong's death stalled attempts to publish a Thai edition.

More recent original contributions include the bilingual *Turtles of Thailand, Lao PDR, Cambodia and Vietnam*³¹ (financed by the World Bank), *Peatswamp Fishes of Thailand*³², and *Mammals of Khao Yai National Park*³³; and the Thai-language Guide to *the Amphibians of Thailand*³⁴ (financed by the World Bank) and *the Guide to the Butterflies of Thailand*³⁵. Plants are poorly served. The National Herbarium has an on-going project to produce a series of English-only monographs known as the *Flora of Thai-*

land, but it was not until the release of the beautifully-illustrated *Trees of Northern Thailand*³⁶ (also supported by the World Bank) that a good field reference to at least part of the flora became available in both Thai and English.

The shortage of identification guides is partly due to lack of funding, aggravated by poor distribution. By their nature, original comprehensive and authoritative identification guides are quite costly and time-consuming to pro-



Some important Thai fieldguides

³⁰ Lekagul & Round 1991
³¹ Stuart et al. 2001
³² Vidthayanon 2002, 2004
³³ Srikosamatara & Hansel 1996
³⁴ Chan-ard 2003
³⁵ Nabhitabhata & Suwannapak 2001
³⁶ Gardner et al. 2000

duce. Field guides are not yet a viable investment for private publishers, and few funding agencies (except the World Bank) have provided meaningful support to such initiatives.

Numbers of websites on Thai biodiversity ...

There is a surprising range of Thai and English language websites on biodiversity in Thailand. Some are ecotourism sites, covering Thai national parks and PAs as well as nature related activities such as trekking, bird watching, butterfly watching, and diving, and there are many biodiversity websites that address biodiversity as an educational subject. Their content varies from general knowledge to specific information. For specific knowledge, there is information available on ecosystems, groups of species, and environmental law. Many websites, especially those hosted by NGOs or community networks address ecosystem issues in their focal areas. An annotated list of websites is provided in Annex 1.



Training organized by WEFKOM for forest rangers (photo by WEFKOM)

DEVELOPMENT OF A CIVIL SOCIETY FOR CONSERVATION

The origin of Thai NGOs ...

Non-government organizations (NGOs) have grown in professionalism, budgets and effective action during the past few decades. The international NGO World Wildlife Fund (WWF) helped spawn a local branch back in the 1970s, which has become Wildlife Fund Thailand, a thriving, and now totally independent organization, although WWF maintains a large and active program. The Bangkok Bird Club, founded by the famous conservationist Dr. Boonsong Lekagul in the 1970s, now attracts hundreds of eager birdwatchers and has become the Bird Conservation Society of Thailand. Several societies are devoted to the protection and conservation of elephants. The list of conservation societies is long, and each fills a particular niche. The list of websites in Annex 1 provides information on the major NGOs.

The numbers and roles of NGOs are increasing ...

While the number of NGOs in Thailand is large and increasing, as there is no single NGO which effectively represents the conservation establishment to the government. WFT occasionally approaches this status, as its position on issues is frequently reported in the press. NGOs are also not so effective in bringing issues to the courts for legal action, as few if any have the necessary legal capacity. However, on large conservation issues like decisions to build large dams, NGOs do speak in unison and are given good press coverage.

The past decade has seen growth in the establishment of international NGOs in Thailand. This had started with WWF-Thailand, and has been followed by, for example, Wildlife Conservation Society (WCS), WildAid, and Greenpeace. Perhaps with the exception of Greenpeace, activities undertaken often overlap with existing programs run by local NGOs. This has created an impact on Thai NGOs. While at times they helped to provide some support to the activities of local organizations, at other times the arrival of international NGOs has resulted in competition for funding and qualified personnel. Thai NGOs are often out-competed due to lower salaries that they can offer. They also tend to be less focused as many are expected to act as public watchdogs on the Thai environment.



CONSERVATION LEGISLATION, INSTITUTIONS
AND FINANCE

LEGAL AND INSTITUTIONAL FRAMEWORKS

Thailand pays special attention to the legal aspects of biodiversity. Many laws concerned with forest, wildlife, plants, PAs and genetic materials have been passed, but their execution and enforcement can be difficult. Responsibility for biodiversity is spread over a number of government institutions, although MoNRE, specifically the Department of National Park, Wildlife and Plant Conservation Department (DNP), is the main agency.

Conservation legislation has a long history ...

The Royal Forest Department was established in 1896 and in 1900 a law was promulgated governing the conservation of wild elephants, the first wildlife species to be protected. The deterioration of the forests in the 1930s caused the Forestry Act to be passed in 1941. In 1958 the Ministers of Agriculture and Interior were directed to establish national parks and other protected areas and to draft their enabling legislation. With the help of IUCN and the US National Park Service 14 sites were selected to become national parks, and in 1961 the Wild Animals Reservation and Protection Act was passed followed by the National Parks Act in 1961. PAs are now managed in conformance with that Act, and also the National Forest Reserve Act of 1964, and Wildlife Conservation Act of 1992, and (for MPs) the Fisheries Act revised in 1994.

In 2001 alone there were 14 Acts, two Cabinet Resolutions, five national plans and policies (including the NBSAP) and two departmental regulations related to the conservation of biodiversity. The challenges presently facing biodiversity management are clearly not due to a lack of legislation, but rather lack of efficient capacity to implement and enforce existing laws and regulations. However, this does not mean that new laws are unnecessary, for example the planned Coastal Resource Management for Sustainable Development Act and Community Forest Act will help bring clarity for biodiversity managers.³⁷



H.E. Suwit Khunkitti, the Minister of MoNRE, a ministry with DNP which is the main agency responsible for biodiversity conservation in protected areas (Photo by MoNRE).

Institutional mosaic for conservation ...

Within the context of Thailand's various laws affecting biodiversity, government institutions with responsibility for certain aspects are in some degree of flux with regard to their roles. Mechanisms of central funding supporting biodiversity research, training and policy studies have proven to be successful. Future development requires integration of laws, plans and budget allocations so that biodiversity conservation is integrated with government work across the ministries, fueled by coalitions of supporting organizations.

Currently there are at least five ministries involved with biodiversity research and conservation (Fig. 18). The main agency for biodiversity is the MoNRE which was formed in October 2002. Governmental organizations carrying the name 'biodiversity' include:

- the Biodiversity Section of ONEP which has a secretariat for Biodiversity Treaties,
- the Thailand Biodiversity Center (TBC) under BIOTEC within the Ministry of Science and Technology which is responsible mainly for biosafety, microorganism collection networks and Biosphere Reserves,
- the National Resources and Biodiversity Center (NAREBI) under the Ministry of Agriculture and Cooperatives which serves as a mechanism to improve administration and management of natural resources and terrestrial and marine biodiversity through closer collaboration in program implementation among

³⁷ ICEM, 2003



MOAC line agencies in order to help recover the genetic diversity of rice, crops and livestock species,

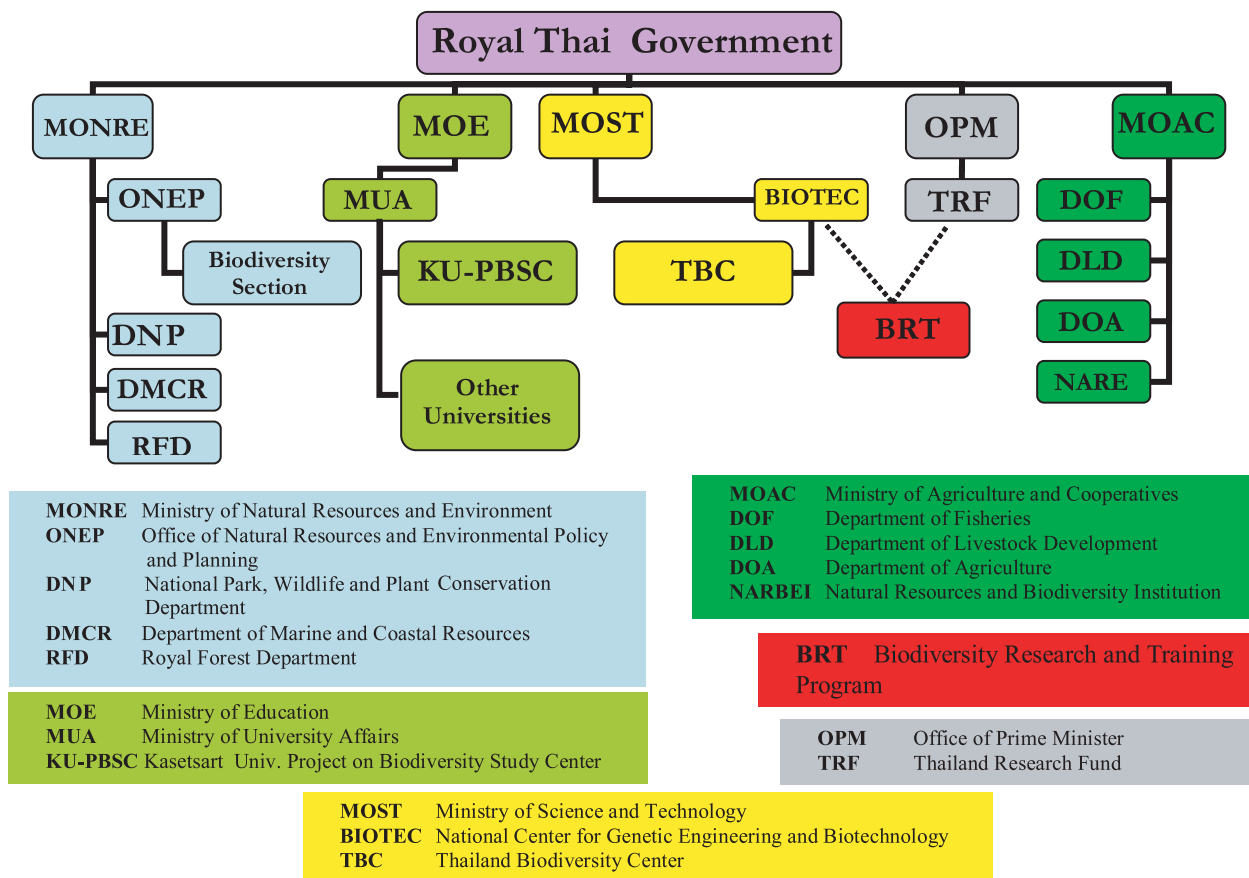
- Biodiversity Research and Training (BRT) Program which is funded by the Thailand Research Fund (TRF) and BIOTEC, which has supplied grants directly to 43 institutions including universities, government organizations, and national and international NGOs, and
- the Biodiversity Study Center at Kasetsart University and other biodiversity programs in other universities.

Other areas of biodiversity conservation, including PA management, wildlife, plants, marine and coastal resource conservation, forestry and NTFPs, are the responsibility of MoNRE. MOAC is responsible for fisheries,

genetic diversity of rice, crops, livestock (including elephants), and sustainable agriculture.

Within MoNRE, matters concerning commercial forests fall under the Royal Forest Department (RFD) while conservation and protection activities are the responsibility of the National Park, Wildlife and Plant Conservation Department (DNP). Thus RFD controls the forest industry, and the marketing of timber and non-timber products, as well as the protection and restoration of their forests, while the main responsibilities of DNP is the conservation and restoration of the PAs, and of Thailand's wildlife and plants. It also has a role in encouraging the participation of local people and the general public to protect biodiversity and local resources.

Figure 18. Key Institutions for Biodiversity



CONSERVATION FINANCE

Biodiversity conservation is supported financially from four main sources: government budgets, donors, the Thailand Environment Fund, and the private sector. These sources differ in their scale and coverage, but are complementary in many other ways.

Government budgets are the core ...

In 2004, the total government budget was 1,028 billion baht. These resources were directed into five areas: 1) economic recovery and development, 2) restructuring the country to increase and sustain competitiveness, 3) social development, poverty resolution and upgrading the quality of life, 4) foreign affairs and security, and 5) national development. Activities related to biodiversity conservation are scattered across all these themes, although the most obvious one is “restructuring the country to increase and sustain competitiveness”, where budgets allocated for nature and environment recovery amount to 15.5 billion baht (1.5 percent of the total budget). The budget received by MoNRE, the ministry most directly responsible for biodiversity conservation, was 14.975 billion baht, with the main recipient being DNP (Fig. 19).

Direct government budget for PA management is 2.019 billion baht or 26 percent of MoNRE’s budget (Fig. 20). Most of this budget is for infrastructure, salaries, and some training. However, the numbers of skilled and knowledgeable staff are still limited. Most personnel are hired temporary workers paid a low daily rate. There is thus little regular budget to support operational expenditures (Fig. 21).

42

Foreign donors provide strategic support ...

In part because of Thailand’s relative wealth among developing countries, there are relatively few foreign governments who support biodiversity conservation here. The main foreign donors are Denmark, the EC, and JBIC.

Denmark: After the 1992 UN Conference on Environment and Development, Denmark decided to allocate 0.5 percent of Danish GNP for programs on environmental management and set up the ‘Environment and Disaster Relief Fund’ (EDRF) a quarter of which would be used for environmental activities in developing countries. As a

Figure 19 Budget allocation among departments within MoNRE in 2004. Total budget is 14.975 billion baht.

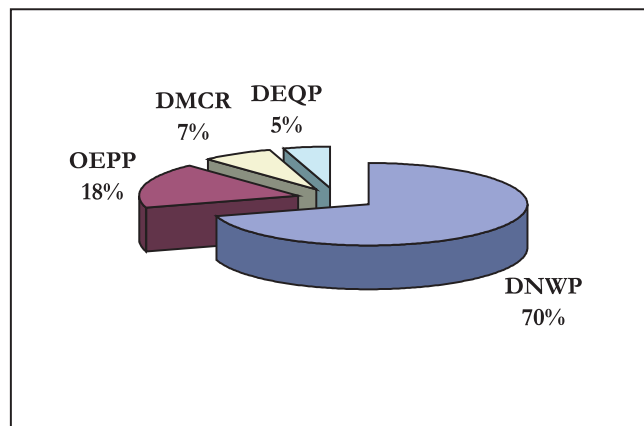


Figure 20. Budget allocation to NPs and WSs within DNP in 2004.

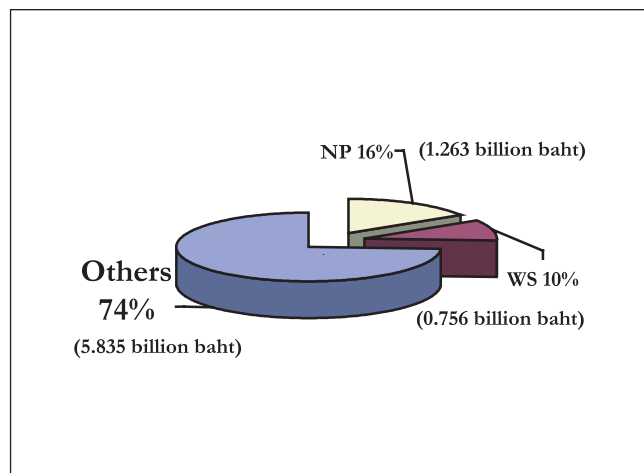
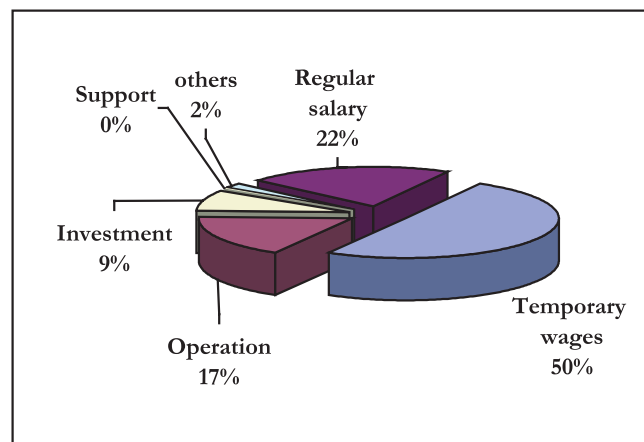


Figure 21. Breakdown of DNP budget in 2004 (Total 2.020 billion baht)





rapidly-growing economy in SE Asia, Thailand was chosen in 1993 as a primary recipient of these funds through the Danish Cooperation for Environment and Development (DANCED). The Danish International Development Agency (DANIDA) also became involved in parallel with DANCED and later took over. To date, natural resource and environment management programs amounting to about 750 million baht have been supported, with most projects executed by consultant firms or NGOs (international and national).

EC: The EC is providing support to the tune of Euro 29.96 million or 14.081 billion baht over the seven years of 1998-2006. The EC also supports the ASEAN Regional Centre for Biodiversity Conservation (ARCBC). It operates through its Headquarters in Los Banos, Philippines and through National Biodiversity Reference Units based in each ASEAN member country; in Thailand's case this is ONEP. Thailand receives grants for research, management and environmental education through this source. One example is a grant to Kasetsart University for community forest management and rehabilitation as means of biodiversity conservation in the Thung Soong community forest in Krabi. The conceptual framework of the project focuses on a better understanding of mechanisms of human-environment interactions and their effects on biodiversity, which are translated into management guidelines.

JBIC: A variety of work has been supported by JBIC such as the preparation of a development strategy and pilot projects for PAs. By identifying tourism as an important factor for improving the Thai economy and influencing biodiversity loss, the project sought to balance increasing the quality of visitors' experience and the volume of visitors to PAs. It also conducted a study on solid waste management and carrying capacity in NPs in collaboration with DNP, and supported the preparation of the inventory of Important Birds Area (IBAs) with the Bird Conservation Society of Thailand.



Agreement between PTT and BRT on biodiversity research using area-based approach at Thong Pha Phum District, Kanchanaburi Province, western Thailand during 2000-2003 (Photo by BRT)



Krating Deang Company and the Small Kids Foundation marked new initiatives to support conservation and education activities at Khao Paeng Ma carried out by WFT.

Private sector engage in biodiversity conservation ...

In 2003, the Petroleum Authority of Thailand (PTT) identified 1 million rai (1,600 km²) for reforestation through His Majesty's Royal Golden Jubilee initiative, which was proclaimed in 1994. Corporate organizations have supported at least 20 percent of these projects. PTT also supported biodiversity research in Thong Pha Phum Province as part of its corporate responsibility program linked to the findings of the EIA on its western gas pipeline construction. The total investment of PPT has been about 120 million baht.

Since the economic crisis in 1997, local Thai companies have found themselves financially unable to support conservation activities. However, on 22 Sept 2004, the Krating Deang Company and the Small Kids Foundation marked new initiatives to support conservation and education activities at Khao Paeng Ma carried out by WFT. The program may be enlarged to form the Wild Cattle Conservation Fund to support research, education and conservation activities for wild cattle. This is perhaps a sign that Thai companies are starting to support of biodiversity conservation.

Innovative trust fund for biodiversity conservation ...

In 1992 the Thailand Environment Fund was established with initial capital from Thailand's Fuel Oil Fund (\$180 million), the revolving fund for Environmental Development and Quality of Life (\$20 million) and grants from the Thai government (US\$50 million)³⁸. The Japanese government also extended a soft loan of \$100 million to the Thai government for the fund. In addition, the fund collects pollution charges, service fees, fines etc.

The primary function of the Fund is pollution abatement, but it has come to support biodiversity and other natural resource management projects proposed by civil society. In the period 1994-2002, it supported 35 projects with total funding of 164 million baht. Examples of projects being supported during the current period of 2004-2007

are environmental management at Ban Don Bay, Suratthani for 4.3 million baht, and forest conservation at Ban Dong Yai, Nakhon Ratchasima Province for 2.4 million baht.

Sustaining the flow of conservation finance ...

To date, high inputs from the government and private organizations have been necessary to safeguard and restore biodiversity. While these mechanisms will be maintained, it will be difficult to measure progress if there are no clear linkages between biodiversity and the country's broader goals and strategies. To make the financial mechanisms sustainable, clear linkages between biodiversity conservation and the debt and poverty reduction programs need to be established. The vast hidden values of biodiversity have to be identified so that the obvious contributions of biodiversity to society can be understood at all levels. However, in order to achieve long term biodiversity conservation there is a need for improved coordination of existing laws, government plans and strategies.

³⁸ Moge 2002



CHALLENGES FOR THE FUTURE

CHALLENGES

The foregoing analyses of trends and responses, and an assessment of chosen case studies suggest that Thailand has several challenges ahead of it in managing its rich and valuable terrestrial and aquatic biodiversity. Thailand has done well in terms of formulating and subsequently refining policy and institutional frameworks for biodiversity conservation. However, the enabling environment for local participation, appropriate mechanisms for financing conservation initiatives, and arresting overexploitation through appropriate enforcement measures, remain key barriers to the realization of an effective and pragmatic conservation program. The major challenges that must be confronted in order to safeguard biodiversity, and at the same time to realize its potential to provide its stream of useful products and other benefits that enrich the people and economy of the Kingdom, are discussed below.

1. Mainstreaming biodiversity

The production landscape. The production landscape, especially important watersheds and coastal zones, should be explicitly planned and managed so that a balance between human activities and natural areas is maintained. For example, agricultural areas are dominated by ricefields and other forms of agriculture (including livestock) together with increasing areas under large-scale tree plantations yet there is an increasing reliance on species or varieties with a very narrow genetic base. While productive under stable conditions, these create biodiversity 'deserts' and tend to benefit larger businesses rather than local farmers due to economies of scale. More attention through community-oriented participation in land use decisions, extension work, and education would help to address this. In diverse landscapes biodiversity provides assorted benefits such as pest control, food, medicines and other services. As currently planned, tree plantations provide little benefit to biodiversity, yet creative thinking – such as planting trees to become 'corridors' to connect forest fragments or to extend the tree cover of PAs - could change this as well as providing social benefits. Similarly, certain rivers could be desig-

nated to be free from obstruction (along and across their length) whereas others which have already had dams and industries should be used intensively for other such developments. Thus to achieve better results, consideration of pro-conservation actions and impacts on biodiversity should be better integrated into the planning activities for large-scale land use projects, such as the proposed plantations of rubber trees in Northern and Northeast Thailand. In addition, the complex and dynamic relationships between the natural resource base and poverty need further examination to help understand the persistent high poverty in the Northeast Thailand.

Tourism. Thailand attracts nearly 10 million foreign tourists annually, and if properly planned offers opportunities for enhanced revenues as well as improved approaches to conservation. Tourism based on Thailand's biodiversity should be better planned and financed so that it capitalizes on the enormous natural resources native to Thailand's tropical forests and seas, and also so that the sector contributes to greater conservation efforts. In order to achieve this, appropriate policies which allow the benefits to be directed to local communities and conservation actions, need to be developed. Effective enforcement of hunting regulations would allow populations of charismatic wildlife to grow and become magnets for tourists. As more foreign and domestic tourists explore and enjoy the country's national parks, a major challenge will be managing their numbers, and behavior, to avoid them damaging or degrading the very things that attracted them to the areas. In particular, effective waste management programs are urgently needed to accommodate the rapidly increasing visitor numbers. Sources of finance for this could come from the restructuring of NP entrance fees, infrastructure usage and rental fees, and conservation donations, which would reflect the true costs of park management as well as visitors' willingness to pay.



2. Learning for protected area management

Thailand has a long history of protected area management, and has been reasonably successful at controlling harmful practices within designated areas. However, as with all management systems, there is scope for further refinement. PA management is still primarily a central government responsibility with rather little local participation. PAs, while governed by national laws restricting use, must nevertheless be managed with the participation of regional and community authorities, so that local people can receive more direct benefits from employment, tourism, and education. Buffer zone management needs to address the persistent problems of poverty around PAs, but it is unrealistic to expect the PAs to finance such development activities. Thailand can gain immensely from learning from both its own and others' experiences. Conservation efforts have been subject to waves of different methodologies and fashion and it is important to take stock. Conservation projects have performed poorly for a variety of reasons such as defining over-optimistic goals and weak assumptions, targeting the wrong threats (e.g. the poor and vulnerable instead of the commercial exploiters of natural resources), lack of attention to plans for sustaining the activities and finance, and not providing adequate or appropriate benefits for surrounding villagers. On the other hand, lessons from successful examples of conservation indicate that success stems from adaptive approaches that explicitly incorporate research and M&E into their design, proper understanding of root causes of threats, realistic targets, approaches that are appropriate to the scale needed, sustained and meaningful engagement with stakeholders to create trust, and professional PA management teams who are sympathetic to the problems of the surrounding people.

3. Making enforcement more effective

Inadequate enforcement is a serious problem with respect to poaching in PAs, the local sale of illegal wildlife products, and illegal wildlife trade, especially across the long and rather porous border with Myanmar. Enforcement needs to incorporate better education of local people, detective and legal work, and international monitoring and enforcement of treaties. Simply because of its geographical location, Thailand has a significant role to play in control of the illegal wildlife trade. Indeed, its pivotal role



Forest guards are the main instruments for law enforcement in NPs and WSs. Most of them are only temporary employees (Photo by MoNRE)



H.E. Suwit Khunkitti at the training center in Khao Yai NP. This center will be used for training law enforcement personnel (Photo by MoNRE)

was demonstrated at the recent 13th Conference of the Convention on International Trade in Endangered Species (CITES), in Bangkok, at which Thailand proposed a regional network to combat wildlife trafficking. This proposal quickly became an official ASEAN-wide declaration of intent to suppress wildlife trafficking, with Thailand taking the lead in implementing it and training up ASEAN partners. This, together with the steps required to achieve regional collaboration in wildlife law enforcement along key border regions and information sharing among relevant agencies, represent some of the most significant challenges ahead.

4. Making effective use of research

Thailand has developed an impressive and regionally-significant research capacity, but research tends to be carried out in a fragmented and uncoordinated manner. There is a great need to make research more policy-oriented. There is a disconnect between researchers and government authorities and local communities, leading to the lack of utilization of research findings in the design of policies, programs and projects. Authorities often ignore research results and recommendations, or have no mechanisms or responsibility for implementing them. Monitoring, especially the consistent use of the World Bank/WWF tool for tracking the effectiveness of PA management and similar tools across the country's PAs, needs to be incorporated into the conservation and planning processes. This will allow feedback into the planning process, and provide indicators of achievements that motivate conservation efforts and instill greater pride³⁹.

5. Broadening conservation financing

Although the government has provided a significant amount of finance for biodiversity conservation, has established an environmental trust fund (focused on the 'brown' environment but also supporting 'green' projects) which collects fees and fines, and has had some generous support from bilateral donors, especially the Danish Government, it has not yet made cost-based plans for how financing of biodiversity conservation will be sustained. What is the cost of maintaining the protected area network and what proportion of this is currently covered? What costs can be held over until such time as more money becomes available? The challenge is now to devise a strategic program for financing biodiversity conservation needs which incorporates the existing and likely future funding. Such a program needs to be based on a long-term vision with sustained government support and strategic use of bilateral or private sector support as required.

6. Harnessing markets and the private sector in biodiversity conservation and sustainable use. There is potential to exploit certain elements of biodiversity in a sustainable manner provided that the following factors are put in place: target populations are strong enough to sustain any commercial use, there is public awareness of sustainability issues, effective regulations and enforcement mechanisms exist to curb unsustainable exploitation, and perverse incentives that promote biodiversity degradation, and regulations that prevent the private sector and local communities from profiting from the sustainable use of biodiversity, are eliminated. By effectively harnessing markets and private sector involvement, public resources could then be more efficiently allocated to supportive regulatory functions, and to certain biodiversity goods and services that markets alone are unlikely to supply.

³⁹ Srikosamatara 2000b



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ANNEX 1 : THAI BIODIVERSITY-RELATED WEBSITES

WEBSITE	URL	BRIEF DESCRIPTION
Biodiversity Research and Training Program	www.brt.biotech.or.th	Executive summary of activities and funding since 1996, publication lists from the program, Thongphaphum Special Project, Guidelines for grant application and project list
Bird Conservation Society of Thailand	www.bcst.or.th	Under construction.
Bird-home.com	www.bird-home.com	Information on birding, bird care, and protecting areas with birds
Civil Network of Nan Province	nancivil.org	Nan River management
Coastal Wetland Policy and Conservation Awareness Project	www.wildlifefund.or.th/wetlands.html	Information of Coastal wetland resources, fishery impacts, and conservation issues
Community-based tourism, Thailand Research Fund	www.vijai.org ; cbt.vijai.org	TRF Regional office with the program on research for local empowerment or community-based research. Details of the projects, networking, meetings, document, database especially on community-based tourism.
Department of Environmental Quality Promotion	www.deqp.go.th	Articles, books, Video, CD, television programs about environment. Environmental Research and Training Center, EE centers at provincial level.
Department of Fisheries	www.fisheries.go.th	Announcement, fisheries statistics in 2004, organization within the department.
Department of Marine and Coastal Resources	www.dmcr.go.th	Established in 2002 under MoNRE. Responsible for maintaining abundance, conservation, rehabilitation and reservation of marine and coastal resources for marine biodiversity and socio-economic integrity.
National Park, Wildlife, and Plant Conservation Department	www.dnp.go.th	Information on national park, wildlife sanctuary, wildlife and plants. Preserved and protected animals, dipterocarp seed insects and coral. Forest herbarium, <i>Flora of Thailand</i> , Thai Forest Bulletin and Bibliography. More information in Thai pages on forest and tourist statistics, projects, research and announcements.
Digital Library for SchoolNet Thailand	web.ku.ac.th/schoolnet/f-snet6.htm	General knowledge for Environmental and natural resources education
Engineering for Environment	kmitnb05.kmitnb.ac.th/%7Esrk/	Information of environmental engineering
Environmental Law Center- Thailand	www.envilaw.org	Environmental issues, environmental laws
EnvironNET	www.environment.in.th	Environmental essays, current issues, natural resources and biodiversity information, games and activities for children
Fernsiam.com	www.fernsiam.com	Fern information, Gallery, Taxonomy
Foundation for Khao Yai National Park Protection	www.khaoyai.org	History, geography, biodiversity, and tourism information on Khao Yai NP
Green World Foundation	www.greenworld.or.th	Specialized in environmental education, including the River and Stream Project for youth (RSPY). Produces bimonthly <i>Green World</i> magazine, biennial review state of environment in Thailand, manuals and nature guides.
Hornbills and birds in Thailand	www.thai.to/bird/thorn.htm	Information and essays of hornbills and birds in Thailand
Knowledge Management Institute	www.kmi.or.th	Good site for documentation of knowledge management. Activities and documents on knowledge management by local communities. Access to Thailand Knowledge Center under ICT Ministry.
MetScience: Explore the world	www.metscience.com	Biodiversity of coastal and marine ecosystems and information on atmosphere
Ministry of Agriculture and Cooperatives	www.moac.go.th	Gateway to various departments in the Ministry including Fisheries, Livestock etc.
Ministry of Natural Resources and Environment	www.monre.go.th	History of the ministry since 2002, details of various organizations within the ministry: environment, natural resources, inland water and administration. Includes Zoological Park, Botanical Garden, Forest Industry, and Water Management.
Nature Conservancy Club	www.nature.thai.org	Major activities are nature education through monthly talks, arranging trips to various PAs. Ex-officers and current officers of the park and wildlife divisions of the Royal Forest Department are active in the club. Information and knowledge about communal forest and natural resources management
Office of Natural Resources and Environmental Policy and Planning (Biodiversity section)	www.onep.go.th/bdm/	Activities organized for International Day for Biological Diversity on May 22, every year. Information on CBD, wetland, Global Taxonomic Initiatives (GTI), NBSAP, books and publications on biodiversity produced by ONEP including 11 volumes on biodiversity.

WEBSITE	URL	BRIEF DESCRIPTION
Office of Natural Resources and Environmental Policy and Planning	www.onep.go.th	Thailand State of Environment Report, policy and plans, Integrated Songkha Lake Management Plan 2003-2007, UNEP GEF Project on reversing environmental degradation trends in the South China Sea and Gulf of Thailand, World Bank Ping River Project, environmental funds, EIA and other environmental networking. Nan River management
RECOFTC: Regional Comity Forest Training Center for Asia and the Pacific	recoftc.ku.ac.th/thai/default.asp	Information and knowledge about communal forest and natural resources management
Save khlung-u-taphao	www.khlung-u-taphao.com	Information, essays, researches, and environmental issues of Khlung-u-Taphao, Songkhla Province
Save Whale Sharks	www.whalesharkthai.com	Knowledge and essays on whalesharks, with observation reports, and guidance on relevant laws
Savebutterfly	savebutterfly.com	Butterfly information, life cycles, habitats, butterfly watching, and species search
Scithai.com	www.scithai.com	Online library, games
SeubNakhasathien Foundation	www.seub.or.th	Specialized in western forest complex. Special program helping rangers at various PAs especially when they die on duty. Articles concerning activities that threaten PAs, e.g. tourism in PAs, effects of roads on wildlife, fence in Huai Kha Khaeng and tourist development in Doi Chiang Dao.
South East Asia Rivers Network, SEARIN	www.searin.org	Essays and news of Mun, Mekhong, and Salween river, impacts from dams, and Thai Baan Research
TalayThai (Thai Seas)	www.talaythai.com	Marine science knowledge, information of marine fishes and other marine animals
Thai Community Forest Networks	www.thaico.net/thaicforest/index.htm	Current information on the activities of networking, community forestry bill, articles and some research carried on by local villagers. Map shows the overlapping of PAs with local communities.
Thailand Biodiversity Center	Biodiversity.biotec.or.th	History of the center, duty, microorganism collecting network in Thailand, Biosphere Reserves in Thailand, biosafety and food plants program
Thaiparks123.com	www.thaiparks123.com	Information of Thailand's national parks and ecotourism activities
Thai Society for the Conservation of Wild Animals	www.tscwa.org	Information on TSCWA projects which aim to improve the conservation of native wild animals, the welfare of captive wild animals confiscated through law enforcement, and other problematic animal issues in Thailand.
Thaiwaterbirds.com	www.thaiwaterbirds.com	Information of waterbirds found in Thailand, migration routes, birding sites, and bird observation report
Trekkingthai.com	www.trekkingthai.com	Ecotourism activities
Water Watch	www.thai.net/wetlab/waterwatch/index.html	Water quality biomonitoring by using benthic microinvertebrate and algae
Western Forest Conservation Club	www.thungyai.org	Activities of the Club, news, information about WEFCON, photo gallery, nature album
Wildlife Conservation Society	www.wcs.org/sw-around_the_globe/Asia/Thailand	Brief information on conservation situation in Thailand, the threats to biodiversity and description of the WCS program
Wildlife Fund Thailand	www.wildlifeand.or.th	Information on various projects including Khao Paeng Ma, Upper Mae Ping Management and recovery, RGJ reforestation, Coastal wetlands project and environmental awareness.
WWF Thailand	www.wwfthai.org	Information on Thai conservation issues and actions by WWF, and links to the broader WWF family.



THAILAND AT A GLANCE

ENVIRONMENT / GEOGRAPHY	ECONOMY / SOCIETY
<p>Environment</p> <p>Forest: forest areas: 172,050 sq km (2001) forest cover: 33.5 percent of land area</p> <p>PAs: PAs: 90,506 sq km (2001) PAs: 17.64 percent of land area Unit of PAs: 341 units (2001)</p> <p>Water quality: Percentage of river basins with water quality below : Good: 40 percent (2002) Moderate: 25 percent (2002) Poor: 32 percent (2002) Very poor: 3 percent (2002)</p> <p>Air quality: Ambient in Bangkok TSP (24 hrs): 0.1 mg/m³ (2002) PM₁₀ (24 hrs): 49.4 ug/m³ (2002) CO (8 hrs): 0.9 ppm (2002) Ozone (1 hr): 13.7 ppb (2002) SO₂ (24 hrs): 5.2 ppb (2002) NO₂ (1hr): 23.9 ppb (2002)</p> <p>Solid and hazardous waste: Solid waste: 14.4 million tons (2002) Industrial hazardous waste: 0.96 million tons (2002) Industrial non-hazardous waste: 5.9 million tons (2002) Community hazardous waste: 0.38 million tons (2002) Infectious waste: 20,000 tons (2002)</p> <p>Natural disaster: Flood: Number of occurrences: 14 (2001) Value of assets loss: 3,666.3 million baht (2001) Typhoon: Number of occurrences: 1,061 (2001) Value of assets loss: 501 million baht (2001) Drought: Population affected: 18.9 million persons (2001) Value of assets loss: 72 million baht (2001) Forest fire: Total forest fire area: 933.3 sq km (2000)</p> <p>Geography Area: 515,113.6 sq.km Land boundaries: <i>total:</i> 4,863 km <i>border countries:</i> Myanmar 1,800 km, Cambodia 803 km, Laos 1,754 km, Malaysia 506 km Coastline: 3,219 km Maritime claims: continental shelf: 200-m or to depth of exploitation exclusive economic zone: 200 nm territorial sea: 12 nm Climate: tropical; rainy, warm, cloudy southwest monsoon (mid-May to September); dry, cool northeast monsoon (November to mid-March); southern isthmus always hot and humid.</p>	<p>Geography (CONT.) Terrain: central plain; Khorat Plateau in the east; mountains elsewhere Elevation extremes: <i>lowest point:</i> Gulf of Thailand 0 m <i>highest point:</i> Doi Inthanon 2,576 m Mineral resources: tin, natural gas, tungsten, tantalum, timber, lead, fish, gypsum, lignite, fluorite. Environment-international agreements: <i>party to:</i> Climate Change, Endangered Species, Hazardous Wastes, Marine Life Conservation, Nuclear Test Ban, Ozone Layer Protection, Tropical Timber 83, Tropical Timber 94 and Biodiversity. <i>signed, but not ratified:</i> Law of the Sea</p> <p>Economy GDP: 5,433 billion baht (2002) GDP growth rate: 5.2 percent (2002) GDP-composition by sector: <i>agriculture:</i> 9.9 percent <i>industry:</i> 45.2 percent <i>services:</i> 44.9percent (2002) Inflation rate-consumer price index: 0.7 (2002) Unemployment rate: 2.2 percent (2002) Exports of good and services/GDP: 64.7 (2002) Industrial production growth rate: 7.5 percent (2002) Agricultural production growth rate: 0.5 percent (2002) Agriculture-products: rice, cassava (tapioca), rubber, corn, sugarcane, coconuts, soybeans. Exports: total value: 2,955.7 billion baht (2002) Imports: total value: 2,778 billion baht (2002) Gross Domestic Investment/GDP: 23.9 (2001) Gross national savings/GDP: 29.3 (2001)</p> <p>Society Population: 63.763 million (2004) Population growth rate: 0.7 percent (2004) Labour force: 34.2 million (2002) Birth rate: 14 births/1,000 population (2004) Death rate: 19 deaths/1,000 population (2004) Infant mortality: 20 deaths/1,000 live births (2002) Access to safe water (percent of population): 92.6 (2000) Access to sanitation (percent of population): 97.8 (2000) Life expectancy at birth: Male 69.9 years, Female 75.0 years (2004) Literacy: 95.5 percent (2002) National capital: Bangkok Administrative divisions: 76 provinces (<i>changwat</i>) Independence: 1238 (traditional founding date; never colonized)</p>

Source: Pollution Control Department (PCD), National Statistical Office (NSO), National Economic and Social Development Board (NESDB), and Ministry of Education.
 Area unit: 1 rai = 1,600 sq.m. = 0.16 ha; 1 ha = 6.25 rai; 1 sq.km. = 625 rai

NOVEMBER 2004



Thailand Environment Monitor 2000
presented a snapshot of general environmental trends in the country



Thailand Environment Monitor 2002
Assessed the status of air quality management in the country



Thailand Environment Monitor 2001
Assessed the status of water quality management in the country



Thailand Environment Monitor 2003
Assessed the status of solid and hazardous waste management in the country



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