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Readers' Corner



Dear Co-Directors,

I have had the opportunity to go through all the issues of ASEAN Biodiversity - the news magazine of the ASEAN Regional Centre for Biodiversity Conservation. I find these magazines most stimulating, educational and informative concerning conservation and sustainable utilization of biodiversity. Here, I came to know some important information about some plant species that appeared in the magazine's Focus Section by your office's Research Branch. The species are *Xanthostemon verdugonianus* Naves., *Acacia leucophloea* [Roxb.] Willd., and *Melaleuca cajuputi*. I am very much interested in these species, and would like to collect seeds/germplasm of these species for conservation and research purposes.

I would thus like to request the Research Branch of ARCBC to get some seeds of those species collected for me.

My best wishes. I look forward to hearing from you soon.

Professor Md. Mustafizur Rahman

Department of Crop Botany
Bangladesh Agricultural University
Mymensingh-2202, Bangladesh



Dear Co-Directors,

Compliments from 'Ed-en'. At the outset, we feel it necessary to make you aware of the organisation 'Ed-en' and its activities. We operate in the Tinsukia District located in the North-Eastern area of India, which is part of a global hotspot.

The 'Ed-en' is a Tinsukia-based Society for Environmental Education registered in the year 2000 under Society Registration Act XXI of 1960, and has been involved in environmental programmes since 1998. The Society through various environmental education programmes has engaged school children in seminar competitions and eco-club activities of NGC MOEF Gov't of India, etc. besides organising regular programmes for teachers, administrators and others. We also maintain a small library that contains journals, periodicals and other publications related to environment from different organisations. These publications are of immense use to children, environment and wildlife activities, and others who visit our office.

We have come to know that your organisation publishes journal periodically. We would be happy to receive complementary copies of the magazine and to have our organisation included in your mailing list.

Dr. Rishi Das

Secretary, Ed-en
Parbotia Feeder Road
Tinsukia - 786 125 (Assam)



Dear Co-Directors,

We wish to acknowledge the importance of your publication, ASEAN Biodiversity, which can be of the highest use for visitors of our library. On behalf of the Siam Society Library, I would like to request for an exchange of your publication with our "The Natural History Bulletin of the Siam Society". The Natural History Bulletin is published as one volume with two issues per year. The Bulletin is sent on exchange to numerous libraries and other institutions. The Bulletin is included in the BIOSIS database, and is indexed in the Fish and Fisheries Worldwide produced by NISC South Africa.

And as a leading learned organisation in Thailand, The Siam Society focuses on the human and social science fields in Southeast Asia. We promote a broader and deeper understanding of the region's history, archaeology, art, literature, language, religion and culture.

Thank you very much for your kind attention. I am looking forward to receiving a response from you soon.

Mr. Ekkarin Latthasaksiri

Librarian
The Siam Society Under Royal Patronage
131 Sukhumvit 21 (Asoke)
Bangkok 10110, Thailand



Dear Co-Directors,

I found your ASEAN Biodiversity magazine Vol. 2 No. 2 very interesting and relevant to my research and teaching activities, which is focused on forest valuation. I would like to request a copy of the magazine and would appreciate your sending me a copy to the address below. For your information, I have already filled up the subscription through your webpage.

Thank you.

Awang Noor Abd. Ghani, PhD

Lecturer/Deputy Dean
Dept. of Forest Management
Faculty of Forestry
Universiti Putra Malaysia
43400 UPM Serdang
Selangor, Malaysia

Contents

Vol. 2, No. 4 • October-December 2002

About You And Us

Readers' Corner	2
Fourth quarter in a nutshell	4
<i>Editorial</i>	
Invasive Alien Species and their Impacts on Biodiversity	8

Special Reports

Invasive Alien Species in Southeast Asia	9
<i>Their Impacts and Management</i>	
Invasive aquatic animals in the Philippines	12



Global Strategy on Invasive Alien Species	16
-------------------------------------------	----

<i>Brunei Darussalam</i> Invasive Alien Species Resource Directory	20
-----------------------------------------------------------------------	----

<i>Indonesia</i> Invasive Alien Species Control Strategy	22
-------------------------------------------------------------	----

<i>Lao PDR</i> Prevention and Management of Invasive Alien Species	24
-----------------------------------------------------------------------	----

<i>Malaysia</i> Prevention and Management of Invasive Alien Species	27
------------------------------------------------------------------------	----

<i>Philippines</i> Invasive Alien Species Resource Directory	30
-----------------------------------------------------------------	----

<i>Singapore</i> Invasive Alien Species in Singapore: A Review	33
-------------------------------------------------------------------	----



<i>Thailand</i> National Profile Report on Invasive Alien Species	35
----------------------------------------------------------------------	----

<i>Vietnam</i> National Report on the Management of Invasive Alien Species	38
-------------------------------------------------------------------------------	----

A profile of the protected area system of Brunei Darussalam	40
-------------------------------------------------------------	----

Country Research Profiles

Malaysia	44
Indonesia	46
Philippines	47
Singapore	49
Brunei Darussalam	50
Thailand	52
Cambodia	55

Profiles



Bukit Timah Nature Reserve **58**

Bookmarks

Philippines Celebrates Clean Air Month in November	62
----------------------------------------------------	----



Celebrating International Year of the Mountain 2002 **63**

The ASOEN: Learning from European Experiences	65
-----------------------------------------------	----

Database

Biodiversity Information Sharing System (BISS) focuses on ASEAN Protected Areas	67
---------------------------------------------------------------------------------	----

Publications

Training Resources Database Entries Capsule Reviews	68
-----------------------------------------------------	----

Dear Co-Directors,

We are greatly interested in your publication "Marine Protected Areas In Southeast Asia" that was featured in your newsmagazine, ASEAN Biodiversity.

We would be very much appreciative if you could send me a free copy of the above-mentioned publication for our awareness campaigns.

Thank you very much for your attention and cooperation and we look forward to receiving the publication.

Yus Ruslia Noor

Biodiversity Specialist
Project Coordinator
Climate Change, Forests and Peatlands in Indonesia (CCFPI)
Wetlands International-Indonesia programme
P.O. Box 254/BOO
Bogor 16002, Indonesia

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Dear Co-Directors,

This is to acknowledge with thanks the receipt of the publication entitled "Partici-

patory 3-Dimensional Modelling: Guiding Principles and Applications", which you have generously donated to the Ramona S. Tirona Memorial Library of the Philippine Women's University.

This publication will serve as good reference for our students, faculty and researchers.

We will appreciate very much if you can include our library as a recipient of any materials you may have in the future.

Thank you and more power!

Mrs. Dionisia M. Angeles

University Librarian
Ramona S. Tirona Memorial Library
The Philippine Women's University System
Taft Avenue, Manila, Philippines

◆◆◆

Dear Co-Directors,

This is my first time to get hold of your highly informative and educational newsmagazine. Its name struck me immediately when I saw a copy of my boss lying on his table.

Everybody at the Department of Environment and Natural Resources (DENR)-Protected Areas and Wildlife Bureau (PAWB) knows what *Dalaw Turo* and its activities are. *Dalaw Turo*, which literally means "visit to teach", is a nationwide information, education and communication programme on protected areas, wildlife and biodiversity of the DENR, particularly the PAWB. Here at the DENR-Cordillera Administrative Region, I am proud and honored to be one of the few members of the select group of *Dalaw Turo* implementers. I believe your "ASEAN Biodiversity and other publications are just the right tools which will enhance our effectiveness in our *Dalaw Turo* outreach activities whether it be in the schools or in the communities. Could you please send me copies of the newsmagazine?

Peter Warner A. Manadao

Community Environment and Natural Resources Office
Tabuk, Kalinga Province, Philippines

Third quarter in a nutshell

December 18 – China established the **Tetraena Protection Institute** in Shizuishan City to conserve the tetraena, a variety of deciduous bush known as the “living fossil” and dates as far back as the giant panda. The last existing tract of tetraena in the world grows on 10,000 hectares of sandy area bordering the Ningxia Hui and Inner Mongolia autonomous regions. The plant has been nicknamed the “giant panda of plants” because it is rare, age-old and has round-shaped leaves with white brushy stalks, similar to the ear of the giant panda. It used to be cut for firewood since it is greasy and flammable. Camels and goats also like to nibble its leaves. Moreover, large tracts of tetraena fields have been converted into factories in the wake of industrial expansion. Local conservationists welcomed the move since it showed that the government is shifting from laying particular stress on protecting wild animals to protecting both wild animals and plants.

December 17 – The Hong Kong-based **Animals Asia Foundation established a \$3 million sanctuary to save Asiatic black bears** from farmers who drained their body fluids to produce an ingredient for traditional Chinese medicine. The centre includes a hospital for injured bears and a 27-acre tract of bamboo forest. The site is part of efforts to stop “bear farming,” which involves surgically implanting tubes to drain bile from the gallbladders of captive animals. China encouraged the practice in the 1990s as a way to stop hunting of endangered bears. But injuries and illness suffered by caged bears led to criticism from environmentalists, who say demand for their bile can be met with herbal and synthetic alternatives. Bear bile, a bitter, greenish fluid that helps with digestion, has

been used for centuries by Chinese physicians to treat diseases of the eye, liver and other organs. Bile farming began in North Korea in the early 1980s as an export industry for the impoverished communist nation and spread to China, Vietnam and South Korea. China lists the Asiatic black bear as an endangered animal. The sanctuary is big enough for 100 bears, and will be expanding under an agreement with Beijing to return 500 animals to the wild.

December 12 – The United Nations earmarked **2003 as the International Year of Freshwater** to address hardships caused by lack of access to clean water. The United Nations, governments and many non-governmental and private sector partners are planning a wide range of events and activities for the International Year of Freshwater, which is being jointly coordinated by the UN Department of Economic and Social Affairs and the UN Educational, Scientific and Cultural Organization (UNESCO). These include the conduct of the 3rd World Water Forum, which will take place in Kyoto, Shiga and Osaka in Japan from 16 to 23 March 2003; and the release of the first edition of the World Water Development Report, which provides a comprehensive view of today’s water problems, and offers wide ranging recommendations for meeting future water demand. The UN estimates that some \$30 billion per year is being spent on meeting drinking water and sanitation needs worldwide. An additional \$14 to \$30 billion per year would be needed to meet the agreed water and sanitation targets. Although water is likely to become a growing source of tension and fierce competition between nations, it can also be a catalyst for cooperation. The International Year

of Freshwater can play a vital role in generating the action needed - not only by governments but also by civil society, communities, the business sector and individuals all over the world.

November 22 – A discovery by The Nature Conservancy has led to a **10% increase in the known number of orangutans in the world.** The research teams documented 1,600 orangutan nests, indicating that between 1,000 and 2,500 orangutans are living within a 1,399 km² area of lowland forests in the province of East Kalimantan, part of the Indonesian portion of Borneo. This is



An orangutan mother and child from the newly discovered population.

Photo © Timothy Laman/National Geographic Image Collection

the largest viable population of wild orangutans known to exist in East Kalimantan and represents one of the best chances to protect a large, healthy population of wild orangutans anywhere in the world. Recently, the Conservancy signed a joint declaration with the Berau District of East Kalimantan - the district in which the orangutan population is located - and the Indonesian Ministry of Forestry, committing all three parties to conserve and manage orangutan habitat in the district. The parties also pledged to protect the function and ecology of the orangutan habitat area and agreed to promote forest conservation through forest certification. While the forest where the new orangutan population was found has

not been heavily logged, it is facing pressure from both legal and illegal logging operations.

November 20 – Conservation International (CI) and the United Nations Foundation have formed a new three-year, **\$15-million partnership to protect and conserve World Heritage Biodiversity hotspots.** The partnership was announced at an international congress entitled “World Heritage 2002: Shared Legacy, Common Responsibility” hosted by the UN Educational, Scientific, and Cultural Organization (UNESCO) to mark its 30th anniversary. Working with UNESCO, the UN Foundation and CI seek to collaborate on the development of projects in proposed or existing natural World Heritage Sites. Of the 730 designated World Heritage Sites, 144 have been inscribed as natural sites. Sixteen of the 25 global biodiversity hotspots have World Heritage Sites, and the partnership will be beneficial by providing the essential on-the-ground work to ensure their protection.



The southern muriqui (*Brachyteles arachnoides*) is one of the most threatened primates in Brazil’s Atlantic Forest.

Photo by Haroldo Palo, Jr. courtesy of Conservation International

November 18 – The **8th Conference of Parties of the Ramsar Convention**, with the theme “Wetlands: water, life, and culture”, opened in Spain with 1,200 registered participants from around the world. There are presently 133 nations that are Parties to the Ramsar Convention, with 1,229 wetland sites totalling 105.9



million hectares designated for protection by inclusion on the Ramsar List of Wetlands of International Importance. A primary concern for the representatives from 68 countries is how the management of wetlands can be improved so that unique species and ecosystems are protected and at the same time can remain a source of income for the poorest communities around the world. Before the Ramsar conference, several governments named new wetlands for protection, including Ecuador (Humedales del Sur de Isabela and Bahía de Puerto Villamil) and Japan (Fujimae-Higata and Miyajima-numa)

November 15 – Delegates agreed to **protect all 32 species of the tiny sea horse from a lucrative global trade** that threatens to drive them to extinction. The decision by the U.N. Convention on International Trade in Endangered Species (CITES) does not ban the sea horse trade, but instead forces countries to better monitor and control cross-border business to ensure that it does not pose a risk to their sea horse populations. Each country must take steps to certify that all sea horse catches and sales are legal. Sea horses, which range from fingernail-sizes to one foot (30 cm) long, are sold mainly as aquarium pets or dried and used in traditional Asian medicine. About 105 countries have sea horses in their waters and 69 are involved in trade. Asian trade alone in sea horses was about 70 tonnes in 2000, up from 40 tonnes five years earlier. The biggest live sea horse exporters are Indonesia, the Philippines and increasingly, Brazil. The United States and Western Europe are top

importers of live sea horses for the aquarium industry.

November 14 – **Twelve proposals to list 20 Asian freshwater turtle species in Appendix II of CITES** were endorsed by CITES members. Threatened by uncontrolled trade for the Asian food market and for traditional medicine, turtle populations have significantly declined, leading to a number of freshwater turtle species being classified as Critically Endangered according to the 2002 IUCN Red List of Threatened Species. Asian turtles are an example of the serious implications, to both human well-being and species conservation, of the increasing demand for wild meat. Although concerns have been most clearly documented in Africa, it is apparent that overexploitation of wild animals for meat is not just an African issue. It has become a global issue that impacts most taxa. While much attention has been on the conservation impacts of the so-called “bushmeat crisis”, IUCN notes it is important to recognise that wild species are an important socio-economic asset to many peoples. As such, the wild meat trade epitomizes the importance of approaching conservation in conjunction with issues such as poverty, health and food security.

November 13 – The World Wide Fund for Nature (WWF) applauded the adoption by Parties to CITES of a resolution submitted by India to **improve conservation of Asian leopard, snow leopard and cloud leopard**. The leopards are largely threatened by rampant illegal trade in skins in countries such as India, China, Kyrgyzstan and Myanmar. Additional threats include the increasing demand for leopard bones for traditional Chinese medicine, and conflicts between these cats and farmers, who kill them to protect their livestock.

November 12 – **Eighteen new sites in 12 countries have been added to UNESCO’s World Network of Biosphere Reserves** while five existing biosphere reserves have been extended. One extension creates the first transboundary biosphere reserve in Africa. The World Network of Biosphere Reserves now consists of 425 sites in 95 countries. More on UNESCO’s Biosphere Reserves is online at: <http://www.unesco.org/mab/nutshell.htm>



Giraffes in Niger are protected by the first transboundary biosphere reserve in Africa.
Photo courtesy of the Embassy of Niger

November 8 – Police confirmed the **death of one of Vietnam’s few-remaining saola** (*Pseudoryx nghetinhensis*), also known as Vu Quang ox, after discovering fresh saola meat in A’ Tep village, Bhallo commune, in the far north of the province. Little is known about this straight-horned mammal, which was only discovered by scientists in 1992, except that it is extremely unique and could be on the brink of extinction. Estimates have put the



Saola (*Pseudoryx nghetinhensis*)
Photo © WWF-Canon / David Hulse

total population of saola at between 70-1000 individuals, restricted to an area of around 4,000 km² in forests of the Truong Son mountains along the Vietnam-Laos border. The area where the saola was caught is thought to be one of only a handful of remaining strongholds for the species, and the loss of even a single saola constitutes a significant blow to the potential survival of the population in the area, as well as to the species as a whole. Fortunately, the saola does not hold particular medicinal values and as such is not as highly prized as other rare species such as tiger. Hunters do not tend to target saola as it is simply not economically viable to do so. As a result, conservationists hope that – with increased awareness and national pride about such a beautiful, unique and threatened animal – there could be hope for the survival of the saola.

November 4 – A study published in the November issue of Science states that the percentage of the **world’s plants threatened with extinction could be as high as 47%**. Previous studies of extinct plants underestimated the numbers because they failed to include many plants growing in tropical countries such as Ecuador and Colombia. Plants are becoming extinct for many reasons, including global warming and human encroachment into area habitats. Researchers from the Missouri Botanical Gardens reviewed data from 189 countries and territories and determined that between 310,000 and 422,000 plants - or 22 to 47% - could be threatened. Maintaining a global database of threatened plants is a crucial step toward developing better management plans to ensure their protection. The vast majority of plants that are threatened in tropical areas are those located within a wide variety of plant life or where habitat loss is rapidly occurring.

November 1 – Some 600 people from 60 countries converged in Kyrgyzstan for the **Bishkek Global Mountain Summit**, the final global event of the United Nations International Year of Mountains. Delegates have been shaping strategies to deal with the impacts of war, poverty, hunger, agriculture, development, and climate change, which is shrinking glaciers and changing plant and animal communities in high altitude areas. The main output of the Summit is the Bishkek Mountain Platform, which aims to provide guidance for future actions to improve the livelihoods of mountain people, to protect mountain ecosystems, and to use mountain resources more wisely. The platform states that climate change, natural hazards and other forces are threatening the complex webs of life that mountains support. It also supports the International Partnership for Sustainable Development in Mountain Regions, which was agreed upon at the September Johannesburg World Summit on Sustainable Development.



Bishkek ala Archa National Park
Photo courtesy VNC Travel

October 25 – A project initiated by the Philippine Rural Reconstruction Movement (PRRM) has **transformed poachers to protectors of sea turtles**. The project supported by the Global Environment Facility's Small Grants Programme and the United Nations Development Programme encouraged fishermen in southwestern Luzon in the Philippines to form a corporation to



Six-month old Olive Ridley turtle ready for release from the hatchery

Photo © David Dudenhoefler

protect the "pawikan" (local name for the Olive Ridley turtle) and to develop income alternatives to poaching. Support from the local government provided seed money for the former poachers to start selling gasoline to their neighbours, and buying fish from them for resale. Government wildlife officials have also taught the fishermen how to handle the turtle eggs and set up a hatchery; the Small Grants Programme paid for other training, basic equipment, and helped the group build a meeting hall.

October 24 – The **European Commission presented a new approach for protecting, conserving and promoting sustainable use of marine resources**. The new approach seeks to develop an integrated policy for the marine environment in response to the increasing threats faced by our oceans and seas and is a first step towards one of the seven "thematic strategies" announced in the European Union's 6th Environmental Action Programme. The strategies are meant to

- Better implement environmental legislation;
- Integrate environmental objectives in other EU policy areas;
- Inform citizens, businesses and NGOs of the EU's environmental priorities;
- Prevent climate change, and implement the Kyoto targets the EU has set for itself and a 20-40% reduction of emissions by 2020;
- Protect nature and biodiversity;
- Improve health and

environment with a special focus on protection of the most vulnerable groups in society (children and elderly people); and,

- Ensure sustainable use of natural resources and management of waste.

The initiative is part of efforts to fulfil EU commitments made at the World Summit on Sustainable Development in Johannesburg relating to marine protection and fisheries. It introduces an ecosystem-based approach to management, and is closely aligned with the Commission's proposals to reform the common fisheries policy.

October 18 – Scientists at the Australian Institute of Marine Science (AIMS) have confirmed the **existence of coral disease on the world's longest reef, the Great Barrier Reef**, which stretches along Australia's east coast. AIMS scientists working in the long-term monitoring programme say the disease they have documented is in a broad category known as White Syndrome, which they hope to learn exactly what it is. The disease is more common on table corals, and starts at the base. It breaks the coral tissue down, eventually killing it. In 1999 only seven reefs were infected with White Syndrome; this year, 33 reefs were affected out of the 48 studied by the AIMS. White Syndrome outbreaks are happening in pristine areas of the Great Barrier Reef, areas untouched by coastal development and tourism. This means the reef diseases are not linked to pollution, as are other coral diseases around the world.



White Syndrome has taken hold of this Tabulate Acropora coral

Photo Australian Institute of Marine Science

October 11 – **Vietnam's dwindling population of dugongs has been further reduced**, with at least six of the sea mammals killed by fishers over the past month. Nick Cox, a dugong specialist at Worldwide Fund for Nature (WWF) in Hanoi, stated that Vietnam is estimated to have about 10 of the mammals on the southern islands of Con Dao and Vung Tau and a small population in the northern province of Quang Ninh. He said the conservation group plans to launch a programme to protect the animals that will include educating fishers. The U.N. Environment Program says the dugong population has been devastated by pollution, coastal development, fishing nets, and trophy hunting in recent years, leaving an estimated 1,000 to 2,000 worldwide. Only a few hundred are believed to live in Southeast Asia. The animal lives in coastal areas in the tropics and subtropics, grazes on seagrass, and weighs up to about 330 pounds (150 kg).

October 11 – An international team of biologists led by Christopher Schneider of Boston University discovered **up to 140 new frog species found in a survey of Sri Lankan rainforests**. The frogs range in size from about an inch to four inches and come in all colours. The new species are all tree frogs and are the latest additions to the estimated 1.7 million species of animals and plants known to science. Some of the newly found frogs lay eggs in the forest leaf litter and develop directly into tiny froglets, bypassing the typical tadpole phase. This adaptation may explain why these species have managed to survive in a rainforest that in recent decades had dwindled dramatically. The concentration of amphibian diversity puts the island on a par with much bigger islands such as Madagascar and Borneo in terms of biodiversity.



Nepalese rhino



Elephant bathing in Nepal's Chitwan National Park
(Photos courtesy Anselmo Lastra)

October 10 – Nepal and India have initiated a joint effort for the conservation of wild animals and plants in the border areas linking the two countries. Both governments have agreed to monitor their common border regularly to halt illegal smuggling of timber, as well as poaching and trade in wildlife parts. Conservation efforts include setting up a joint trans-border consultative committee, constructing a database for information sharing, as well as identifying and implementing

research programmes and restoring migratory corridors for the large wild species such as elephant, rhino, swamp deer and tiger. Each species has its own season of migration across the India-Nepal border and patches of forests at several points make it difficult to determine where the border actually lies. These circumstances allow poachers to hide and flee in the absence of coordinated actions by both the bordering countries. Conservation officials from both countries hope that the new collective measures will now minimise illegal activities along the borders.

October 2 – Taiwan's Forestry Bureau said it has no plans to open a legendary forest of giant Taiwan hinoki cypress trees to the public. The site of the forest is an area long referred to by the local Atayal people as "divine temple of giant cypress." The Atayal people have passed the legend of the "divine temple" down through generations, but due to the forest's remoteness and rugged terrain, few people have ever seen it. The Forestry Bureau has listed it as a primary forest subject to special protection.

Noting that many of the cypress trees in the forest are thousands of years old, conservation officials hope that individuals who happen to discover the forest will refrain from publicizing its location to avoid creating pressure for it to be opened to the public. Among seven species of cypress in the world, Taiwan hinoki cypress and Taiwan red cypress are indigenous to Taiwan.

October 2 – A report by the Genetic Resources Action International (GRAIN), a Barcelona-based campaigns group, and Kalpvriksha, an Indian environmental organisation, state that the quest to commercialise plant genes by trans-national companies and national governments is destroying a wealth of



Kava, originally used as a ceremonial drink, is now packaged and sold under seven U.S. patents as a stress reducer and mood elevator.

genetic resources and livelihoods across the Asia-Pacific region. The report, called "**Traditional Knowledge and Biodiversity in Asia-Pacific: Problems of Piracy and Protection,**" examines the plight of people in the region who rely on plants for food and medicine. With annual global sales of products derived from plant genes estimated at between US\$500 billion and US\$800 billion, many countries, and the large businesses they support, increasingly want to control these resources and the knowledge associated with them for commercial purposes. The report recommends that governments consider alternatives to Intellectual Property Rights contracts to enable greater protection of traditional knowledge, and foster stronger network building among NGOs and for the documentation of traditional knowledge. Governments should also bolster the rights of indigenous people to control the genetic resources that are the underpinnings of their livelihoods. The full briefing report is online at: <http://www.grain.org/publications/tk-asia-2002-en.cfm> ■

The International Foundation for Science Call for Research Grant Applications from Developing Countries

The International Foundation for Science (IFS) provides support to young scientists of merit in developing countries by awarding research grants and providing grantees with additional services such as travel grants and purchasing assistance.

The IFS supports research related to the renewable utilisation of biological resources in areas such as crop and animal production, forestry, food science, natural products, and fisheries, as well as research on the sustainable utilisation and conservation of natural ecosystems, including themes such as water management and biodiversity. Proposals for projects may address biological, chemical, or physical processes as well as social and economic relationships important in the conservation, production, and renewable utilisation of the biological resource base.

Research grants are awarded up to a maximum value of USD 12,000 for a period of one to three years and may be renewed twice. They are intended for the purchase of equipment, expendable supplies, and literature.

Applicants must be citizens of, and carry out the research in, a developing country. They should also work at a university or national research institution in a developing country. Specifically excluded are countries in Europe, including Turkey and Cyprus, as well as countries of the former Soviet Union. Argentina and Uruguay are also not eligible to receive support. As well as being under the age of 40 (under 30 for applicants from China) and at the start of their research career, candidates must possess a higher academic degree, which should be at least an MSc or equivalent.

Applications are made on the application form, in English or French, which is available from the IFS Secretariat or can be downloaded from the website.

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Editorial

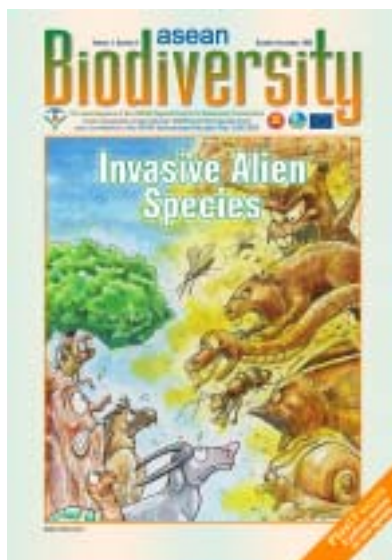
Invasive Alien Species and their Impacts on Biodiversity

■ By Gregorio I. Texon

One of the major threats to biodiversity in the ASEAN region as well as globally is the introduction of exotic species into the region. For the past 40 years, the rate of and risks associated with biotic invaders have increased enormously because of human population growth, rapid movement of people, and alteration of the environment.

Alien species are those that occur outside their natural range or have established themselves accidentally or introduced deliberately. Invasive alien species (IAS) are those that threaten the existence of native plants and animals or other aspects of biodiversity, and occur in all groups of plants and animals. The Species Survival Commission of IUCN reports that as competitors, predators, pathogens and parasites, alien species have invaded almost every type of native ecosystem, and caused hundreds of extinctions. Accordingly, their impacts are immense, insidious and usually irreversible. The article on page 16 (Global Strategy on Invasive Alien Species) of this magazine points out that the establishment of non-native species that have wreaked havoc on local ecosystems is one of the significant impacts of the globalisation of trade.

Political boundaries are indeed porous to the intentional and unintentional movement of species from various ecosystems in all parts of the world. And in both ecological and economic terms, the scope and cost of biological alien invasions are enormous. Introduced pests and pathogens reduce crop and stock yields, and weeds degrade marine and freshwater ecosystems. In South-



Cover illustration by Rene Aranda

east Asia alone, according to John R. MacKinnon's article (see page 9 of this magazine), IAS are causing billions of dollars worth of damages.

Among the worst IAS in the ASEAN region are the: water hyacinth (*Eichhornia crassipes*), pantropical weeds (*Imperata cylindrical*), Thai catfish (*Clarias batrachus*), Chinese super-tree (*Paulownia tomentosa*), bullfrogs (*Rana catesbeiana*), golden apple snail (*Pomacea canaliculata*), ship-spread rats (*Rattus rattus*), and American cockroach (*Periplaneta americana*). Add to these species those listed in the national reports of each ASEAN member-country featured in this issue of *ASEAN Biodiversity* (see pages 20 - 39); the articles discuss the status of IAS as well as nationally implemented strategies to manage and control these.

However, we still have a long way to go before we could even match the enormous problem and risks with a well-balanced solution. Concerted efforts are needed at the national, regional and international levels.

Government planners and regulators must ensure that IAS issues are addressed and efforts of various institutions are well supported and enhanced.

Being intrinsically global in nature, IAS require international attention and solutions. Future work should thus include:

- Development of a regional programme for taxonomists to build core competencies and expertise in identifying specific taxonomic groups and alien species
- Assessment of the extent of invasions by alien species and their economic implications.
- Update and/or amendment of the existing sanitary and phytosanitary measures or other associated legislations, regulations and procedures to make them more effective in dealing with exotic species
- Improved education and dissemination of information that could help reverse or at least halt the problems should be shared sufficiently to all sections of the international community.
- Development and/or establishment of national databases on websites that should include a list of recognised invasive species, and case studies of levels of damage and of control measures employed.
- Introduction of national programmes including tax incentives that promote the use of native germplasm for horticulture, urban greening, parks, golf courses, roadside trees and forestry. ■

Invasive Alien Species in Southeast Asia

■ By John R. MacKinnon

Invasive alien species (IAS) are causing billions of dollars worth of damage in Southeast Asia (SEA) as well as causing displacement and, in some cases, extinction of hundreds of indigenous species. Yet despite the magnitude of the damage, the prominence given to the control of IAS in the Convention of Biological Diversity and the many international protocols and initiatives to tackle this issue, almost no attention is paid to this threat in SEA; there are few national programmes to combat established IAS or reduce the risk of more from becoming introduced. Equally shocking is the fact that whilst some species have become established accidentally, the bulk was deliberately introduced.

The data sheets held on SEA countries by the Global Invasive Species Programme database <http://www.issg.org> for instance fail to reflect the great extent or urgency of the problem. Hundreds of species are involved – not less than ten species per country documented in the database.

The rate of introduction of alien species is greatly increasing with the globalisation of trade, and with more people traveling around the world. Moreover as more natural areas are transformed by rapid development, the openings for invasion become more numerous.

Some major culprits

Almost all lakes and fresh waterways of the region are clogged with such species as water hyacinth (*Eichhornia crassipes*), water lettuce (*Pistia stratiotes*), and yellow burhead (*Limnocharis flava*). These species impede boat transport and fishing activities and also cause eutrophication and loss of productivity. Clearing these weeds annually involves great labour costs.



Water lettuce

Most lakes of the region have become invaded by introduced fish such as tilapia (*Tilapia mossambica*), which now even inhabits saline estuaries, Thai catfish (*Clarias batrachus*), bighead (*Aristichthys nobilis*), grass carp, snakeheads and even goldfish (*Cyprinus carpio*). Almost all endemic lake fish of the Philippines are already extinct as a result of such introductions. Losses of indigenous fish in major fisheries such as Tonle Sap in Cambodia have huge economic impacts.

In addition to many pantropical weeds that have become very aggressive such as *Eupatorium (Chromolaena) odoratum*, *Mimosa pudica* and grasses like *Imperata cylindrica*, many ornamental plants are spreading out of control across the region. These include *Lantana camara*, *Caesalpinia pulcherrima* and climbing plants that can smother the original vegetation such as Blue Trumpet Vine (*Thunbergia grandiflora*), Morning glory (*Ipomea carnea*), *Ipomea cairica*, Mile-a-minute vine (*Mikania micrantha*), *Bougainvillea spectabilis* and the edible Thai vine (*Coccinea indica*).

Exotic coloniser shrubs such as *Piper aduncum*, *Mimosa pigra* and prickly pear (*Opuntia monacantha*) now cover huge areas of the region. The undergrowth of important nature reserves and parks in Luzon, Philippines, which should be covered in endemic palms and shrubs, are dominated by the admittedly attractive South American shrub (*Pachystachys coccinea*), in no way inhibited by the lack of its natural pollinators – the humming birds.

Foresters have consistently introduced exotic trees for plantations. There is often a short-term advantage in planting a species in the place where its natural pests and diseases are absent. In some cases such species spread out of control, displacing natural vegetation and profoundly changing the natural ecology. The Chinese super-tree (*Paulownia tomentosa*) is listed as invasive in many countries. Several introduced conifers have become established in the region and the spread of Australian eucalyptus and *Acacia* has a profound effect. Both *Acacia auriculiformis* and *Acacia mangium* grow well in SEA and spread natu-

rally over cleared and burned areas. These species create conditions of great flammability and themselves thrive on regular fire episodes in lands where natural forest fires were unheard of. As the 'haze' fires now burn annually in Borneo and Sumatra, so do these species spread at the expense of native species and transform those islands into firescape monsoon forests.

The introduced bullfrogs (*Rana catesbeiana*) and marine toads (*Bufo marinus*) have spread right across the region, competing with and actually devouring endemic amphibians along the way.

Moreover, the introduced African Giant snail (*Achatina fulica*) and golden apple snail (*Pomacea canaliculata*) for human consumption have been ecological disasters. These species are mostly not appreciated as foods in the region but are now dominating many ecosystems and, like agricultural pests, are causing huge losses. Other snails spread Eastern Schistosomiasis disease to humans.

Ship-spread rats – *Rattus rattus* and *R. norvegicus* – have eliminated local bird species on small islands, competed with indigenous rodents and also are potential sources of diseases and major agricultural pests.

The wild pig (*Sus scrofa*) has spread throughout the region, causing huge agricultural losses and outcompeting the indigenous forest pigs of the bearded pig (*barbatus*, *celebensis*) group.

Domestic cats and dogs have done untold damage, especially in islands that formerly lacked significant mammal predators such as in Sulawesi, parts of the Philippines and many small oceanic islands. Humans also seem to have spread the common palm civet (*Paradoxurus hermepoditus*) in early times.

Tree sparrow (*Passer montanus*) and House crow (*Corvus splendens*) have spread across the region as commensals of man and have become serious grain and urban pests, respectively. Java sparrow (*Padda oryzivora*) has become an established pest in many areas even though it remains endangered and rare in its native Java. Exotic parrots such as the Lesser yellow-crested cockatoo (*Cacatua sulphurea*) and the rainbow lorikeet (*Trichoglossus haematodus*) have even become established in some areas and have become noisy local pests in some cities.

Dangerous invertebrates introduced to the region include the American cockroach (*Periplaneta americana*), which has become such a terrible household pest, crazy ants (*Anoplolepis gracilipes*), which have caused havoc among some native fauna, red fire ants, nematode worms and avian malaria.

Even more difficult to notice and control are the many microorganisms such as wood rot fungi that become introduced with timber shipments, other fungal pests and viral

and bacterial diseases.

The scale of damage/losses

Economic assessments of the levels of damage caused by IAS in the U.S.A. result in figures of billions of US dollars per year. These losses are seen in production losses in agriculture, forestry, and fishery, and costly eradication programmes to eliminate undesirable species and diseases. The cleanup cost of one species of *Tamarix* is estimated at \$US4 billion. Similar costing exercises are almost totally absent in the SEA region. But given the size of the region, the total human population and the greater direct dependence of the population on biodiversity and primary production systems, it is clear that the damage to ecosystems and economies must also be counted in billions of U.S dollars per annum.

Vulnerability

Examining patterns of invasion allows us to make some generalisations. Some ecosystems are more vulnerable than others. Freshwater systems, small islands, areas with high number of local endemic species and areas undergoing major landcover transformation are particularly vulnerable and need special vigilance and protection. A logged forest is more prone to invasion than a primary forest.

Equally we can recognise certain types of organisms that have a greater chance of becoming invasives. Vig-



African giant snail



Wild pig

orous r-selected coloniser species with fast reproductive rates and good dispersal ability are very dangerous. Such species include many grasses, climbers, coloniser shrubs and trees with wind dispersed seeds. Parasitic and carnivorous animals are also dangerous. Introduction of close relatives of indigenous species is highly prone to result in genetic pollution of the local form.

Why do we continue to introduce new species?

- Accidents: inadequate controls, laws, quarantine, etc.
- Irresistible urge to try to improve on nature (*ars versus natura* debate) or the "grass always looks greener on the other side of the hill" syndrome. The reason may be innocent, greed-driven or even malicious.
- Lack of local species to meet specific needs i.e. good fibre or ornamental properties.
- Short-term or long-term superiority of exotic varieties (often due to lack of local pests and diseases)
- Easier availability of alien seeds than local species; and lack of development of local germplasm over much of the developed world.

Why do local agencies pay so little attention to the problem?

- Failure to recognise long-term and indirect costs of introductions or costs will not be borne by an importer who generally shows a profit.
- Weaknesses of systematics and lack of awareness problem. Lack of recognition of local versus exotic species such that people do not notice that they are surrounded by exotics.
- Some problems such as spread of diseases, crop pests, grain losses to rats and domestic pests such as cock-

roaches are recognised as major economic losses but not generally recognised as being caused by alien invasives.

- Weakness of laws and control measures resulting from the lack of awareness as to the true scale of the problem.
- Unwillingness to interfere in 'commercial development'
- Over-concern over the hype of genetically-modified organisms (GMOs) without realising IAS is a more immediate and serious threat.

Conclusions

The enormous scale of threat from IAS has been consistently under appreciated in the region. IAS is probably the second greatest threat to biodiversity after loss of habitat.

Each country should be encouraged to take the problems of alien invasives more seriously.

Large countries should even be concerned about limiting movement of species across internal biogeographical barriers such as between different major islands of Indonesia or the Philippines.

They should undertake surveys and research to assess the extent to which indigenous or native species are already invaded by alien species and assess the economic implications of these invasions.

The findings of such studies need to be much more widely publicised or broadcast and in particular must be brought to the attention of government planners and regulators so that actions to control or eradicate IAS and limit further introductions can be justified and implemented.

National databases about alien invasives should be established on websites. International programmes such as GISP can assist in collating such data into easily accessible international databases. A good example of a national database can be found on <http://www.chinabiodiversity.com>. Such

databases should list recognised invasives, give case studies of levels of damage and of control measures employed, biodata (maybe drawn from the country of origin) and have outreach and awareness role.

Most of the regulations limiting introduction, field trials and releases of new organisms into the environment would be the same for alien species and GMOs. GMO regulations should not be developed independently of alien invasive controls.

National programmes should be introduced including tax incentives to promote the use of native germplasm rather than introduced species for horticulture, urban greening, parks, golf courses, roadside trees and forestry.

The ASEAN Regional Centre for Biodiversity Conservation, which has held one national workshop on the subject of IAS in the Philippines, will set up a regional database on IAS, and host a regional IAS workshop in 2003. ■

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THEIR IMPACTS AND MANAGEMENT

Invasive aquatic animals in the Philippines

■ By Rafael D. Guerrero III

Introduction

There have been more than 40 introductions of fish, crustacean and mollusk species into the inland waters of the Philippines since 1907. The species were intentionally introduced for food, recreation and mosquito control or inadvertently introduced in association with the imported species.

Invasive species are “species which have the ability to become established in natural or semi-natural environments or communities and cause an ecological imbalance” (Bruton and Merron, 1985). Such species can be alien (foreign) or indigenous (native) to a country.

This paper presents the experiences in the Philippines on the impacts and management of indigenous and alien aquatic animals (freshwater fishes and a snail) that have become invasive.

18 species (Mercene, 1997). The species were first reported by Herre (1924, 1926).

While Villaluz (1966) reported that the cyprinids contributed 49.4% to the total fisheries production of the lake in surveys conducted in 1963-1964, Escudero (1995) found the contribution of the species to be only 9.1% in 1990-1991. Davies (1990) reported that only five of the 18 cyprinids recorded by Herre were present in Lake Lanao in the 1980s.

The indigenous white goby was accidentally introduced in the lake by personnel of the then Philippine Fisheries Commission (PFC) (now the Bureau of Fisheries and Aquatic Resources or BFAR) in 1960 (Rosagaron, 2001). While the exact details are not known, it is believed that the goby was inadvertently stocked with the Mozambique tilapia (*Oreochromis mossambicus*)

fingerlings from the PFC's Freshwater Fish Farm and Nursery in Anibongan, Kitcharao, Agusan del Norte (Escudero, pers. comm.). The goby is found in Lake Mainit from which the farm gets its water supply.

The impact of the introduction of the white goby on the cyprinids of Lake Lanao is difficult to assess because of the lack of fisheries data. There are no statistics available prior to 1963-1964. Escudero *et al.* (1964) noted, however, that the *G. giurus* is predaceous on the cyprinid, *Puntius sirang*, in biological studies.

The eleotrid, an endemic species in Lake Mainit (Mercene, 1997) was accidentally introduced in Lake Lanao in the early 1970s along with the stocking of the Nile tilapia also from the fishfarm in Agusan del Norte (Escudero, pers. comm.). The *H. agilis* is believed to have dealt a more serious blow on the cyprinids of Lake

Indigenous invasive fishes

The decline in the biodiversity of the endemic cyprinids in Lake Lanao, Lanao del Sur, Philippines due to the accidental introduction of the white goby (*Glossogobius giurus*) and the eleotrid (*Hypseleotris agilis*) is a case of indigenous fishes that have become invasive on endemic fishes.

Lake Lanao is the second largest lake in the country with an area of 34,700 hectares. It is world famous for its endemic cyprinid species flock of four genera and



White goby

boydski.com

Lanao than the *G. giurus* because in 1990-1991, the cyprinids and goby contributed only 9.1% and 0.9% to total fisheries production of the lake while that for the eleotrid was 31.5% (Escudero, 1995). Only three cyprinid species (*P. sirang*, *P. tumba* and *P. lindog*) in the lake were in commercially available quantities during the study period.

In 1974, Escudero (1995) reported that the goby was the second most important fish in the lake in terms of production (next to the cyprinids). Until 1977, the *P. sirang* had the biggest contribution of 50% to the lake's total fisheries production. With the drastic drop in the production of the cyprinids, the eleotrid had overtaken the goby as the second biggest contributor to fisheries production of the lake (next to the Nile tilapia) by the 1990s.

The eleotrid is found in the whole littoral portion of the lake. It has been observed to voraciously feed on the eggs of the goby and common carp (*Cyprinus carpio*) attached to the vegetative substrate (Escudero, 1995). De Silva (1989) contends that the loss of cyprinids in the lake is attributed to predation and spatial take-over by the introduced goby and eleotrid.

Clearly, the accidental introduction of the predaceous indigenous fishes in Lake Lanao could have been avoided if more care was taken in the stocking operations to ensure that no extraneous species were mixed with the intentionally stocked fishes. There should have been a thorough study of the food and breeding habits of both the introduced and endemic fishes prior to the introductions to avert possible displacements.

To save the three remaining cyprinids in Lake Lanao, their artificial propagation has been resorted to. Professor Pedro Escudero and his co-workers at the College of Fisheries of the Mindanao State University in Marawi City, Lanao del Norte have succeeded in the artificial breeding



Golden apple snail

of the *P. sirang* and *P. tumba*. Studies on the third species, *P. baolan* have also been done (Guerrero, 1999).

An exotic invasive freshwater snail

The freshwater snail (*Pomacea canaliculata*) popularly referred to as the "golden apple snail" was introduced in the Philippines from the United States in 1980 by a local trader as an aquarium novelty. Because of its prolific nature and fast growth, it was promoted as an aquaculture commodity for food production and livelihood generation in the rural areas.

The snail was mass produced in concrete tanks and earthen ponds to market the adults as breeder stocks for farmers. It was widely distributed in the country in the 1980s. By the early 1990s, the breeder market for the snails had collapsed for lack of consumer demand. The snail was disposed of indiscriminately in irrigation canals and drainage systems.

The snails became a major pest of rice in many parts of the country affecting as much as 11% of the total irrigated area in 1990. Newly-transplanted rice seedlings are most vulnerable to the voracious feeding

habit of the *P. canaliculata*, which is herbivorous. To combat the pest, the country imported 439,472 kg of molluscicides with a value of US\$23 million in 1984-1998 (Dancel and Joshi, 2000).

Apart from being an agricultural pest, the *P. canaliculata* has also replaced the native freshwater snail (*Pila conica*) in Luzon, the largest island in the country (Pagulayan, 1997). The snail pest is also found now in the other major islands of Mindanao, Negros, Panay and Mindoro.

The first report of *P. canaliculata* infestation was in 1986 from the Cagayan Valley with 300 hectares of irrigated rice fields affected. In 1986, the pest had damaged about 4% of the country's 2.5 million hectares of lowland rice area.

As early as 1984, the damage of *P. canaliculata* to rice was already reported in Japan where it was introduced from Taiwan in 1964 as an aquarium species. It was also introduced in Thailand in 1982 but the first outbreak was reported in 1988.

A website (applesnail.net) lists six countries invaded by the *P. canaliculata* and one country, which is threatened. Information on the

management of the snail as a pest is also given (Joshi, *pers. comm.*).

Measures taken for invasive aquatic animals

On 15 October 1990, Executive Order No. 430 instituted the National Committee on Biosafety of the Philippines (NCBP), which formulated the national policies and guidelines on biosafety. The guidelines cover work involving genetic engineering as well as activities requiring the importation, introduction, field release and breeding of organisms that are potentially harmful to people and the environment.

The NCBP reviews and approves work proposals and/or the import and introduction of regulated materials and organisms. Each institution engaged in research, production, manufacture and/or introduction involving potentially hazardous biological work is required to create its Institutional Biosafety Committee, which shall be responsible for monitoring its work and enforcing the rules and regulations on biosafety.

As provided in the Philippine Fisheries Code of 1998 (Republic Act 8550), the regulation, control and monitoring of foreign aquatic species in the country are the responsibilities of the BFAR of the Department of Agriculture. The specific provisions related to introduction of foreign aquatic species and fisheries inspection and quarantine services are as follows:

Sec. 10. Introduction of Foreign Aquatic Species

"No foreign finfish, mollusk, crustacean or aquatic plants shall be introduced in Philippine waters without a sound ecological, biological and environmental justification based on scientific studies and subject to biosafety standards as provided for by existing laws; provided, however, that the Department may approve the introduction of foreign aquatic species for scientific/research purposes.

Sec. 67. Fisheries Inspection and

Quarantine Service

"For purposes of monitoring and regulating the importation and exportation of fish and fisheries/aquatic resources, the Fisheries Inspection and Quarantine Service of BFAR is hereby strengthened and shall have the following functions:

- a. "Conduct fisheries quarantine and quality inspection of all fish and fisheries/aquatic products coming into and going out of the country by air or water transport to detect the presence of fish pest and diseases, and if found to harbor fish pests or disease, be confiscated and disposed of in accordance with environmental standards and practices.
- b. "Implement international agreements, commitments on biosafety and biodiversity as well as prevent the movement or trade of endemic fisheries and aquatic resources to ensure that the same are not taken out of the country.
- c. "Quarantine such aquatic animals and other fisheries products determined or suspected to be with fisheries pests and diseases, and prevent the movement or trade from and/or into the country of these products so prohibited or regulated under existing laws, rules and regulations as well as international agreements of which the Philippines is a State Party;
- d. "Examine all fish and fisheries products coming into or going out of the country which may be a source or medium of fish pests or diseases and/or regulated by existing fisheries regulations and ensure that the quality of fish import and export meet international standards; and
- e. "Document and authorize the movement or trade of fish and fisheries products when found

free of fish pests or disease, and collect necessary fees prescribed by laws and regulations."

Lessons learned

There are important lessons that can be learned from the experiences of the accidental introduction of invasive fishes in Lake Lanao and the propagation of the imported freshwater snail as an aquaculture species in the country. First, in the case of Lake Lanao, invasive fishes can be indigenous or endemic and need not be foreign. Second, thorough studies need to be done prior to introductions in natural waters to ensure that no adverse biological and ecological impacts result. And third, utmost care in the stocking of introduced fishes should be taken to avoid the accidental introduction of other species that may accompany the principal species.

In the case of the imported freshwater snail, three lessons can also be learned. One, introduced aquarium species should be subject to the biosafety guidelines and quarantine regulations of the responsible agency or institution; two, no aquarium species should be used for aquaculture unless it has been approved by the regulating institution; and three, cooperation between the government and private sector concerned, and between trading countries is needed to provide appropriate information for risk analysis prior to importation of aquatic species.

Recommendations

With the lessons learned from past "biological and ecological disasters" and the prevailing laws and regulations concerning the introduction of aquatic species, it is hoped that untoward "invasions" can be averted in the future.

In developing countries like the Philippines, the strict implementation of quarantine and regulations and biosafety measures is hampered by

limitations in expertise, facilities and staff. Despite such constraints, however, it is incumbent on the government in cooperation with the private sector, particularly the aquarium trade and aquaculture industries, to protect native (indigenous and endemic) aquatic species and the environment from ecological and economic ravages of invasive species with the maxim of "prevention is better than control."

The following are recommended in the importation and introduction of alien aquatic species:

- Introduced species should not endanger any of the indigenous/endemic species
- Introduced species should not have any detrimental/deleterious effect on natural waters
- Introduced species should not be a host or vector of a new disease or parasite. ■

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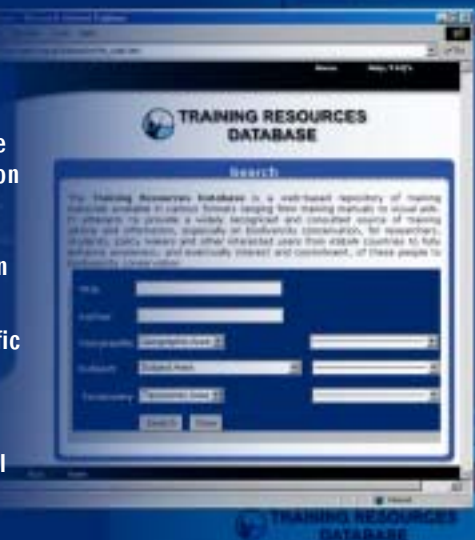
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Global Strategy on Invasive Alien Species

Expanding global trade in agriculture, forestry, fisheries and other industries that depend on raw materials has allowed the transport of species to various parts of the world. This has provided wider access to the world's biodiversity, thus providing better opportunities for economic and social enrichment. However, the trade has its drawbacks. One of the most significant impacts of the globalisation of trade has been the establishment of non-native species that have wreaked havoc on local ecosystems. These invasive alien species (IAS) are non-native organisms that cause, or have the potential to cause harm to the environment, economies, or human health.

Increased and more efficient worldwide trade, travel, and transport is greatly increasing the number and diversity of harmful organisms being moved around the world, as well as the rate at which they are moving. At the same time, human-driven changes in land use and climate are rendering some habitats more susceptible to invasion. These species have had adverse impacts on the local environment and economy, affecting the livelihood of thousands. Invasive alien species are thus a growing problem, and one

that has to be addressed with utmost urgency.

The need for concerted global action to combat IAS has led to the creation of the Global Invasive Species Programme (GISP). The Programme was established in 1997 to address the global threats caused by IAS and to provide support to the implementation of Article 8(h) of the Convention on Biological Diversity (CBD). GISP is operated by a consortium of the Scientific Committee on Problems of the Environment (SCOPE), CAB International (CABI), and the IUCN-World Conservation Union in partnership with the United Nations Environment Programme (UNEP). GISP seeks to:

- improve the scientific basis for decision-making on invasive species;
- develop capacities to employ early warning and rapid assessment and response systems;
- enhance the ability to manage invasives;
- reduce the economic impacts of invasives and control methods;
- develop better risk assessment methods; and
- strengthen international agreements.

GISP strives to develop public education about invasive species, improve understanding of the ecology

of invasives, examine legal and institutional frameworks for controlling invasives, develop new codes of conduct for the movement of species, and design new tools for quantifying the impact of invasives.

In essence, GISP aims to conserve biodiversity and sustain human livelihoods by minimising the spread and impact of IAS. To realise this mission, GISP operates through a "Partnership Network" comprised of scientific and technical experts on IAS issues from around the world. GISP stakeholders are its Partners – governments, intergovernmental organisations, non-governmental organisations, academic institutions, and the private sector. Although GISP Partners can be found the world over, its services are primarily intended to benefit developing countries and the institutions that support sustainable development. Capacity building is the underlying theme for all GISP activities.

Some of the services provided by the GISP Partnership Network include:

- Raising awareness of the IAS problem and potential solutions through relevant organisations and frameworks at national and international levels;
- Creating linkages among

governments, between governments and the private sector, and across disciplines;

- Networking databases and providing a gateway for information on IAS issues and expertise;
- Designing and co-hosting workshops on strategic planning, priority setting, and the development of new and better tools to address the problem;
- Summarising scientific and technical information to make it readily available to policy makers, scientists, educators, and other audiences; and
- Supporting Partners in the design of projects and programmes to minimise the spread and impact of IAS.

The GISP initiative encourages countries to recognise that they alone cannot solve IAS problems by working solely within their own borders. IAS are an international problem and GISP helps bring governments and other institutions together to collaborate in efforts to address national and regional IAS problems.

GISP has also compiled 10 strategic responses to address IAS problem based on agreements made by parties to the CBD as well as inputs provided by scientific experts.

1. Build management capacity

At the national level, capacity-building initiatives should include:

- Designing and establishing a “rapid response mechanism” to detect and respond immediately to the presence of potentially invasive species as soon as they appear.
- Designing educational programmes and training courses for relevant staff and policy makers.
- Building capacity to conceptualise and implement educational programmes aimed at community empowerment.

- Establishing institutions to address the provisions of the CBD and other international agreements in relation to IAS.
- Establishing IAS specialist positions in natural resource management agencies.
- Ensuring that all those involved in border and quarantine control are aware of the provisions of the CBD and its Biosafety Protocol.

2. Build research capacity

To enhance current knowledge in IAS, further efforts should concentrate on strengthening institutional frameworks and collaboration; improved scientific assessment and prediction; and management (early detection, assessment, prevention and control) strategies to contain IAS.

3. Promote sharing of information

Since considerable information on IAS is already available, efforts should focus on building a distributed information system of linked regional and national databases on the issue.

4. Develop economic policies and tools

Species invasions are a consequence of economic decisions and have economic impacts. Therefore, GISP encourages countries to incorporate the following economic principles into their national strategies for addressing IAS:

- User pays – those responsible for the introduction of economically harmful invasive species should be liable for the costs they impose.
- Full social cost pricing – ensure that the prices of goods and services whose production or consumption worsens the damage of invasives reflect their true cost to society.
- Precautionary principle – “when an activity raises threats of harm to human health or

the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.”

- Protection of the public interest – since the control of harmful invasives yields benefits that are a public good, it requires public investment in prevention, eradication, control, mitigation and adaptation.
- Subsidiarity – operate policies and management at the lowest level of government that can effectively deal with the problem.

5. Strengthen national, regional and international legal and institutional frameworks

Efforts at the national level should include:

- Reviewing relevant policies, legislations and institutions to identify conflicts, gaps and inconsistencies; and strengthen or develop effective national measures for the prevention, eradication, and control of alien species.
- Considering the establishment of a coordinating mechanism as well as a process between different levels and departments of government.
- Ensuring the participation and access to relevant information by all stakeholders, including local communities, in the implementation of laws and policies.
- Ensuring that legislation extends to all ecosystems and biomes within the national territory, especially vulnerable ecosystems, such as geographically or evolutionary isolated ecosystems, oceanic islands, aquatic ecosystems, and protected areas.
- Ensuring that all sectors and the full range of activities,

vectors and pathways are covered.

- Providing control measures to regulate and minimise the control of IAS, at the point of origin (export), destination (import), or both.
- Strictly regulating the movement and release of alien species domestically, especially in or near vulnerable ecosystems, between islands and to protected areas.
- Providing surveillance, monitoring and early warning systems to detect the introduction of IAS and take emergency action, as necessary and appropriate.
- Establishing an appropriate set of rights and responsibilities to address the impact of IAS along with supporting institutions, compensation mechanisms, and incentives and disincentives.
- Promoting coordination and cooperation at the international and regional levels should involve:
- Encouraging a detailed review of possible differences, inconsistencies or gaps between the mandates of major international and regional instruments relevant to IAS, with a view to encouraging their resolution.
- Continuing to integrate and promote biodiversity in international standards and processes, including risk analysis.
- Continuing to develop international guidance on standards and methodologies applicable to IAS.
- Encouraging a full discussion of a more comprehensive international approach.
- Supporting the work of the International Marine Organization (IMO) to develop a legal instrument on marine IAS and encouraging similar developments in other sectors.

6. Institute a system of envi-

ronmental risk analysis

Since Risk Analysis (RI) and Environmental Impact Assessment (EIA) measures have been adopted in many countries, the challenge is to ensure that they are implemented. Considerations to ensure their effectiveness require:

- Promoting the extension of risk analysis criteria and methods to all invasive taxa.
- Building on work undertaken by the plant and animal protection community to develop a rigorous process of risk analysis in relation to any deliberate introduction of species, including detailed analysis of the balance between benefits and costs.
- Developing criteria to measure and classify impacts of alien species to natural ecosystems, including detailed protocols for assessing the likelihood of invasion to specific habitats or ecosystems.
- Developing tools to factor invasive species into the decision-making processes regarding land use planning and development.
- Investigating ways in which strategic and project-specific EIA can be applied to unintentional introductions.

7. Build public awareness and engagement

Active public engagement is critical to successful invasive species management. This strategy is intended to help states and organisations engage the public successfully and coordinate their efforts for greater global benefit, leading to an informed public that supports ongoing actions to reduce the threat of IAS, and key stakeholders who are actively engaged in the implementation of IAS solutions.

8. Prepare national strategies and plans

Elements in such strategies should

include:

- Promoting cooperation within each country among sectors whose activities have the greatest potential to introduce IAS, including the military, economic development, forestry, agriculture, aquaculture, transport, health, tourism and water supply.
- Coordinating the activities of government agencies with responsibility for human health, animal health, plant health, transport, tourism, trade, protected areas, wildlife management, water supply and other fields relevant to IAS.
- Encouraging collaboration between different scientific disciplines and approaches that can contribute to addressing IAS problems, and combining these to produce a framework for the assessment of vulnerability of systems or geographical regions to IAS.
- Ensuring that the necessary information and policy guidance is provided to national delegations to sessions of the World Trade Organization and others responsible for setting world trade policy.
- Applying experiences in agricultural, forestry, and human health systems to combat IAS in natural systems; and
- Fully involving environmental and developmental NGOs as a means to address IAS issues.

At the regional and international levels, measures to address IAS issues can include:

- Establishing close links between public health agencies.
- Working with the wide range of relevant international trade authorities and industry associations.
- Encouraging and contributing to the development of collaborative industry, improved standards of practice, guidelines or codes of conduct,

which minimise or eliminate unintentional introductions; or strengthen these where they already exist.

9. Build IAS issues into global change initiatives

The interactions of IAS with other elements of global change may occur in complex and unpredictable ways, acting as drivers of further change. Global change results from the cumulative impacts of local decisions, and hence the issues need to be addressed both at international and local levels. Key actions in response to this will include:

- Articulating the interactions between IAS and other elements of global change (e.g. climate change, land use change).
- Quantifying the current and anticipated impacts of IAS at global and regional scales.
- Using scenario building as a means of incorporating uncertainty into projections of inter-

actions between different elements of global change.

- Ensuring that relevant international organisations with responsibility for global change issues include IAS as a component of global change, directly and through their member states; and
- Responding to global change issues without increasing the risks derived from IAS.

10. Promote international cooperation

Elements that would foster better international cooperation might include:

- Developing an international vocabulary that is widely agreed upon and adopted.
- Developing cross-sectoral collaboration among international organisations involved in trade, tourism and transport.
- Developing harmonisation and linkages among the international institutions dealing

with phytosanitary, biosafety and biodiversity issues related to IAS and supporting these by strong linkages to coordinated national programmes and their focal points.

- Developing joint work programmes among relevant conventions.

Aside from the GISP, numerous international instruments have been developed to deal with IAS. The most comprehensive is the 1993 Convention on Biological Diversity, which calls on its parties to "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species" *Article 8h). Another is the 1952 International Plant Protection Convention (IPPC), which applies primarily to plant pests, based on a system of phytosanitary certificates. The IPPC was extensively revised in 1997 to meet some of the new challenges of plant pests.

The International Maritime Organization (IMO) has also been working on ways to prevent the spread of marine alien organisms in ballast water and sediments since the mid-1970s. In 1997, the IMO Assembly adopted Guidelines for the Control and Management of Ships' Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens. The Guidelines are intended to assist Governments and appropriate authorities, ship masters, operators and owners, and port authorities, as well as other interested parties, in minimising the risks through ships entering their ports, but call for this issue of worldwide concern to be addressed through action based on globally applicable regulations. ■

*Excerpts from the document "A Global Strategy on Invasive Alien Species" edited by J.A. McNeely, H.A. Mahoney, L.E. Neville, P. Shei, and J.K. Waage. 2001. IUCN Gland, Switzerland, and Cambridge, U.K., in collaboration with the Global Invasive Species Programme

Following is a partial list of international and regional instruments and institutions pertaining to IAS:

Cartagena Protocol on Biosafety to the Convention on Biological Diversity	2000
IUCN-Guidelines for the Prevention of Biodiversity Loss Caused by Alien Invasive Species	2000
Guidelines for the Control and Management of Ships' Ballast Water to Minimize the Transfer of Harmful Aquatic Organisms and Pathogens	1997
Convention on the Law of Non-navigational Uses of International Watercourses	1997
Agreement on the Application of Sanitary and Phytosanitary Measures	1995
Convention on Biological Diversity	1992
Protocol for the Conservation and Management of Protected Marine and Coastal Areas of the South East Pacific	1989
ASEAN Agreement on the Conservation of Nature and Natural Resources	1985
United Nations Convention on the Law of the Sea	1982
Convention on the Conservation of Antarctic Marine Living Resources	1980
Convention on the Conservation of European Wildlife and Natural Resources	1979
Convention on Migratory Species of Wild Animals	1979
The Convention on Wetlands of International Importance especially as Waterfowl Habitat	1971
Agreed Measures for the Conservation of Antarctic Fauna and Flora	1964
Plant Protection Agreement for the Asia and Pacific Region	1956
International Plant Protection Convention	(1952, amended in 1997)

Source: McNeely, J.A., H.A. Mahoney, L.E. Neville, P. Shei, and J.K. Waage (eds.) 2001. A Global Strategy On Invasive Alien Species. IUCN Gland, Switzerland, and Cambridge, U.K., in collaboration with the Global Invasive Species Programme.



BRUNEI DARUSSALAM

Invasive Alien Species Resource Directory

One of the lead agencies mandated to address the issue on alien species in the country is the Plant Protection Unit of the Department of Agriculture under the Ministry of Industry and Primary Purposes (MIPP). The Unit is responsible for the prevention of the introduction of pests and diseases that are considered harmful under the Agricultural Pest and Noxious Plants Act. The Act stipulates that all plant materials, animals and animal products imported into Brunei Darussalam must be free from pests and diseases.

Other government agencies, ministries as well as non-government organisations that are involved with the management of Invasive Alien Species (IAS) include the Departments of Fisheries and of Forestry, both under the MIPP; the Department of Environment, Parks and Recreation under the Ministry of Development; the Department of Museum under the Ministry of Culture, Youth and Sports; and the University of Brunei Darussalam.

In a survey conducted from January 1996 to December 1998, the Department of Agriculture recorded 101 pathogen-caused diseases that are new to Brunei. The survey however found no cases of diseases that seriously affected the ecology and the economy.

Of the total 101 diseases recorded, there were 36 new diseases of fruit crops, 10 of vegetables, 45 of ornamental plants and 10 of miscellaneous crops and medicinal plants. Some of these are:

Diseases of fruit crops

Patch canker (*Phytophthora palmivora*) - durian
 Fruit rot (*Geotrichum candidum*) - durian kuning
 Black cross leaf spot (*Phyllachora musicola*) - banana
 Bacterial canker (*Xanthomonas campestris* pv *citri*) - sweet orange
 Black mildew (*Meliola citricola*) - musklime
 Crusty leaf spot (*Zimmermaniella trisporea*) - mango
 Seed rot (*Aspergillus niger*) - mangosteen
 Seedling blight (*Botryosporium longibrachiatum*) - tarap
 Fruit anthracnose (*Colletotrichum gloesporioides*) - durian

Diseases of vegetable crops

Stem blight (*Diplodia* sp.) - longbean
 Fruit rot (*Monilinia fruiticola*) - bottle gourd
 Tuber rot (*Chalropsis thielavioides*) - carrot
 Leaf spot (*Alternaria brassicicola*) - radish
 Leaf spot (*Cercospora cocciniae*) - bitter gourd
 Anthracnose (*Colletotrichum capsici*) - okra
 (*Corynespora carricola*) - pumpkin

Diseases of medicinal plants and miscellaneous crops

Anthracnose (*Colletotrichum* sp.) - taro, sweet potato
 Leaf spot (*Cercospora ipomoeae*) - sweet potato
 Leaf spot (*Myrothecium roridum*) - betel

leaf

Powdery mildew (*Oidium phyllanthi*) - Phyllanthus

Leaf spot (*Pseudocercospora pterocarpicola*) - Pterocarpus

Leaf spot (*Cercospora blumeae-balsamiferae*) - Blumea

Powdery mildew (*Oidium phyllanthi*) - Phyllanthus

Leaf spot (*Cercospora viegasii*) - Mikania

Diseases of ornamental plants

Collar rot (*Sclerotium rolfsii*) - orchids
 Leaf spot (*Stenella orchidacearum*) - orchids
 Bacterial leaf spot (*Pseudomonas andropogonis*) - bougainvillea
 Leaf spot (*Stenella alocasiae*) - alocasia



Fruit rot

www.botany.unimelb.edu.au



images.google.com

Stem blight



crosci.utuc.edu

Leaf spot



www.botany.hawaii.edu

Powdery mildew



images.google.com

Crown gall

Powdery mildew (*Oidium* sp.) - Anthurium, Acacia
 Anthracnose (*Colletotrichum gloeosporioides*) -
 Dieffenbachia

Crown gall (*Agrobacterium tumefaciens*) - Rose
 Flower blight (*Choanephora cucurbitarum*) -
 Hibiscus

Leaf spot (*Pseudocercospora jasminicolavar. effusa*) -
 Jasmine

Root rot (*Fusarium oxysporum*) - Croton

Leaf spot (*Pseudocercospora thelypteridis*) - fern

Sooty mold (*Brooksia tropicalis*) - Royal Palm

Leaf spot (*Annellophora trichogonis*) - Royal Palm

Leaf spot (*Sicrorium carrisiae*) sealing wax palm

False smut (*Graphiola phoenicis*) - date palm

Stem rot (*Botryodiplodia theobromae*) - nerium

Powdery mildew (*Oidium* sp.) - Acacia

Among the priorities identified for future management and policy recommendations are the following:

- Accede to the Convention on Biological

Diversity

- Set up a working group representing various relevant government agencies and NGOs in Brunei Darussalam to address IAS
- Awareness raising programme about IAS for farmers and importers, which the Department of Agriculture is already implementing.
- Strengthen acts and regulations to address IAS
- Train more personnel to become experts in addressing IAS
- Set up databases for IAS and its management strategies
- Undertake a monitoring programme on IAS
- Undertake a research programme on the management of newly introduced alien flora

*Excerpts from the paper entitled "Brunei Resource Directory on Invasive Alien Species" presented by Ms. Martinah Haji Tamit during the workshop on "The Prevention and Management of Invasive Alien Species: Forging Cooperation through South and Southeast Asia" held from 14-16 August 2002 in Bangkok, Thailand.



INDONESIA

Invasive Alien Species Control Strategy

Invasive alien species (IAS) were introduced several years ago as novelties, ornamentals and even for human consumption. Several of these introduced species are now replacing the habitat of indigenous species. Three of these are *Hemilia vastatrix*, which eliminated most Arabica coffee plantations in the coastal region of Indonesia; *Exobasidium vexans* that attacks tea plantations severely; and *Achatina fulica* snail that eats any leafy green plants.

Management efforts and awareness campaigns of the IAS control programmes are limited. These have not been undertaken nationwide yet, and thus are not fully operational. The Ministry of the Environment as focal point of CBD, with its limited source, and in cooperation with several government institutions and NGOs had undertaken the following activities:

- In the last two years, an IAS assessment in Indonesia, the past, today and the future, to find out the pictures of their impacts and the control methods, were partly done by the scientists of research centers or universities.
- National seminar on biodiversity and control of IAS in 2002;
- Develop an academic paper on the prevention and control of AIS with the involvement of universities, research centres and NGOs;

The Working Group on the Environment, an ad hoc committee of scientists, and coordinated by the Ministry of the Environment in cooperation with three other ministries (Agriculture, Forestry, Marine Affairs and Fisheries) drafted and submitted a quarantine law to the national authority. The draft law aims to mitigate against the risk of introducing animal/fish/plant pests and diseases that could even spread domestically and/or internationally. Mitigation measures will include quarantine inspection, especially for transboundary commodities movement into or from Indonesia territory. Quarantine measures will be the major national control programme to guard against IAS.

Quarantine measures in Indonesia are being implemented by the Agency for Agricultural Quarantine (AAQ) under the Department of Agriculture.

These measures, which comply with the codes of Office Internationale des Epizooties (OIE), IPPC, and international standards/recommendations, cover three groups of commodities: animal, fish and plant and their products. AAQ works in collaboration with the Food Crops/Horticulture/Estate Crops Production Service also of the DA, which has authority in import/export licensing; in fish quarantine.

The environment control instrument works on the species approach or species-based measures, where species as moving commodities are targeted for control. A species is considered IAS when it poses a potential environment hazard and is detrimental to other species especially the indigenous ones. The

environment control measures are implemented based on environment regulations such as Undang-Undang No. 23/1997, which are mostly based on the CBD.

Cognizant of the global transportation, increasing trading volume and frequency, and tourism-induced global spreading of animal/fish/

plant pests and diseases and IAS in this millennium, the Working Group is planning to set up a legal system and single organisation to implement biosecurity measures or activities in the country.

Among the policies of the government relative to managing IAS and completing tasks are as follows:

- Prevention of species, which are potential IAS, has to be undertaken in any entry point throughout the Indonesian archipelago by integrating quarantine and environment risk assessment prior to the introduction. Institutionally, AAQ works collaboratively with the Ministry of the Environment.
- Control or eradication of IAS that have been established domestically, has to be jointly operated by all biological security agencies such as the Departments of Agriculture, of Forestry, of Marine Affairs and Fisheries, and coordinated by the Ministry of the Environment, which is the 'focal point' of the Convention on Biological Diversity (CBD).
- Regulations have to be properly implemented to avoid any legal confusion.
- A legal framework on the control of IAS in



Indonesia has to be established as legal basis of risk analysis and certification system

- International standards/ recommendations issued by the CBD Secretariat have to be adopted and disseminated.

The Ministry of the Environment identified organisations or parties to become involved in the IAS control programme, as follows: Departments of Agriculture, of Forestry, and of Marine and Fisheries; Indonesian Institute for Science; Universities (Gajahmada, Bogor Institute of Agriculture, etc); non-government organisations (such as The Nature Conservancy, Wetland Indonesia, Kehati Foundation); and other stakeholders.

Some of the introduced IAS and their impacts on plant and animal life are:

Plants: These species are considered invasive especially in Wasur National Park: *Chromolaena odorata*, *Eichornia crassipes*, *Acacia nilotica*, *Mimosa pigra*, *Stachytarpetta urticaefolia*, *Hanguana sp.*, *Pistea sp.*, *Salvinia sp.*, *Sida acuta*, *Lantana camara*, and *Azolla sp.*

Insects: *Lyriomyza huidobrensi*. The leaf miner wiped out most potato and garlic plants of horticulture centres in mountainous regions; and *Heteropsylla cubana* attacks meristematic plant tissues.

Invertebrates: *Pomacea canaliculata*: Introduced purposely to provide additional protein for people (and which accordingly has failed), the snail has become invasive and attacks rice plants.

Vertebrates: *Cervus timorensis*: invasive in Wasur National Park

Fishes

Lebisstes reticulates: invasive competitor for feed and space

Cleptomus spp.: invasive competitor for space

Vandelia sp.: invasive predator

Serralmus sp.: invasive predator

Liposesteus sp.: invasive predator

Silurus alansis: invasive predator

Esox masquinongy

Electrophorus electricus

Tetraodon spp.

Insects and their hosts

Pink mite (*Accaphylla steinwadeni*) and white mite (*A. indiae*) - tea



Mexican fruit fly

Sweet potato butterfly (*Acraea acerata* Hew.)

- Sweet potato

Cotton ball weevil (*Amorphoides lata* Motsch.)

- Cotton and *Theopesislampas*

Mexican fruit fly (*Anastrepha ludens* Loew.)

- Citrus, papaya, anona, apple, sapodilla, guava and mango

Sorghum shootfly (*Atherigona soccata* Rond.)

- Sorghum, rice, wheat, grasses

Stem tissue borer (*Augosoma centaurus*) - Oil palm

Root borer (*Diasprepes abbreviatus* L.) - citrus,

- sugarcane, coffee, coconut, cassava,

Piperaceae sp.

White-fringed weevil (*Graphognathus spp.*) -

- rice, peanut, corn, cotton, vegetables, ornamental plants

Colorado potato beetle (*Leptinotarsa decemlineata* Say.) - Potato

European red mite (*Panonychus ulmi* Koch.) - apple, pear, peach, plum, elm, *Prunus spp.*

Invertebrates

European slug, grey garden slug (*Arion circumscriptus* Johnson) - potato, cron, strawberry, carrot, rye, tobacco, celery, barley, rape, poppy

Brown garden snail (*Helix aspersa* Muller) -

- grapes, strawberry, citrus, Tomato, heat, vegetables

Iberian slug, Canadian slug (*Lehmania velentiana* Ferrussae) - potato, orchids, vegetables ■

*Excerpts from the paper entitled "Invasive Alien Species Control Strategy in Indonesia" presented by the **Delegates of the Republic of Indonesia** during the workshop on "The Prevention and Management of Invasive Alien Species: Forging Cooperation through South and Southeast Asia" held from 14-16 August 2002 in Bangkok, Thailand.



LAO PDR

Prevention and Management of Invasive Alien Species

The protection of the environment in Lao PDR is anchored in the Constitution: "All organizations and citizens must protect the environment and natural resources: land, underground, forest, fauna, water resources and atmosphere."

Since then, many pieces of legislation were promulgated such as the Decree on the Prohibition of Wildlife Trade (1986), Decree on the Management and Protection of Wild Animals, and on Hunting and Fishing (1989), Decree on the Establishment of National Protected Areas (1993), Quarantine Legislation (1994), Forest Law (1996), Water Resources Management Law (1996), Plant Application Legislation (1996), Land Law (1997), Mining and Mineral Resources Law (1997), Transportation Law (1997), Electricity law (1997), Environment Protection Law (1999), and the Pesticide Legislation (2000). The bio access legislation draft, which contains measures related to legal and illegal exportation of indigenous species and introduction (legal and illegal) of alien species, is still being discussed among concerned institutions at the central level, and will be promulgated in the near future.

The implementation however of these laws has been facing some constraints such as lack of qualified human resources, limited budget, and the population's not being used to legislation procedures yet. The effective implementation of these laws requires institutional strengthening, appropriate budget allocation, and public awareness on the importance of these laws.

Lao PDR is Party to the Convention on Biological Diversity, which it ratified in 1996, and is in the process of ratifying the RAMSAR and the CITES Conventions, among others. The Science, Technology and Environment Agency (STEA), together with the Ministry of Agriculture and Forestry, is formulating the National Strategy and Action Plan on Biological Resources that would be promulgated by the end of 2003.

Lao PDR became a member of the ASEAN in

1997. The principal legal instrument of ASEAN that has potential nature conservation obligations for Laos is the Agreement on the Conservation of Nature and Natural Resources.

Institutionally, the STEA, created in 1993 under the Prime Minister's Office, is in charge of the overall management and control of the environment activities at the national level. It is therefore the main manager and coordinator of activities related to the conservation and sustainable use of national biological resources. On the other hand, the Ministry of Agriculture and Forestry is responsible for solving environment issues related to agricultural and forestry development, notably on the conservation and sustainable use of agricultural and forestry biological resources. The Ministry of Public Health is mainly involved in the use of biological resources, in particular traditional medicine.

Quarantine inspectors at the central, provincial and district levels including checkpoints, are in charge of issuing import permits, particularly phytosanitary certificates.

Case Studies on Major Invasive Alien Species

For many centuries, alien species notably coffee have been introduced in Laos. Since then, coffee has become a major export product of Laos. These introductions are mainly due to economic reasons. However, some alien species have been observed to have destructive impacts on rural household's income. Among these species are: golden apple snail (*Pomacea* sp.), bakanea (*Fusarium fujikoro*), and some weeds: *Echinochloa colonum* (Graminae), *Echinochloa crus-galli* (Graminae), *Minisa invisa* Mart (Leguminosae), *Mimosa pigra* (Leguminosae). Although there has been no in depth study or research undertaken relative to the positive and negative impacts of the alien species in the country, there were a number of case studies done on some weeds and on the Golden Apple Snail.

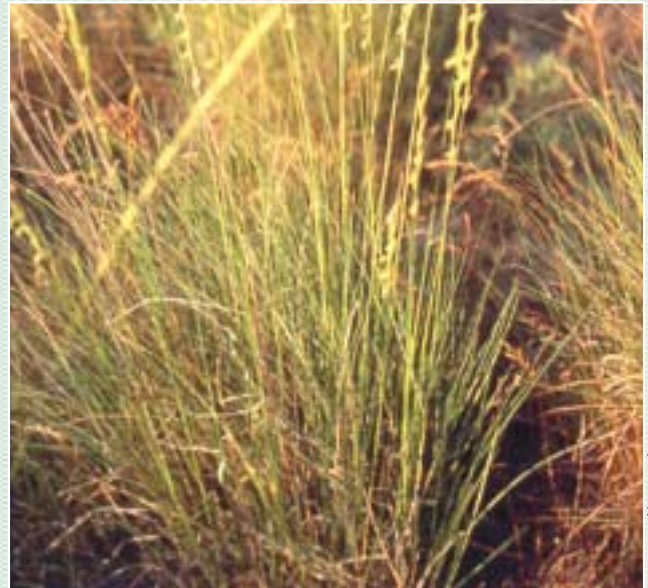
Weeds. According to farmers, the weed problem has increased severely over the last 20 years due to





Mimosa pigra

Virg Ranney



Graminae

courses.washington.edu

the spread of many new species introduced from abroad. In the upland agricultural production systems in the northern provinces of Laos, it is mainly the Leguminosae *Minisa invisia* Mart and *Mimosa pigra* that have become increasingly problematic, whereas in the lowland rice production system, it is the Graminae *Echinochloa colonum* and *Echinochloa crus-galli*.

Farmers usually hand weed their fields, but this has become very inefficient and labour is limited. Thus they gradually started using commercial herbicides, which in the long-term could lead to water pollution.

Studies related to finding appropriate solutions for these issues have been undertaken but due to budget and qualified staff constraints, these activities have not been continued.

Golden apple snail (*Pomacea* sp. from Thailand). The snail was first introduced at Sikhotabong District of Vientiane Municipality in 1991 and spread out in three villages: Viengsavanh, Nahai and Phosi. Damages to lowland ricefields were first reported in 1992. Two years later (1994), snails from Vietnam were brought to the Northern provinces of Laos mainly as a source of food.

Since then, the snail has spread to 10 of 17 provinces of the country mainly thru connecting waterways such as irrigation canals and rivers as well as by people. The golden apple snail attacks mostly young rice seedlings (seedbed up to 20 days after transplanting), and consequently fields infested with the snails have to be re-planted several times in order to replace the missing hills.

In several infested areas, collecting the golden apple snail in the field to contain its increasing

population has not succeeded due to labour constraints. Thus farmers resorted to using chemicals (e.g. Niclosamide or Baylucide, and copper sulfate) to control its spread. Although the chemicals may have helped in controlling the spread of the snails, these products have also polluted the water and seriously threatened other aquatic organism living as well as the health of people working in the paddy fields.

Many different control techniques were developed by the Agricultural Extension Center and have been already transferred to farmers. The core of technologies was focused on integrated apple snail management using different techniques applied simultaneously such as preventing the entrance of snails to the rice field, hand picking, transplanting with old seedlings, and reduction of water level in the rice field using a variety of local experiences. Still many people in the country are still unaware of the threat. As they are attracted by the snails' colorful egg masses, they bring them home for consumption.

Existing programmes

The following research programmes are still seeking appropriate and effective alternatives (notably the use of ecological products) to conventional pesticides for the control of pests:

- The National Agricultural Research Center in cooperation with the Lao-IRRI project, has initiated research experiments testing the efficiency of several biological controls against the golden apple snail.
- The Northern Agricultural and Forestry Research Center in Luang Prabang, together with

the Lao-IRRI project has started several method controls against weeds.

- The Australian Cooperation for International Agricultural Research (ACIAR) is supporting a four-year project (1999-2002) focusing on techniques for rodent control in the upland agricultural production systems.

The prevention and the management of invasive alien species in Laos are still at the infancy stage due to financial constraint and the lack of qualified staff, of appropriate information, and of a legal framework, notably in its implementation as well as the low level of awareness of the Lao society on the negative impacts of the species to the health of the population, to the economy, and to the environment as a whole.

Considering the urgent need to take serious actions to effectively prevent and manage IAS, Nhoibouakong and Khamphoukeo (2002) in their paper entitled "Prevention and Management of Invasive Alien Species in Lao PDR," recommended a number of actions, among which are to:

- Promote and develop economic incentives on the sustainable use and conservation of national biological resources specifically on the indigenous species;

- Promulgate appropriate legislation, particularly related to the introduction of invasive alien species, emphasizing on the cooperation and support of local communities;
- Strengthen the capacity of local staff, notably taxonomists, tropical botanists and zoologists;
- Establish a National Network or Working Group related to the prevention and management of invasive alien species;
- Promote researches on the positive and destructive impacts of invasive alien species;
- Create a National Biodiversity Conservation Fund in order to effectively address the IAS issues; and
- Cooperate with relevant institutions at the sub-regional, regional and international levels related to this issue such as information sharing, capacity strengthening and collaboration of research. ■

**Excerpts from the paper entitled "prevention and management of Alien Invasive Species in Lao PDR" presented by Monemany Nhoiboukong of the Environmental Research Institute, and Khamouane Khamphoukeo of the National Agricultural Research Center during the workshop on "The Prevention and Management of Invasive Alien Species: Forging Cooperation through South and Southeast Asia" held from 14-16 August 2002 in Bangkok, Thailand.*

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MALAYSIA

Prevention and Management of Invasive Alien Species

Certain foreign species are officially listed by the country's regulatory agencies as dangerous exotic species as these are potential threats to agriculture (plants, crops, animals, livestock), non-cultivated ecological systems and human beings once these species enter and establish themselves in the country. In general, the management strategies and control measures of such species aim to prevent or deny their entry, to eradicate, to contain, or to effectively control them should their entry and establishment occur. Legislation, regulations and procedures are provided to legalise and smoothly implement these measures. Both the Plant Quarantine Act of 1976 and the Plant Quarantine Regulation of 1981 provide the legal framework in dealing with dangerous exotic pests of plants. Effective implementation of these Acts could help prevent the introduction or establishment of alien species.

Plant quarantine is the first line of defence in managing invasive pests of plants in the country. The Department of Agriculture, which enforces the quarantine law, has stationed 250 enforcement officers in all the 49 entry points to inspect all agricultural goods that are brought into the country. Agriculture products or consignments found to be infested with live pests are held at a secured area at the port of entry until the pests shall have been identified. If the pest is positively identified as a quarantine pest, the consignments are either seized and destroyed or sent back to the exporting country. For the year 2000, a total of 580 consignments with 82 species of arthropods were intercepted. Of the total, only three species were gazetted as dangerous pests under the present act and regulation.

Besides immediate quarantine action at entry points, plant quarantine inspectors are given the authority to isolate the premise or any area and to conduct direct eradication treatments as necessary. The first effort to contain and eradicate plant pests in Peninsular Malaysia was in 1986 when the cocoa pod borer (*Conopormopha cramerella* Snellen)

started to spread beyond control. This initial effort has failed probably due to the wide area that the pest had already infested when it was first detected, making containment rather difficult and ineffective. Later, two other eradication programmes were implemented following the detection of two dangerous exotic pests namely: Khapra beetle (*Trogoderma granarium*) and the golden apple snail (*Pomacea* spp.).

When it was first detected, the Khapra beetle was found only in one isolated rice godown and it was successfully eradicated. However subsequent attempts

to contain and eradicate the golden apple snail proved unsuccessful as the snail had already widely spread in several areas including irrigation canals when it was first detected. Also, there were no effective and viable methods available to control the snail. In addition, there were no other attempts made to eradicate

any pest even though numerous introductions of exotic pests had occurred. It is believed that since these pests were detected only when they were already widely spread, their containment and eradication was not a viable option.

Pest management strategies have changed when exotic pests became invasive, that is, they appear to be permanently established and spread widely. In general, they are no longer treated as quarantine pest, but are regarded as a common pest. As such management is no longer focused on eradication but aimed at reducing the population and the effects or damages. The cocoa pod borer is a classic example of a quarantine pest that lost its status. Today, it has become the most serious cocoa pest in Malaysia. Control measures are ongoing to maintain the population and infestation below the threshold level so that economic loss could be avoided. In general, control measure should be a combination of chemical and cultural methods. Other control methods are used if these are not effective and available.

Research bodies either government or private have played important roles in helping regulatory



and extension bodies in managing invasive species. They have developed better technologies that are more effective and more environment-friendly. For example, at the beginning of the cocoa pod borer infestation, its control depended much on the heavy use of pesticides. Later, better control methods were developed which achieved the same control objective, as that when pesticides were used. Proper fruit harvesting and introduction of biological agents had significantly controlled the cocoa pod borer infestation. Integrated pest management has been developed for another invasive species, *Plutella xylostella*, a serious pest of crucifers. Several biological agents were imported and released. A few of them have been successfully established and have played a major role in regulating this pest. Other major management components include crop scheduling and using environmental friendly pesticides such as insect growth regulator and bio-pesticides.

Agencies Involved in Managing Invasive Species

Management of invasive species is the responsibility of government agencies. Most of the alien species that have been brought into the country are quarantined and checked by the Department of Agriculture and the Department of Veterinary Services. Control strategies and technologies are made available by research and extension bodies, but the implementation of control measures as a preventive and curative action is the responsibility of individual growers. Extension agencies such as the Department of Agriculture play an important role in advising the regulatory agencies, individual growers as well as the general public on the effective measures to control a particular pest.

However, until today, there are no agencies in the country that are working specifically on the biological invasion. There is also no detailed study conducted on IAS nor any comprehensive or coordinated monitoring and cataloguing of invasive species. A listing of major alien, invasive or pests of Malaysia may be seen in the Country Report of Malaysia by Mat Hassan Othman and Abdul Kadir Abu Hashim entitled "Prevention and Management of Invasive Alien Species". An elaboration of the more important invasive alien species is given below.

Invasive Species and their Impacts

Cocoa pod borer (*Conopormopha cramerella* Snellen): This pest was first detected in Sabah in August 1980. Initially, infestation was confined to some 4,000 ha cocoa plantings in Tawau, Sabah. However, by mid 1983 or within two and a half years, all major cocoa growing areas in Sabah

were infested. Within the same period, the pest had found its way into, and established itself, in the neighbouring state of Sarawak. In Peninsular Malaysia, the cocoa was free of the pest until 1986 when it was detected in about 700 ha of cocoa in Melaka. Subsequently, the pest was detected in nearby cocoa areas and other major cocoa growing areas. Up till today, the borer is the most important insect pest of cocoa in the country. Although overall economic loss is difficult to ascertain, crop loss in badly infested holders can be very severe, and a loss of up to 30% is not uncommon.

Diamondback moth (*Plutella xylostella* L.):

Accordingly, the insect was introduced into Malaysia due to three reasons: 1) most of its preferred host were imported plants; 2) there are few endemic natural enemies of the Diamondback moth (DBM) in Malaysia; and 3) The genus *Plutella* in the country is poorly represented and only one species is known. The insect was first recorded in Malaysia in Fraser



Cocoa pod borer



Diamondback moth

www.uccs.iota.ama.edu

www.nre.vic.gov.au

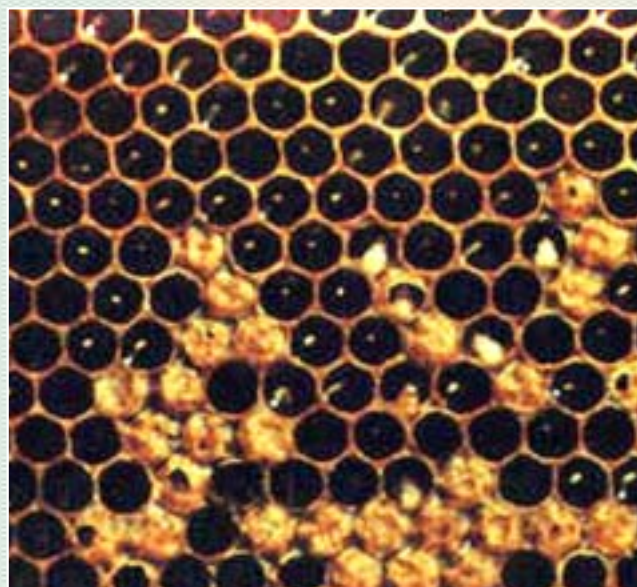
Hill in 1925. By 1934, the insect was found in Cameron Highland, which was then newly opened for cultivation of temperate vegetables. By 1941, it was reported that DBM was a major pest of cabbage in the Cameron Highland. Today the DBM is the most serious pest of *Brassica* in the country. It is the major pest in both the highland and lowland areas where cabbage and crucifers are grown. Outbreaks and high incidence of infestation are reported yearly.

Beet armyworm (*Spodoptera exigua*): The beet armyworm is an important crop pest and widespread in sub-tropical, tropical and temperate regions. The pest was first detected in 1996 attacking hot pepper crops in Ayer Hitam Johore. Subsequently small outbreaks of *Spodoptera exigua* were reported in other parts of Johore and Melaka. Now, *S. exigua* has become an important pest of various crops such as onions, brinjal, legumes, chili and crucifers.

Golden apple snail (*Pomacea* sp.): The snail was illegally brought into Malaysia for commercial purposes. It was first detected in fishponds in Puchong and Subang, both in Selangor in 1991. The snail species found in Puchong has been identified as *P. insularis* and in Subang, *P. canaliculata*. Following the discovery, a nationwide survey was conducted to detect the presence of the snails. The survey showed that the snail was found only in a few isolated areas such as fishponds, unused tin mines, aquarium, and in a small ricefield at Kg. Pengkalan Semeling, Kedah. Control measures aimed to contain and eradicate the snails were implemented. The measures succeeded only in slowing down the spreading. In some areas the snails made their way to nearby rivers, water drains, irrigation canals and ricefields. Currently, the snails have been detected in about 5,000 ha of rice fields in Perak but there are no reports of serious damages to the rice plants caused by the snail.

Papaya ring spot virus (PRSV): The disease, which originated from South America, was first detected in the southern part of Johore in 1991. Following the discovery of PRSV in Johore, a nationwide survey was conducted twice a year to detect the disease. Results of the surveys showed that the PRSV occurred only in the southern part of Johore while the rest of Malaysia, including Perak – the second biggest papaya producer state after Johore – is still free from PRSV.

Citrus greening disease: Citrus greening is a highly destructive disease of citrus caused by the bacterium *Liberobacter asiaticum* and it probably originated from China. How it came to Malaysia is



Sacbrood

not yet known and it was only in 1989 that the presence of the greening disease was confirmed in the country.

Sacbrood virus disease: Sacbrood is an infectious virus disease that affects the brood of honey bees. In early 1994, *Apis cerana cerana*, which is known to be more productive than the native bee – *Apis cerana indica* – was imported from Southern China with the objective of improving local honey production. The imported colonies were kept in Sungai Burung Selangor and Merlimau Melaka for quarantine observation. After 6 months of introduction, sacbrood, which was previously unknown, was found to have infected the nearby colonies of the native bee (*Apis cerana indica*). The disease spread and within 6 months, almost 100% of the native bee colonies was wiped out. Since then containment measures have been implemented to prevent its spread. The measures employed were successful, confining the disease in Selangor, Melaka, Johore and Terengganu.

Other IAS include the itch grass (*Rottboellia cochinchinensis* Lour); water hyacinth (*Eichhornia crassipes* Martius); aquarium watermoss (*Salvinia molesta* Mitchell); Timor deer (*Cervus timorensis*); red-eared tortoise (*Trachemys scripta elegans*); house crow (*Corvus splendens*), and the Philippine glossy starling (*Aplonis panayensis*).■

*Excerpts from the paper entitled "Prevention and Management of Invasive Alien Species" presented by **Matt Hassan Othman** of the Department of Agriculture, and **Abdul Kadir Abu Hashim** of the Department of Wildlife and National Parks during the workshop on "The Prevention and Management of Invasive Alien Species: Forging Cooperation through South and Southeast Asia" held from 14-16 August 2002 in Bangkok, Thailand.



PHILIPPINES

Invasive Alien Species Resource Directory

More than 475 plant species have been introduced in the Philippines since pre-historic time, coming mainly from the Malayan region, but a high percentage has been introduced within the past 400 years, including a great number of American origin (Merrill 1912). About 255 species were found only in cultivation for food and were not reported to cause economic or environmental harm. Intentional and accidental introduction of alien species have been done due to economic reason until they were observed and reported to have become invasive and caused economic losses and environmental damage. Biosafety measures and environmental impacts were not considered before their introduction.

This country report presents only a few information because of lack of data on the economic as well as social impacts of introduction of invasive alien species. Also, only few researches have been conducted on their effects to the environment, and on their management.

Some Alien Species and their Effects on the ecosystems

Terrestrial plants

Hagonoy weed (*Chromolaena odorata*)
Source: Mexico, West Indies and Tropical America

It is considered as a threatening/harmful weed in grassland ecosystems because it outgrows or prevents the establishment of other species like *Imperata* thus reducing the feeds available for livestock and biodiversity. The weed clogs waterways, and has been reported by farmers to be harmful to cattle when eaten.

Large leaf lantana (*Lantana camara*)
Widely grown as an ornamental shrub, it is known as a weed in pasturelands.

Chinese creeper (*Mikania micranth*)
This is a fast-growing perennial, creeping and twining plant commonly called mile-a-minute be-

cause of its vigorous and rampant growth habit. It grows best where fertility, organic matter, soil moisture, and humidity are all high and, damages or kills other plants by smothering them thereby cutting out the light.

Gmelina arborea
Host of *Ozola minor*, *Attacus*

Acacia mangium
Host of *Anoplophora luciphor*

Eucalyptus camaldulensis
Host of an unidentified termite species



Swietenia macrophylla
Host of *Zeuzera coffeae*

Dipterocarpus grandiflorus
Host of *Dryocoetiops laevis*

Leucaena leucocephala
Host of *Heteropsylla cubana*

Toona ciliata
Host of an unidentified weevil

Terrestrial invertebrates

Big headed ant (*Pheidole megacephala*)
One of the most invasive species having achieved global distribution, the ant displaces most invertebrate faunas; it is considered as a pest of agricultural crops as it harbours phytophagous insects that reduce crop productivity.

Fire ant (*Solenopsis geminate*)
A grave threat to conservation values as it will invade native communities and affect many or all of the animals and plants in that community. The name fire ant comes from their fiery and painful stings; it is most prevalent in isolated areas, living in open land, including barren areas and grassland, and nests in the soil.

Jumping plant lice (*Heteropsylla cubana*)
Introduced by the typhoon in the late 1980s, it has



Fire ant

affected almost 100% of standing *Leucaena leucocephala* all over the country. Spiralling whitefly (*Aleurodicus dispersus*)

Accidentally introduced with the importation of ornamental Kalanchoe in the 1970s, the whitefly is now affecting vegetables and ornamentals.

Leaf miner (*Liriomyza* sp.)

Accidentally introduced with the importation of the Chrysanthemum, it has become a major pest of potato and ornamentals.

Mealy bug (*Pseudococcus* sp.)

Accidentally introduced in the late 1990s with the importation of hybrid coconut planting materials, the mealy bug has affected the coconut in Northern Palawan.

Riceblack bug (*Scotiniphora coarctata*)

This bug species was introduced through vessels plying the route between the province of Palawan, the Mindanao Island and countries south of the Philippines. It is a major problem in rice in Mindanao and the province of Leyte.

Oncidium sp.

This is an orchid virus brought in with the importation of orchids in the late 1970s.

Potato cyst nematode (*Globodera rostochlensis*)

Accidentally introduced with the importation of

potato planting materials, it is heavily infesting potato farms in the province of Benguet, in Northern Philippines.

Aquatic/wetland Plants

Water fern (*Salvinia molesta*)

It is considered a serious aquatic weed in many Asian countries and is rapidly invading other bodies of water; it was then a problem weed in Iloilo, especially in irrigated ricefields as it competes with nutrients and water, and also clogs waterways.

Water hyacinth (*Eichhornia crassipes*)

Rapidly invading Laguna Lake, it continues to reduce the growth of phytoplankton that provides food to fish; it also clogs waterways.

Aquatic/Wetland Animals

Thai catfish (*Clarias batrachus*)

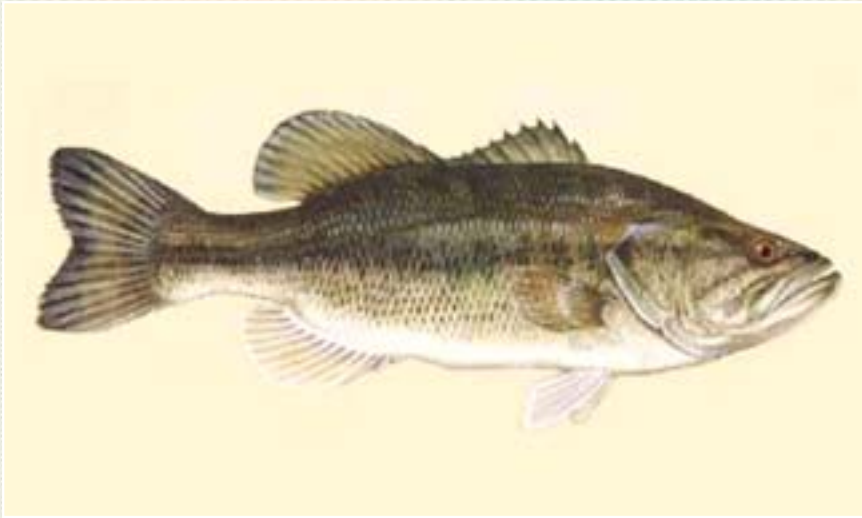
Its introduction in Luzon led to the displacement of the native catfish (*Clarias macrocephalus*), and has spread to many parts of the country. It was thought to boost the aquaculture industry, but it was not successfully commercialised because of its tough flesh.

African catfish (*Clarias gariepinus*)

Not yet considered invasive but on the "watch list."



Water fern



Black bass

South American catfish or janitor fish (*Plecostomus* sp.)

Although it has invaded Laguna Lake, it is not yet considered invasive but on the "watch list".

Golden apple snail (*Pomacea canaliculata*)

Its introduction led to the displacement of the native kuhol (*Pila luzonica*). In 1999, it was considered as a major pest of newly planted rice seedlings; purposely imported to avert malnutrition as source of protein.

White goby (*Glossogobius giurus*) and *Hypseleotris agilis* (eleotrid)

Their introduction has caused the extinction of majority of 15 cyprinid species in Lanao Lake, Mindanao.

Black bass (*Micropterus salmoides*)

It has led to the disappearance of the original fish population in Caliraya Lake, Laguna.

Marine toad (*Bufo marinus*)

A very prolific toad species, it has decreased the population of several species of native frogs in Dumaguete City, Negros.

American bullfrog (*Rana catesbeiana*) and Leopard frog (*Tana tigrina*)

Both species may displace native frogs.

Management Efforts and Awareness Campaigns on Invasive Species

- Implementation of existing quarantine regulation
- Implementation of Philippine policy on Biodiversity
- Implementation of the Guidelines on Planned

Release to the Environment of Genetically Modified Organisms and Potentially Harmful Exotic Species

- Biological control of *Chromolaena odorata* using the gall fly
- Management of rice black bug thru the monitoring, mass production and field application of metarhizium. This is an ongoing programme of the Department of Agriculture, Philippines

Action Done

- Seminar-workshop on the Biodiversity and Management of Alien Invasive Species in the Philippines, 22-23 May 2001 including an exhibit on the biodiversity and management of IAS.

Priorities for Future Work and Strategies for Management and Policy Recommendations

- Inventory/Status Report of each alien species (invasive and non-invasive) in respective countries
- Database of all alien species
- Database of management strategies
- Networking
 - Establishment of country hubs specific for the monitoring and management of alien species;
 - A regional hub that will serve as repository of all data from member countries and their management; responsible for knowledge management that can be shared by member countries; also responsible for alerting member countries on the invasiveness of a certain species; responsible for fund sourcing for all activities related to alien species including research and development.
- Enforcement of quarantine regulation
- Enhancement of policies and other regulations related to IAS
- Monitoring of IAS
- Research and Development
- Enhance public awareness and encourage advocacy campaign on IAS. ■

*Excerpts from the paper entitled "Invasive Alien Species Resource Directory for the Philippines" presented by **Veronica O. Sinohin** of the Ecosystems Research and Development Bureau, and **Wilma R. Cuaterno** of the Bureau of Plant Industry during the workshop on "The Prevention and Management of Invasive Alien Species: Forging Cooperation through South and Southeast Asia" held from 14-16 August 2002 in Bangkok, Thailand.



SINGAPORE

Invasive Alien Species in Singapore: A Review

Singapore has a long history of introduction of foreign plants and animals. The Island's location at the centre of major air and shipping routes has inevitably resulted in the accidental or deliberate introduction of numerous plant and animal species, not to mention micro-organisms and fungi (Ng *et.al* 1993).

For plants, more than half of the introduced species are from tropical America, followed by Asia, and then, Africa and Australia. However, among plant groups, the focus of past investigations has been on the seed plants. Only now do we have information about alien pteridophytes and exotic mosses (e.g., *Ochrobryum kuzianum* and *Pterigonidium pulchellum*) that have become established in Singapore.

For the animals, we have good knowledge about non-indigenous mammals, birds, reptiles, amphibians, freshwater fishes and decapod crustaceans. Apart from rats, few non-native mammals have established themselves in Singapore. This is in contrast to a total of 72 species of non-native birds now known to be residents in Singapore (Lim & Gardner 1997). Majority of naturalized birds in Singapore originated from the Asian subcontinent; the rest are from Australia and Africa.

Many are cage escapees that have adapted to the now largely urban environment of Singapore.

Naturalized reptiles as a result of the pet trade include the red eared terrapin (*Trachemys scripta*) from North America (Anonymous 2002), striped keelback (*Xenochrophis vittatus*) from Indonesia, and changeable lizard (*Calotes versicolor*) from Indochina (K.K.P. Lim, pers. comm.).

The painted bullfrog (*Kaloula pulchra*) from Indochina and the American bullfrog (*Rana catesbeiana*) from the USA are now common in residential areas and reservoirs, respectively. Similarly, the majority of the alien freshwater fishes in resident in Singapore are a result of the ornamental fish trade. Examples are *Liposarcus pardalis*, *Poecilia sphenops*, *Gambusia affinis*, *Oreochromis mossambicus*, *Etroplus suratensis*. These are either escapees or were introduced recently for mosquito control. Of a total of 58 non-indigenous teleost fish species recorded from Singapore thus far (K.K.P. Lim pers.comm.), about half are from Asia, while species from Central and South America comprise 33% of the total number of exotic species.

The remaining species consist mainly of African cichlids. Two species of freshwater prawns (*Macrobrachium lanchesteri* from Thailand and *M. nipponense* from East Asia) are now established in freshwater streams in Singapore, but again, their impact on native inhabitants has not been fully



Changeable lizard

Dr. Martin Williams



American bullfrog

www.nps.gov



eebweb.arizona.edu

Bivalve

elucidated. Other significant invertebrate groups such as protozoa, platyhelminthes, nematodes and insects remain poorly documented and their presence (or absence) is not immediately known.

In the estuarine environment, two exotic bivalve species have established themselves. The Caribbean bivalve, *Mytilopsis sallei* (Dreissenidae), is found in large numbers mostly along the walls of tidal monsoon canals, forming mats of several kilometres long in some cases (Tan & Morton, submitted). This bivalve is closely related to the notorious Asian zebra mussel, *Dreissena polymorpha*, which has invaded and caused havoc in waterways in the North American continent. Not surprisingly, *Mytilopsis* has already established itself in various Asian ports including Japan, Taiwan, Hongkong, Thailand, Fiji, Darwin and India.

In Singapore, *Mytilopsis* occurs together with native byssate bivalves, *Isognomon ehippium* (Isognomonidae) and *Musculista senhousia* (Mytilidae), which are common in mangroves but have found the monsoon canals to be suitable habitats as well. Note however that *Mytilopsis* is rare in the mangroves, and it remains to be seen if this bivalve can be classified as "invasive" as defined in this review. The other exotic bivalve is the Indian mussel *Brachidontes striatulus* (Mytilidae), which although not as widespread as *Mytilopsis*, is also found in monsoon canals (Morton and Tan, submitted). It is quite likely that the two bivalves have travelled to Singapore either as adults attached to ships' hulls, or as larvae in ballast water.

However, not all exotic species that became adapted to or naturalized in Singapore are invasive or threaten the survival of local counterparts. Observations suggest that a great majority cannot even survive outside of human intervention. Of about more than 2000 introduced plant species grown in Singapore, about 136 species have become natu-

ralized on their own capability (Corlett 1988). Only a small fraction such as *Adiatum latifolium*, *Clidemia hirta*, *Spathodea campanulata*, *Dioscorea sansibarensis* and *Thunbergia grandiflora*, have been reported or observed to actually invade the primary and old secondary forests, and/or inhibit the regeneration of secondary forest (Turner & Tan 1992). The explanation has been attributed to the fact that many of the introduced species are sun-loving plants and require a nutrient rich soil for their establishment and expansion. Apparently, in Singapore, many local forest plant species have evolved over the millennia to become well adapted to the closed tropical forest condition and, therefore, are resistant to foreign aggression, as long as the remaining forest or original vegetation is not disturbed further by human activities (Teo *et al.*, submitted). In other words, it would appear that the continuous human disturbances facilitate the local spread of invasive alien plant species.

Interestingly, Ng (1993) made a similar conclusion on the assessment of the invasiveness of introduced fresh water fishes and prawns in Singapore as a result of the aquarium trade in recent years. These introduced species have not affected significantly the fauna in pristine forested streams. Of a total of 58 exotic fish species known to occur in Singapore, about 22 species have established populations in the wild. The likely reason for the poor penetration of exotic species into native habitats is that more than 80% of the native species are forest species. They are adapted to living in acid water that is characteristic of the pristine water system inside forest, whereas the introduced ones, thus far, were found to prefer more neutral and harder waters. In fact, their assessment showed that more than 50% of the indigenous fauna have become extinct today due to forest clearance instead.

The poor performance of invasive plant and animal species in Singapore at present does not mean that serious cases of invasive weeds and pests will not occur in the future. Perpetual alertness and constant monitoring are needed to prevent the problem from becoming an environmental crisis. This is particularly relevant in the case of micro-organisms, which have direct relevance for ballast water management. ■

*Excerpts from the paper of the same title presented by **Benito C. Tan** of the Department of Biological Sciences (DBS) and **Tan Koh-Siang** of the Tropical Marine Science Institute (TMSI), both of the National University of Singapore, during the workshop on "The Prevention and Management of Invasive Alien Species: Forging Cooperation through South and Southeast Asia" held from 14-16 August 2002 in Bangkok, Thailand.



THAILAND

National Profile Report on Invasive Alien Species

In Thailand there is no single or centralized competent national authority that is responsible for the prevention and management of invasive alien species (IAS). The responsibilities are scattered in different ministries such as the:

- Ministry of Agriculture and Cooperatives (MOAC) in the Department of Agriculture (DOA), for plants, insects, plant pathogens and biological control agents;
- Department of Livestock Development (DOLD), on microorganisms and animals of livestock and veterinary importance;
- Department of Fisheries (DOF), on fish and aquatic animals and plants (freshwater and marine);
- Royal Forest Department (RFD), on other plants, shrubs, trees, wildlife and endangered animals under the CITES' lists;
- Ministry of Public health (MOPH) such as the Department of Medical Science (DOMS) and Department of Communicable Diseases Control (DOCDC), on microorganisms and causal agents of epidemiological importance; and
- Ministry of Commerce (MOC), on the import and export of certain flora and fauna into and out of the country.

Plant quarantine is under the Department of Agriculture while animal quarantine is under the Department of Livestock Development; both agencies are under the Ministry of Agriculture and Cooperatives.

With no single or central authority responsible for all IAS, the National Environmental Board's Convention on Biological Diversity (CBD) Subcommittee created in 1997 a Working Group (WG) on Alien Species to oversee all issues dealing with alien species, invasive or beneficial, in the country. The Working Group is composed of representatives from the government agencies concerned and experts. The Office of Environmental Policy and Planning (OEPP), official CBD national focal point, under the Ministry of Science, Technology and Environment

serves as the secretariat. The WG has included IAS prevention and management as a priority programme in the National Biodiversity Strategies and Action Plans for 1996-2001 and 2002-2006. It was also under this WG that inventories of alien species, microorganisms, plants and animals have been undertaken, and the prevention and management measures prepared to cope with IAS in particular in addition to occasional recommendations have been provided to the competent authorities for appropriate action whenever any unprepared problem arises out of IAS in the country.

The WG has also accomplished a large amount of work in preparing inventories of alien species in the country, taking into account alien species that are both invasive and beneficial in nature.

However, the number of known alien species of microorganism, plant and animal origin is still far from being reasonably estimated and the inventories of alien species could at least reflect the extent at which alien species as well as IAS exist in the country.

Results of the inventories include:

- In their report on endemic and exotic microorganisms of livestock and veterinary importance, the National Institute of Animal Health, DOLD, MOAC, estimated that 19 out of 168 virus / virus strains are exotic while 135 of 274 bacterial strains or serotypes and one out of 31 protozoa are of exotic origin. These estimates were from the culture collections maintained at the institute. MIRCEN Bangkok is yet to carry out the inventory of its microbial collections.
- The National Biological Control Research Center (NBCRC) of Kasetsart University and the National Research Council of Thailand identified 24 serious insect pests of agricultural importance to be IAS. In addition there were introductions of four vertebrate species for the biological control of water weeds, 12 insects for the biological control of both terrestrial



and aquatic weeds, two predator snails for the control of giant African snails, and altogether 42 species of beneficial alien species for the biological control of insect pests and weeds of agricultural importance as well as insect vectors of medical and public health importance. They also has recorded two alien species for biological control of weeds from South America, which have found their way to Thailand and neighbouring Southeast Asian countries.

- DOF estimated at least 32 species of introduced aquatic animals including snails.
- Another authority estimated 94 mammal, 168-228 bird, 63-93 reptile, 23 amphibian, 218 fish, four invertebrate and 37 insect alien species.
- RFD reported 190 exotic plant species while the National Science and Technology Museum made an inventory of 921 exotic plant species. The Office of Cane and Sugar Board under the Ministry of Industry estimated 59 major alien weed species present in the sugarcane-growing areas of the country. The Institute of Horticultural Research, DOA also prepared an inventory of horticultural crops imported into the country on an annual basis.
- While RFD has an inventory of 116 bird species and 15 mammal species brought into the country in 1995 under the CITES' lists, the Zoological Parks Organization of Thailand has an inventory of some 371 exotic animals found in both the government- and privately-run zoos.

Status of Alien Species: Invasive and Beneficial

Of the 100 world's worst IAS listed by the Invasive Species Specialists Groups (ISSG), at least 38 species are present in Thailand: one microorganism, one aquatic plant, 13 land plants, nine land invertebrates (two snails, seven insects), five fish, one bird and eight mammals. Of this 38, the following are considered beneficial alien species in Thailand and probably elsewhere in the Southeast Asian region: at least 12 (one microorganism, five land plants, five insect species, and one fish) are supposed to be either endemic or are within the centre of origin; and few species such as rosy wolf snail (*Euglandina rosea*), which is native to Florida, U.S.A., was introduced for biological control of the giant African snail (*Achatina fulica*); four fish species consisting of carp (*Cyprinus carpio*), and tilapia (*Oreochromia mossambicus*) which were introduced as protein source, walking catfish (*Clarius batrachus*),



Mosquito fish

Bob McDowall



Striped snakehead fish

www.thetropicaltank.co.uk

a delicacy for the Thais and other Southeast Asians, and mosquito fish (*Gambusia affinis*), which was introduced for the biological control of mosquito larvae. The giant snakehead fish (*Channa micropeltis*) and other snakehead fish like the striped snakehead fish (*Channa striatus*) are very common fish dishes for the Thai despite the Chinese strain of the giant snakehead fish (*C. micropeltis*) being considered a new IAS in few states in the United States today.

Some of the more important IAS identified are water hyacinth (*Eichornia crassipes*) and giant water fern (*Salvinia molesta*) among the water weeds, and giant sensitive plant (*Mimosa pigra*), Siam weed (*Chromolaena odorata*), mile-a-minute (*Mikania micrantha*), and Maui pamakani (*Ageratina adenophora*) among the terrestrial weeds. The latter two, which are from India and China, are invading



Water hyacinth

www.waterscapes.ca



Ivy gourd

www.tripod.com



Siam weed

www.cpitt.uq.edu.au

the northern highland areas of Thailand, Myanmar and Laos. Weeds of endemic origin in SEA such as itch grass (*Rottboelia cochinchinensis*) and *Rubus alceifolius* also became IAS of economic importance outside of the region in South America and ReUnion and Mauritius respectively. The leafy purge (*Euphorbia geniculata*) and *Hyptis* sp. are newcomers in the region. However, the aquatic *Neptunia natans*, an alien native to Central America has become neutralized and cultivated as an economic crop like other cultivated alien plants species such as papaya, cassava, pineapple, and para rubber. A semi-cultivated ivy gourd (*Coccinia cordifolia* or *C. grandis*) has travelled with the SEA refugees to Hawaii to become one of the worst weeds in Hawaii during the mid 1980s.

Classic examples of IAS invading the Asia and Pacific region were the spiraling whitefly (*Aleurobus*

dispersus) in the early 1980s and the *Leucaena* psyllid (*Heteropsylla cubana*) during the late 1980s and the early 1990s. These were later followed by a complex of agromyzid leafminers. Recently, there was an invasion of the cycad scale (*Aulacaspis yasumatsui*), which was discovered on cycads shipped to Miami Botanic gardens from Pattaya, Thailand. The same scale was also discovered in California and in Hawaii as recent as 2002. Thus an insect parasite (*Coccobius fulvus*) and a predatory cybocephalid (*Cybocephalus binotatus*) from Thailand were immediately introduced and released in Miami to help lessen the problem.

Existing programmes and other government agencies involved

The only bold and obvious programme dealing with the management of IAS was the establishment of the National Biological Control Research Center (NBCRC) at Kasetsart University in collaboration with the National Research Council of Thailand (NRCT) and 17 collaborating universities and agencies under the MOAC, MOPH and few other government enterprises since 1978. NBCRC deals only with biological control programmes aimed at IAS amenable to biological control and in collaboration with other national, regional and international organisations and institutions within the context of biological control and the integrated pest management (IPM) systems. ■

*Excerpts from the paper entitled "Thailand National Profile Report" presented by Banpot Napompeth, Chairman, Working Group on Alien Species during the Workshop on the Prevention and Management of Invasive Alien Species: Forging Cooperation through South and Southeast Asia, held on 14-16 August 2002 in Bangkok, Thailand.



VIETNAM

National Report on the Management of Invasive Alien Species

Background

Vietnam's commitment to conserve and protect biodiversity dates back well before the government ratified the Convention on Biological Diversity (CBD) in 1994 and adopted a Biodiversity Action Plan (BAP) in 1995. The declaration of the first national park in 1962 and the National Conservation Strategy (1985) and the National Plan for Environment and Sustainable Development (1991), were the foundations for the development of the BAP (Sulma Warne and Tran Lien Phong *In: Biodiversity Planning in Asia: Vietnam* www.icem.com.au/bioplan/vietnam.pdf).

Today, an impressive number of priority projects found in the BAP has been completed or is being implemented. The BAP has succeeded in putting biodiversity on the national agenda and heightening awareness of the values of biodiversity resources. Accordingly however, the BAP must now be updated and its implementation strengthened within the umbrella of the new National Strategy for Environmental Protection 2001-2010 (Sulma Warne and Tran Lien Phong *In: Biodiversity Planning in Asia: Vietnam* www.icem.com.au/bioplan/vietnam.pdf).

Key Threats to Biodiversity

The key threats to biodiversity in Vietnam include agricultural encroachment, wildlife trade, hunting/fishing, NTFP collection, logging and subsequent erosion, alien invasive species, forest fires and pollution. (Sulma Warne and Tran Lien Phong *In: Biodiversity Planning in Asia: Vietnam* www.icem.com.au/bioplan/vietnam.pdf)

Aside from the degradation of terrestrial, wetland and marine ecosystems due to industrial developments among other causes, an increasing number of plant and animal species are under threat because of uncontrolled wildlife trade, alien invasive species, and unsustainable harvesting of non-timber forest products.

Coupled with this is that the existing legislative and institutional frameworks are weak and the roles

and responsibilities of line ministries involved in the conservation of biodiversity have not yet been clearly defined. There are no appropriate mechanisms to effectively coordinate biodiversity conservation activities, particularly between line ministries, and between government and international conservation organisations and donors. (Sulma Warne and Tran Lien Phong *In: Biodiversity Planning in Asia: Vietnam* www.icem.com.au/bioplan/vietnam.pdf)

Major Alien Species Identified as Harmful, Invasive or Pests and their impacts

1) Golden apple snail (*Pomacea* sp.)

The Golden apple snail (GAS) was introduced in Vietnam in 1988 through many pathways without undergoing quarantine. Since its introduction, the apple snail was considered a rich protein food for fish and duck, thus its culture was

encouraged from the South to the North. In 1992, two golden apple snail farms were established in the country - one in Kien Giang province, and the other in Ho Chi Ming City - as a joint venture between Vietnam and Taiwan. The aim was to culture the golden apple snail on a large scale for export to Taiwan. Unfortunately, a large number of snails escaped from the culture ponds, and found their way into others ponds, trenches, and ricefields nearby. When the floods came, the snail spread more rapidly into the delta region of the Mekong River.

Ten years after its introduction, the apple snail has found its way in 57 of the 61 provinces of the country, and in 1997 has affected more than 132,000 hectares of ricefields, ponds, lakes and trenches.

The GAS has greatly affected the crops as it has:

- Reduced seedling density; reseeding has to be done two or three times per crop season;
- Increased the use of pesticides and the cost for pest control;
- Reduced the income of farmers; and
- Affected the tourism industry.





Golden apple snail

www.appleinail.net



Mimosa plant

The Kyoto Shimbun Co., Ltd.

- 2) Yellow meal worm beetle (*Tenebrio molitor* L.)
- 3) Ho mang chua (*Ophiphagus hannah*)
- 4) Haily (*Myocaster coypus*)
- 5) Mimosa plant (*Mimosa pigra* L.). Mimosa is not an alien plant but it is restricted in Vietnam, and drifted from Cambodia following the Mekong River.

Programmes and Management Efforts on Invasive Species

- The Plant Protection Department of the Ministry of Agriculture and Development has included in its training programme for farmers the Integrated Pest Management (IPM) in rice to help control the spread of the snail and other pests. This programme has now expanded to the Mekong River delta in the South of Vietnam.
- The Prime Minister issued two decisions prohibiting the culture, trade and movement of the GAS, and a standing committee was created to control the golden apple snail at both the Central and provincial levels.
- Two national programmes for controlling GAS were carried out from 1994-1995 with the attendance of pupils, farmers, women, students

and soldiers.

- The most useful method for controlling GAS is handpicking them. Other methods used were botanical insecticides; using fishes and ducks to control GAS; and also chemicals.
- Some 2,684 Farmer Field Schools (FFS) on Integrated Pest Management (IPM) in rice have been organised nationwide and more than 182,000 farmers trained on how to recognise the GAS, how to distinguish its characteristics, and how to control the infestation in rice fields, ponds, lakes, and trenches.
- Another project, which was funded by FAO, was on the Integrated Snail Management of rice in Vietnam, wherein farmers were trained on the IPM of the snail; this included the study and transfer of the techniques on using fish to control the golden snail.
- The National Plant Protection Institute of MARD is studying the use of biological agents for controlling the mimosa plant: The NIPP is implementing a project using the biological agent (*Calosobruchus quadritatus*) for controlling mimosa plant (*Mimosa pigra* L.) at Nam Cat Tien National Park in Dong Nai province).
- Thu Duc University of Agriculture and Forestry and the Queensland Department of Primary Industry Study have also conducted a study to control mimosa plant (*Mimosa pigra* L.) at Tram Chim National Park in Dong Thap province. The project is facing difficulties because seeds of mimosa drift annually from Cambodia to Vietnam thru the Mekong River.
- The Mushroom Thien Tan Ltd. Company and the Department of Agricultural and Forestry Extension under the MARD, conducted an evaluation project in Hanoi on the farming of haily (*Myocaster coypus*), which was imported from China. At the end of 2002, after having more information on the high risk potential of *Myocaster coypus* to agricultural production and other sections, the Minister of MARD decided to eradicate haily by prohibiting its culture, import, and transport in the whole country. ■

*Excerpts from the paper entitled "National Report on the Management of Invasive Alien Species in Vietnam" presented by **Duong Minh Tu** and **Pham Dinh Viet Hong** during the Workshop on the Prevention and Management of Invasive Alien Species: Forging Cooperation through South and Southeast Asia, held on 14-16 August 2002 in Bangkok, Thailand.

Other Source:

Sulma Warne and Tran Lien Phong In: Biodiversity Planning in Asia: Vietnam www.icem.com.au/bioplan/vietnam.pdf

A profile of the protected area system of Brunei Darussalam

■ By Sahlee C. Bugna

Background Information

Brunei Darussalam is situated in the northwestern part of the island of Borneo, covering a total area of 5,765 km². It has a common border with Sarawak, Malaysia, which also divides Brunei Darussalam into two parts. The western part consists predominantly of hilly lowland below 100 m but rising to over 300 m along the Sarawak border. The eastern portion has mostly rugged mountain terrain, rising up to 1,850 m on Bukit Pagon. Near the coast, it has a wide tidal and swampy plain. Narrow alluvial valleys extend up the main rivers. Most streams flow north to the coast, including the Belait River, the longest in the country.

The last comprehensive forest census of 1984 revealed 58% (341,000 ha) of the land area to be under primary forest cover. Six forest types with biologically and ecologically distinctive features are distinctly identifiable. Mixed dipterocarp forests cover over 30% (192,000 ha) of the land area and constitute more than half the primary forest cover in the country. Unfortunately, logging and other activities in some portions of this forest type have given way to secondary forests with reduced biodiversity. The most abundant trees in these forests belong to the family *Dipterocarpaceae*, which includes species of meranti (*Shorea*), urat mata (*Parashorea*) and kapur (*Dryobalanops*). Other species include the rubber tree (*Euphorbiaceae*), coffee (*Rubiaceae*) and durian (*Bombacaceae*). Peat

swamp forests, which covered about 90,000 ha in 1984, are the second most abundant forest type in Brunei. These include endemic species such as *Shorea albida* and *Dryobalanops rappa* (Fernando, 2001a). Montane forests (about 7,000 ha), on the other hand, are confined to the high elevations of Batu Apoi Forest Reserve in Temburong. The characteristic flora of this forest type includes the ground orchid (*Entomophobia kinabaluensis*), the bamboo orchid (*Kinabaluchloa nebulensis*) and the tree orchid (*Prunus oocarpa*). Many species of the insectivorous pitcher plants (*Nepenthes*) thrive in this forest type, as well as mosses and liverworts. About 3,500 ha of heath forests or Kerangas lie scattered in patches in the Temburong and Belait districts. These forests are the habitat of members of the animal kingdom ranging from the two-layered Coelenterata (earthworms) to the highly developed primates such as the Bornean Gibbon (Fernando, 2001b).

Brunei's 130-km coastline contains the country's most productive ecosystems and valuable onshore and offshore hydrocarbon deposits. Five hundred species of fish and insects

as well as 12 species of shrimp have been reported in Brunei waters. Mangroves cover 18,418 ha or 3.2% of the total land area and provide habitats for the Chinese egret, which migrates every winter from Siberia to Southeast Asia. In 1996, out of the 81 species of flora identified in Brunei, 48 are flowering plants and 33 are ferns. The country's 33 islands occupy 7,939 ha or 1.4% of the total land area. Turtle nesting has been sighted on a few islands, while most have a substantial population of long-nosed monkeys, the flying fox or fruit bat and a variety of birds. The long-nosed monkey, considered a vulnerable and endangered breed, is found only on Borneo Island (Borneo Bulletin Brunei Yearbook 1996).

The mammal and bird population of Brunei Darussalam is similar to that of Peninsular Malaysia, Sumatra, and Borneo as a whole. There are about 100 non-flying mammal species, of which nearly half are rodents (e.g. squirrels, rats, and porcupines). Mammals active during the daytime include tree shrews, squirrels, and monkeys and apes, while the shrew, moon-rat, pangolin, civet, wildcat, flying lemur, and flying squirrel

are active at night. There are five large terrestrial herbivorous mammal species: the bearded pig, two mouse deer species, barking deer, and sambar deer. The clouded leopard is Brunei Darussalam's largest wildcat species. Endemic species include the proboscis monkey (*Nasalis larvatus*), which is restricted to mangroves and specialises in eating leaves. Another is the tufted ground squirrel



Belait River

www.mighty.com



Clouded leopard

(*Rheithrosciurus macrotis*), a spectacular and rare rodent, which is about 3.5 cm long and with an enormous bushy tail of nearly the same length. Brunei Darussalam contains more than 300 resident bird species out of the 390 species recorded for the whole Borneo. A great majority of these are exclusively forest dwellers. All eight Bornean species of the larger birds - eagles, pheasants, and hornbills - occur in the country. The most evident of all bird groups are the brownish colour babblers, which feed on insects in the lower levels of the forest canopy. There are 26 species of this group in the country. The Bornean bristlehead (*Pityriasis gymnocephala*), a noisy black bird with a red and orange head, is found principally in peat swamp and kerangas forests, and other forests on flat land. Two crocodile species occur in the country - the estuarine crocodile (*Crocodylus porosus*) and the false gharial (*Tomistoma schlegelii*). Both breed in or near riverine or coastal forests or in vegetation around lakes (<http://www.forestry.gov.bn/>).

There are few threats to biodiversity since the country enjoys one of the highest living standards in Asia with most of its income coming from oil. Pressure on forest resources is very low. There are no timber exports and limited logging activities are conducted only to meet local needs. Controlled logging operations are confined to the production of 100,000 cubic metres of logs per

year, by law (Fernando, 2001a). Most timber requirements are met by imports. Hunting is largely traditional (using spears, dogs, nets, blowpipes, etc.) and is conducted by inland indigenous groups with negligible impact. Firearms have been strictly prohibited since 1962. The greatest threats to biodiversity are the disturbance to habitat and occasional spillages and pollution from oil exploration, although this only affects the shoreline and swampy lowlands (MacKinnon, 1997). Brunei's mangroves are among the best preserved in the region and non-oil coastal resources are relatively lightly exploited. All these place Brunei in a position to promote and execute a sustainable development plan (Borneo Bulletin Brunei Yearbook 1996).

Legal Framework

Biodiversity issues are largely governed by the 1934 Forest Act (revised in 1984), which covers the establishment and management of forest reserves. The Act allocates land within forest reserves into five categories: protection forest; conservation area; recreational area, production forest, and national park. The 1978 Wildlife Protection Act, on the other hand, details measures for wildlife conservation and protection, and the establishment of wildlife sanctuaries in the country. Other relevant environmental laws include (Dalgaard, 2000):

- 1909 Land Code (amended in 1982) and 1949 Land Acquisition Act (1949) - govern the allocation and management of all lands, including private use and tenure of land in the country.

Ratification of International Agreements Related to Biodiversity Conservation:

United Nations Law of the Sea - 1997
 Convention on the International Trade of Endangered Species - 1990
 ASEAN Agreement on the Conservation of Nature and Natural Resources - 1985
 ASEAN Declaration on Heritage Parks and Reserves - 1984

- 1967 Antiquities and Treasure Trove Act - provides for the protection of historical sites and antiquities, which refers to any object that can or cannot be moved, or a part of a site, river, lake, or sea which had been built, designed, drawn, dug, extracted, or moved by man at one time or believed to be dated before 1 January 1894. These include any human skeletons or remains of any plant or animal (including fossils) dated or believed to be dated before 1 January 1894 (<http://www.forestry.gov.bn/>). The Brunei Museum has used this law to designate some of Brunei's islands as historical sites to ensure the protection of the area's fauna and flora.
- Town and Country Planning Act - provides for national development planning, particularly with respect to allocation of land for urban development, settlement, industry, etc.
- 1972 Fisheries Enactment - designates areas that may be closed to fishing and other forms of exploitation.

Environmental policy has also been incorporated into the Seventh National Development Plan (1996-2000). The Plan's objectives include the sustainable utilisation of natural resources, minimisation of negative impacts of population growth and human settlement, and the balancing of socio-economic development with a quality environment. In addition, the Forestry Department of the Ministry of Industry and Primary Resources has formulated a National Forestry Policy. The Policy sets out the government's determination to pursue sustainable utilisation and management of its forest resources consistent with global strategies on bioecology (Tan, 1998).

In 1996, a review of existing environmental laws determined that although various existing laws covered environmental protection, these

were largely sectional in nature. Some laws overlapped while others had gaps. As a result, the First Inter-Departmental Consultative Workshop on the Draft Environmental Order was conducted in 2000 to discuss the development of a new environmental law. The Second Inter-Departmental Consultative Workshop on the Draft Environmental Order was held in 2001 (Othman, 2001).

Institutional Arrangements

The Forestry Department, which contains a Parks and Conservation Division, is responsible for the administration and management of forest reserves. The Department manages the Ulu Temburong National Park and other forest reserves. The Brunei Museums Department under the Ministry of Culture, Youth and Sports is responsible for wildlife conservation in the country, including the administration and enforcement of the 1978 Wild Life Protection Enactment. The Fisheries Department, on the other hand, is responsible for the enforcement of the 1972 Fisheries Enactment, including the protection of living marine resources (Galt *et al.*, 2000).

Two institutions play important roles in coordinating environmental policy. These are the National Committee on the Environment (NCE) and the Environmental Unit of the Ministry of Development. The NCE was established in 1993 as part of the government's Sixth National Development Plan. The NCE is a high-level inter-agency consultative body with representation from the relevant government departments and units concerned with the environment. It is tasked with coordinating the environmental functions and sectoral interests of the relevant agencies within and outside the government. It ensures general coordination of environmental policy-making, provides an overall framework for environmental management, and oversees the implementation of national environmental activities, legislation and

policies pertaining to the environment. On the other hand, the Environment Unit of the Ministry of Development serves as the full-time Secretariat to the NCE. This Unit is also involved in policy development and guidance, and is responsible for regional and international environmental relations, and for promoting environmental awareness in Brunei (Tan, 1998).

Other organisations or institutions involved in environmental work include these non-government organisations: Brunei Nature Society, Panaga Natural History Society, and the Universiti Brunei Darussalam (Tan, 1998). The Brunei Nature Society was formed nearly 26 years ago with the object of promoting an interest in natural history. In the past, it has taken part in many projects of the Forestry Department. It has conducted mass tree plantings and adopted a 3-ha plot of burnt forest for rehabilitation (Tanjong, 2002a).

Conservation Projects

The government and local institutions largely conduct environmental projects in the country. Government efforts include the allocation of \$23.3 million for social forestry programmes over the next five years, of which \$15.5 million will be spent on the Temburong district for the development of the National Park. Many activities are designed to encourage local involvement in park protection, including the launching of the new Bukit Patoi Trail in the Perdayan Forest Reserve in Temburong. The project involves the Forestry Department, the Forestry Club of Sultan Hassan Secondary School and the Brunei Nature Society. Under the project, the Brunei Nature Society and the Forestry Club of Sultan Hassan Secondary School will "adopt" the Bukit Patoi Trail. Both organisations will clear and maintain the trail as an alternative access to the Bukit Peradayan Forest Recreation Park. The Forestry Department will provide logistical support (Tanjong, 2002b).

A major conservation effort is the National Turtle Conservation Programme that was launched in April 2000 to actively promote the protection of turtles from extinction. Of the seven turtle species found in the world, the Green Turtle, Hawksbill and Olive Ridley come to Brunei's shores to lay their eggs. The turtles are protected under the Wildlife Protection Act. Fortunately, the efforts of the Fisheries Department, the National Turtle Management, and the Conservation Programme are slowly changing the way people feel about turtles (Zukarnaen, 2001). Various activities and programmes are carried out to create awareness among the public. Concerned individuals can participate in a programme where they can adopt a turtle hatchling for \$30, and then release it to the sea. The programme also accepts volunteers to help the turtle conservation effort (Lim *et al.*, 2001).

Another project that promotes environmental consciousness is the Princess Rashidah Young Nature Scientist Award (PRYNOSA), which debuted in 1997. The PRYNOSA project was proposed as part of the annual World Forestry Programme organised by the Forestry Department to help youngsters become more aware of the importance of the forest (Sulaiman *et al.*, 2001).

The Sultan Hassan Secondary School Forestry Club and the Brunei Nature Society also conduct tree planting activities in the nation's forests. This year, they led more than 30 students in planting 40 "Petai," "Tarap," and "Cempadak" local fruit trees at Bukit Peradayan Forest Reserve in Temburong (Tanjong, 2002a).

Status of the Protected Area System

In 1986, the Town and Country Planning Department commissioned a special report on wildlife conservation and management as an addendum to the Negara Brunei Darussalam Master Plan. The report contained recommendations for the

designation of specific protected areas (PAs) and draft legislation, although there has been little indication of the plan's implementation. The 1989 Forestry Strategic Plan also contained proposals for consolidating the PA system and maintaining sustainable use of forest resources. The many organisations involved in PAs and forest reserves however, have contributed to some confusion on overall protected area management in the country. Still, notable strengths in the PA system include (Dalgaard, 2000):

- High proportion of PAs due to commitment to a forest conservation policy and economic diversification.
- Possibility of additional support to PAs due to increased tourism.
- Broader understanding of the values of forest reserves and PAs as reflected in current forest policy.
- More opportunities for local employment.
- Improved regulations inside PAs, which has facilitated better visitor information service and movement, improved sanitation, prevented erosion, and ensured adherence to park guidelines.

There are a total of 25 PAs in Brunei covering 2,260 km (39% of the total land area). PAs are categorised into National Parks (2), Protection forests (5), Conservation forests (11) and Recreational forests (8) (Galt *et al.*, 2000).

The Way Forward

In 1999, the Southeast Asian Regional Forum of the Commission on Protected Areas provided several recommendations aimed at improving PA management in Brunei Darussalam. In terms of legislation, a new Wildlife Conservation Act should be developed to replace the inadequate 1978 Wildlife Protection Act. Specific legislation and management plans for individual PAs are also needed to ensure their efficient and

effective management. Since management of conservation areas is divided among a number of agencies, PAs would benefit from the development of a new government agency that will undertake overall management of existing and potential PAs in the country. If a new government agency is not feasible then the existing Parks and Recreation Section of the Forestry Department could be reorganised to have jurisdiction over all parks and reserves. Capacity building of staff involved in resource management could be addressed through collaboration with partners in ASEAN or other international environmental organisations. The Forum also recommended collaboration with local communities in planning and managing environmental protection projects, which can be achieved through public awareness campaigns, as well as formal and informal educational programmes targeted at communities surrounding PAs.

Fragile ecosystems and coastal regions, where most population and development are concentrated, should be priority areas for protection measures. Transboundary collaboration and management is also a consideration since some areas are shared with Brunei, Sarawak and Sabah (Galt *et al.*, 2000).

The Food and Agriculture Organization (FAO) provided the similar recommendations in its profile of Brunei Darussalam. It stated that a major challenge to the PA system is the lack of a comprehensive PA legislation or management plan, which limited the ability to establish, maintain or improve the existing system. Entities involved in the management of forest reserves and PAs such as the Forest Department and the Brunei Museum Department also have limited administrative capabilities, particularly in the areas of conservation management and enforcement. Management capacity is certainly a more significant issue since financial resources are largely available. The

fragmentation of responsibilities for the protection of reserves among different organisations is also an obstacle to effective planning and management. Increased tourism, although considered favourable to PAs, may also be a possible threat since an uncontrolled number of visitors may add stress to the carrying capacity of PAs (Dalgaard, 2000). ■

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MALAYSIA

Project Title: The Impact of Introduced Species (Non-native and Exotic) on the Genetic Diversity of Native Freshwater Fishes in Malaysia (RE-MYS-002)

Study leader: Yuzine B. Esa, Universiti Malaysia Sarawak

Significant findings: For the first year of the project, sampling studies were conducted in several rivers of Sarawak: Seriting, Jempol, Negeri Sembilan Layar, Spak, Baking, Tinjar and Ba' Kelalan. One of the project's objectives is to develop and characterise molecular genetic markers useful for the identification of introduced and native freshwater fishes. In line with this, the research concentrated on examining the genetic diversity of several important indigenous freshwater fish species such as *Tor douronensis* (Semah), *Puntius schwanenfeldii* (Tengadak/Lampam Sungai) and *Hampala macrolepidota* (Adong/Juak/Sebaru). Several techniques were applied such as sequencing of amplified (PCR) mitochondrial genomes in order to resolve the genetic structure and diversity of those fishes. Phylogenetic analysis using sequencing of the mitochondrial *cytochrome b* gene revealed two distinct groups between samples of *Puntius schwanenfeldii* from Peninsular Malaysia and Borneo Island. A similar result was observed in samples of *Hampala macrolepidota*, most possibly related to the biogeographic history of the Sundaland region. Among *P. schwanenfeldii*, samples from Peninsular Malaysia formed a sister taxa to the Borneo samples. Samples of the introduced Indonesian *P. schwanenfeldii* also formed a separate cluster within the Borneo populations, showing their genetic distinctiveness from the local *P. schwanenfeldii*. More genetic analyses are underway to examine genetic diversity in both introduced and indigenous fish species.

Project Title: Community-based Plant Conservation in Ulu Padas, Sabah (RE-MYS-004)
Study leaders: Geoffrey Davison and Perpetua George, World Wildlife Fund - Malaysia

Significant findings: One of the objectives of this project, is to investigate opportunities for Plant Conservation Areas (PCAs) such as Ulu Padas to generate economic benefits and become financially self-supporting in the long-term. Another objective is to support and enhance skills and capacity amongst local communities and forest officers to manage both existing and newly-established PCAs. Thus the study leader considered and added a new dimension to the project, with the assistance of four students from Universiti Malaysia Sabah.

The students took soil samples from a high altitude acidic peat swamp forest, and from oak chestnut forest on dry ground. They expected that the microbial flora present in soils from the highly acidic swamp forest might display unusual biochemical properties.

The many isolates of actinomycetes were tested on three genes - MKK1, MSG5 and GLC7 - that are associated with cell proliferation in yeast *Saccharomyces cerevisiae* and in mammalian cancers.

None of the 79 samples tested against these genes acted as an inhibitor. However, 21 of the samples from oak chestnut forest were toxic against MKK1, and 24 from oak chestnut forest were toxic to these genes. The big surprise was that 7 peat swamp samples were toxic to the gene GLC7, but none from the oak chestnut forest. This is strange because toxicity to GLC 7 should march in step with toxicity to the other genes. The analysis was therefore repeated with the same result. Why the peat swamp samples are toxic to one gene, and the oak chestnut samples toxic to two other genes, would make an interesting study.

Fifty-three (53) samples from both peat swamp and oak chestnut forest all proved toxic to the mycobacterium responsible for human tuberculosis. This is not necessarily good news because what is toxic to the tuberculosis mycobacterium may also be toxic to mammalian cells. It would have been more encouraging to find an inhibitor acting selectively.

How are these results linked to the conservation of higher plants? First, the samples were taken from the main habitat types around Ulu Padas, so we know the plant communities these soil microbes are associated with, and can probably find them again. We know the soil type, pH and history of disturbance of the forest. Second, the soil samples were taken from the bases of named trees, so we know the precise plant association and can look for mycorrhizal associations. Third, the trees they were taken from fall into distinct groups, and we can seek out links between the soil microbes and characteristics of the trees. For example, soil was taken from around the roots of strangling figs, which are likely to grow at sites independent of soil type (because the seeds germinate on branches of other trees, high in the forest canopy, before they send roots down). Soils were also taken from beneath various oaks, and from beneath conifers. It will be interesting in the future to take samples from beneath casuarinas trees, which have nitrogen-fixing root nodules.

This work was developed unexpectedly as a result of the opportunity provided by the ARCBC activities, and we hope it will have a long term value for science and health. The work was carried out by Prof. Ho Coy Choke and his students, and will be continued.

Project title: Regional Collaboration for Peatland Biodiversity in Southeast Asia (RE-MYS-003)

Study leader: Faizal Parish, Global Environment Center

Background

At the Ministerial Forum during the World Conference and Exhibition on Land and Forest Fires Hazards in Kuala Lumpur on 10 June 2002, the Malaysian Minister of Science, Technology and the Environment called for cooperation amongst ASEAN countries to address the issue on fire prevention and control in peatlands. Subsequently, the 19th ASOEN Haze Technical Task Force (HTTF) and the 9th ASEAN Ministerial Meeting on Haze (AMMH) on 10 -11 June 2002 discussed the issue on fire prevention and control in peatlands, which is considered critical to the ASEAN region. An update was given to the HTTF on the recent work in the region such as by the Global Environment Centre (GEC), coordinator for the Southeast Asia Peatland Network (SEA-PEAT), which brings together more than 340 individuals and more than 50 agencies involved in peatland assessment and management. GEC is a recipient of funding from ARCBC to develop regional collaboration for the conservation of peatland biodiversity in Southeast Asia. The incidence of peatland fire and associated haze has been seen as the main threat to peatland biodiversity, hence there is a strong linkage between protection of biodiversity and prevention and control of fires in peatlands. Due to the severe impact of peatland fire and haze on the regional economy and health, the AMMH subsequently decided to develop further the concept for a regional initiative on peatland management and fire prevention. The HTTF Chair was requested to follow up on this matter.

Updates

Following that, the HTTF with technical inputs from GEC and the ASEAN Secretariat developed a draft working paper on ASEAN Peatland Management Initiative (APMI): Sustainable Management of Peatlands, Prevention and Control of Peatland Fires. The working paper was then circulated through the HTTF to the member countries in early August 2002. It was presented at the 11th and 12th Joint Meetings of the Working Groups on the Sub-Regional Fire-fighting Arrangements (SRFA) for Sumatra and Borneo in Singapore in August 2002 and Brunei in January 2003, respectively. The SRFA working group supported the further development of the APMI proposal and suggested that the collection of critical peatland status and management information be made through the development and circulation of a questionnaire. Hence before the end of 2002, questionnaires were circulated to all HTTF focal points in the ASEAN countries to gather information and feedback regarding

Peatland Management Initiative. Questionnaires were also sent out to other international/local agencies, institutions, NGOs and individuals and have a wider range of feedbacks. Results from the questionnaires were analysed and a revised proposal for the initiative was developed based on these feedback and inputs. The proposal was discussed and adopted on 28 February 2003 at the 20th ASOEN HTTF meeting in Manila. The APMI was then further supported by the ASEAN Ministers of Environment during the 10th ASEAN Ministerial Meeting on Haze meeting in Siem Riep, Cambodia on 4 March 2003.

Framework of APMI

The objectives of the APMI are to:

- Build capacity and understanding on peatland management issues in the region;
- Reduce the incidence of peatland fires and associated haze in the region;
- Prepare national action plans and support their implementation at the local level; and
- Develop a regional strategy and cooperation mechanism to promote sustainable peatland management.

One of the main focuses of the initiative is to find ways of building upon or linking up all the existing activities/work on peatlands in the Southeast Asian region. The primary tool for information dissemination and sharing would be the internet using "Simplify" community portal software and building on the initial "PEAT-PORTAL" site and SEA-PEAT Network developed by GEC and partners in 2001/02. The initiative would link all these activities, facilitating exchanges of information or promoting dialogues between the different groups working on these projects. The initiative aims to support on-the-ground actions in different ASEAN countries to restore and improve management of peatlands by developing pilot projects and establishing demonstration sites for best practices. Experiences and lessons learned from demonstration sites will be shared and disseminated between the countries in the region. The Initiative will also look into aspects of facilitating exchange and sharing of international experiences in successful peatland management, ecological restoration and fire prevention/control with the countries in the region through best management practices (BMP).

The endorsed APMI concept proposal can be viewed at the PEAT-PORTAL (www.peat-portal.net). For those who are interested in knowing more regarding the development and activities and possible involvement in this Initiative, or would like to share information on the BMP of peat, i.e case studies, please contact Dr. Raman Letchumanian (raman@aseanses.org) or David Lee at (david@genet.po.my) or at 7A, Jalan 19/29, 46300 Petaling Jaya, Selangor, Malaysia. ■

INDONESIA

Project Title: The Effect of Human Impact on Cave and Karst Biodiversity: Indonesia Component

Study Leader: Dr. Yayuk Suhardjono, Indonesian Institute of Sciences, Indonesia

Various caves and ecological sites located in Maros Karst, South Sulawesi, Indonesia were studied to assess their biodiversity and the impacts brought about by human activities such as logging, tourism and agriculture. The study included the creation of a cave biota reference collection with respect to the National Museum and development of a database from the collected samples, and the drafting of recommendations to effect a national policy change for the management of cave biodiversity.

The Project started in August 2001 and will terminate in July 2003. There has been enormous data on collected and identified specimens, but only some accomplishments will be discussed. Specimens of mammals, mollusks and arthropods were collected and studied.

Mammals. Seventy-six specimens of small mammals were collected. Thirteen localities were sampled but only 11 localities provided mammal species. Collected materials consist of 64 specimens of 9 bat species (Chiroptera), 1 specimen of 1 shrew species (Insectivora) and 11 specimens of 5 rat species (Rodentia). Most species are endemic.

Suncus murinus, commonly named House Shrew, was the only Insectivora found in TWA Bantimurung and regarded as a cosmopolitan species. For Chiroptera, there were six species found. These are *Hipposideros dinops*, *Emballonura alecto*, *Dobsonia*

exoleta, *Cynopterus luzoniensis*, *Nyctimene cephalotes*, and *Rousettus celebensis*. Three more species were found, such as *Miniopterus schreibersii*, *Rhinolophus arcuatus*, and *Rhinolophus philippinensis*. Among rat species, *Paruromys dominator*, the largest rat in Sulawesi, was found. Other species include *Maxomys musschenbroekii* and *Rattus hoffmanni*. There is no new record of rodent in the study sites.

Outside the caves, occurrence of some species like *Rattus tanezum* (house rat) in a nature tourism forest like TWA Bantimurung, is likely an indicator that disturbance already exists. The effect of disturbance affects species richness and abundance inside and outside the caves, in particular at the Kacici and Pattunuang Caves where tourists often visit and local people do their laundry and take their baths. Most of the species were gathered at night using traps. Very few species of bats were collected. There was one large cave where not even one species of living bat was collected. Local folks confirmed the presence of bats before but due to human disturbances, mostly treasure diggings, the bats disappeared.

Molluscs. Terrestrial snails are represented by the families: Cyclophoridae, Clausiliidae, Subulinidae, Helicarionidae, Ariophantidae, and Camaenidae. Only the Family Thiariidae with species *Melanoides granifera* represents the freshwater snails.

Arthropods. About 1,417 specimens representing more than 46 species of Microlepidoptera and 169 species of moth were collected from four sites with different types of ecological stress: Bantimurung Nature Reserve, Karaenta Nature Reserve and Pattunuang TWA and Cani Karst (disturbed area of cacao plantation). The study found out that Bantimurung Nature Reserve has the highest number of species while the lowest was that of Karaenta



Cyclophoridae



Isopoda

PHILIPPINES

Project Title: Responses of the Herpetological and Mammalian Faunas of Negros Island, Philippines to Fragmentation of the Tropical Rain Forest

Study Leader: Dr. Ely Alcala, Siliman University Angelo King Center for Research and Environmental Management (SUAKREM), Philippines

This two-year project in Negros Island has two main activities: survey of mammals and herpetofauna habitat, and networking with community and local government. The following discussion is the partial results of the first year of project implementation on the survey of mammals and herpetofauna habitat.

The study area covers about 344 ha in the southwestern towns of Cauayan, Hinoba-an, and Sipalay in Negros Island, Negros Occidental. It is parceled out into nine fragments, all of which had been logged continuously between 1950 and 1980. A small reforestation area served as a control site. The eight remnants belong to the public forest and are probably the last remaining limestone (hardwood) forests on the Island. The remaining biodiversity in these forest fragments has been surviving there for about 20-30 years following their isolation. The limestone forest fragments contrast with forests studied earlier. These are Mt. Canlaon, Cuernos de Negros and Lake Balinsasayao areas, all of which are volcanic in origin.

The vertebrate fauna of Negros Island is the best studied in terms of systematics and ecology as compared with those from the various larger islands of the Philippines. Scientists associated with Silliman University, in Dumaguete City, Negros Oriental, and their research collaborators abroad, have been conducting research on this group since the 1950s, and a number of scientific papers, monographs and books have been published. The existing information and data serve very well as a baseline for the present study. With the standard methods of sampling applied, the following preliminary data resulted:

Species composition. Some plants belonging to 63 families occurring in Cuernos de Negros and environs and in the forest fragments in Cauayan and Hinoba-an have not been identified as to species level but are listed according to common names. The list is not exhaustive but it shows the difference in the number of plant species between a large area of forest (Cuernos de Negros) and the forest fragments. Cuernos has about 197 species while the fragments have 147 species.

There are 87-88 species of frogs, lizards and snakes

Nature Reserve. A main road with a dense traffic of large vehicles crosses this Reserve. This condition possibly affects the population of Lepidoptera. Another possible reason is the use of light trap during moonlight, wherein light intensity could be less efficient in attracting insects.

Among the cave species of arthropods, Isopoda dominates the collected specimens, followed by Collembola and Crustacea (Shrimps). One of the most interesting findings is the presence in Gua Saripa of a Coleoptera that belongs to the genus *Eustra* (Pausidae). The beetle has been described as a new species of cave beetles from a single specimen collected under rotten bamboo. Two other cave beetles have been described from the Maros Karst: *Mateuis troglobiticus*, which has been collected again in several specimens, and *Speonoterus bedosae*, which is only known from the type locality and not found in the others.

A new species of aquatic isopods (*Cirolana* (*Anopsilana*) *marosina* Botosaneanu) was found during field studies. Botosaneanu qualifies it as the first cave aquatic isopod from Indonesia, and the first cave freshwater Cirolanid from Southeast Asia. This species was found during the first fieldwork in Gua Saripa spring, a remnant pool of the cave stream and in the subterranean river of Gua Assuloang (Balocci). Another probable new record is the *Cyathura* (*Stygocyathura*) *munae* Botansaneanu). It was found in Gua Lamansi, Muna Island, Southeast Sulawesi, a karst cave with more or less brackish water. To date, this is the second Anthurid species from Southeast Asia caves. The first is from Sarawak, Malaysia.

Among the spider species, a giant hunt spider (Arachnida: Sparassidae) was collected and sent to Dr. Peter Jaeger of Germany for further identification. Other collections were initially identified under Heteropoda.

Other species such as the shrimps and crabs were sent to Dr. Peter K.L. Ng of Singapore for identification. Among the interesting species found were the Atyids shrimps, which include highly evolved stygobites (blind, obligate cave aquatic species), and species of a genus still unknown to Southeast Asia.

At present, other species are being sorted and in the process of identification by concerned international institutions.

The conduct of collaborative cave visits is planned in May 2003 with another ARCBC- funded research project team in Thailand, headed by Dr. Chaweevan Hutacharern, Project Leader for the Thailand component. Previously, the Thai team visited some caves in Indonesia with the Indonesia team. ■

recorded from Negros Island (forest area 1.3 million ha), including one species of crocodile and two species of mangrove and estuarine snakes. Of these, 71 species have been recorded from Cuernos de Negros, a volcanic area (forest area 10,000 ha), over a period of 50 years.

Graphically, the data shows that the total number of frog and reptile species in the 10 forest fragments in southwestern Negros taken together is 47, compared with 71 for the Cuernos de Negros area, and 87-88 for the whole Negros Island. The predominantly limestone forest fragments in southwestern Negros with an aggregate area of 367 ha harbor 54% of the Negros Island herpetofauna and 66.2% of the Cuernos de Negros herpetofauna. On the assumption that all of the Cuernos species occurred throughout the Island before the denudation of southwestern Negros, about one-third of the species of frogs and lizards have disappeared from these limestone forest during the past 50 years.

It is possible that this lower species count is the result of the modification of the habitat (Davies *et al* 2001). However, survey results of the species in these fragments may yet be incomplete. It should be noted also that the absence of at least one species of forest frog, *Platymantis dorsalis*, in the Linab forest fragment and in the control man-made forest in Sipalay, was caused by the modified habitat resulting from changes in the physical conditions such as the loss of the closed forest canopy. Apparently in this forest fragment, there were insufficient moisture and forest floor cover for the species. This is in contrast to the presence of the frog in the Canlabac non-limestone forest, which has retained sufficient moisture because of a natural water source and a closed canopy, and in the other six limestone forest fragments.

The present study area differs from Cuernos de Negros in being mainly a limestone forest, the former being a volcanic area. It also lacks large river systems and mangroves, both of which are found in other parts of Negros, and therefore lacks the Philippine crocodile and other species adapted to salty environments. However, it has a unique frog species restricted to the limestone forest in southwestern Negros, the cave frog, *Platymantis spelaeus*.

Species endemism. Philippine endemics constitute 38% of the total herpetological species on the island and 41% of the species on Cuernos de Negros.

Ecological groupings. By grouping herpetological species according to observed preferences, it is possible to show the differences between the species composition in Cuernos de Negros and in the limestone forest fragments. Species of frogs, lizards and snakes are heavily dependent on moist arboreal habitats and moist forest floor habitats in Cuernos de Negros and in the forest



Platymantis dorsalis

fragments. More moisture-dependent species are found in the former site, indicating the role of moisture in species distribution. Furthermore, some species found in the Cuernos de Negros area are absent from the forest fragments because of the lack of suitable microhabitats in the latter.

Population densities of surface and burrowing species

Amphibians. From the 10 forest fragments studied, only four species of frog (*Platymantis dorsalis*, *P. spelaeus*, *Limnonectes visayanus* and *Kaloula conjuncta negrosensis*) were found in the plots. The two species of *Platymantis* co-existed in all limestone forest fragments, except in Linab, where only *P. spelaeus* occurred. The last two species were caught on only one plot and are excluded from this analysis.

Reptiles. Only eight species of burrowing and surface-dwelling reptiles, seven lizards and one snake, were found in the plots in at least three limestone forest fragments. These are the three species of *Brachymeles*, three species of *Sphenomorphus*, one species of *Mabuya*, and the common species of *Ramphotyphlops*. All burrowing and surface species of lizards and snakes had low population density of less than 100 adult individuals per hectare in suitable habitats in three or more limestone forest fragments.

Six other reptile species were rarely found in the plots and only in forest fragments. These were the burrowing lizard *Dibamus argenteus* (one forest fragment), the surface lizard *Mabuya multicarinata* (two forest fragments) and the small burrowing snakes *Calamaria gervaisi iridescens* (two forest fragments), *Oxyrhabdium leporinum visayanum* (two forest fragments), *Pseudorabdion mcnamarae* (one forest fragment) and *Pseudorabdion oxycephalum* (two forest fragments).

Not much data exists on their density in the intact forest on Negros Island (Alcala 1976) and, therefore, in most cases, it is not possible to say that their population density has been reduced as a consequence of forest fragmentation. ■

SINGAPORE

Project Title: Interactive Malesian Moss Database – Phase I

Study Leader: Dr. Benito Tan, Raffles Museum for Biodiversity Research and University Herbarium (SINU), National University of Singapore

The Interactive Malesian Moss Database Project aims to collate, organise and make available on the internet all published information on relevant aspects of biology, ecology and economic importance of mosses found in the Malesian floristic region. As documented today, the Malesian region has a high diversity of mosses consisting of about 1,819 species in 347 genera and 80 families (Tan & Iwatsuki, 1999);



Bukit Timah moss



Benito moss

data collected for the project, 2002).

Employing the newly purchased Apple iBook 800 notebook, the project has registered a total of 9,021 entries of Malesian mosses in a raw database set up at the Herbarium (SINU) of the National University of Singapore using the Filemaker Pro programme. This wealth of information was gleaned from some 132 articles obtained from journals, books and scientific reports, some of which dated a century ago. Subsequently, an interactive programme has been developed for data entry and simple and multiple search functions, using the software programme called MySQL, which is based on SQL language.

The newly developed prototype of the interactive moss database programme has 20 fields of information, namely: taxon (scientific name), genus, species, species authority, infraspecific taxon, authority of infraspecific taxon, family, synonyms, country, island, state/province, locality, GPS position, elevation, distribution range, IUCN status, economic importance, picture/photo, web-link and source literature. At present, this prototype, with a small entry of 67 moss sample entries, is temporarily available on NUS internet at (<http://www.sheares.nus.edu.sg/sinu/>) for examination and public testing.

Future work in the year 2003 will see the (1) transfer of all the 9,021 entries of moss data from the raw moss database to the interactive moss database programme developed by the project; (2) standardisation of accepted scientific names and the names of authorities of plant nomenclature; (3) addition of more entries of Malesian mosses into the existing database; (4) creation of a digital file of pictures and line drawings from various publications as well as new color photographs of live plant specimens to show the image of various moss species; and (5) addition of editing capability to the existing function in order to keep the database entry as updated as possible with the changes in taxonomy. Additional effort will also be focused on the improvement of the relevant internet linkages and the search engine of this prototype of interactive programme to enable more efficient and/or multiple, complex search of information from the moss database. ■

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BRUNEI DARUSSALAM

Project Title: Vegetation Rehabilitation of Burnt over Forests of the University of Brunei Darussalam Campus

Study Leader: Dr. Kamariah Abu Salim, University of Brunei Darussalam, Brunei

Heath or kerangas forest is the most easily recognised of all lowland rainforest formations. The greatest extent of heath forest in the Far East is found in Borneo. The original areas of Bornean heath forests is estimated at 66,882 km², with only 48% remaining today. A broad swathe of these forests, approximately 24,759 km², runs diagonally through Central and East Kalimantan while the rest is distributed between Sabah, Sarawak and Brunei.

In Brunei, there are 3,455 ha of undisturbed heath forests in addition to the 1,339 ha and 2,814 ha, which are classed as exploited and remnant kerangas, respectively. These forests are found mainly in the coastal zone where most of the development is taking place. Hence, there has been much degradation of the kerangas forests here through a relatively long period of disturbance such as frequent forest fires that retard and overcome the recovery of the vegetation through normal regrowth. The drought-fueled fires of 1992 and 1998 have continued to erode this much-endangered vegetation type, thus, the objectives of this project.

The project aims to rehabilitate the biodiversity of burnt-over kerangas forests around the University of Brunei Darussalam campus and make the campus more aesthetically pleasing and attractive to staff, students, and visitors; to minimise the occurrence of natural forest fires; and to set up permanent plots for education, teaching and research.

It would take two years to complete the project's planned major activities on the selection of plant species, establishment of nursery and fire breaks, enumeration of trees, preparation of sites, planting and monitoring, and maintenance of study sites.

Although the first year of project implementation was reportedly slow moving because of many problems, some sub-major activities have been accomplished. These included the establishment of the nursery, which had a size of 13m x 30m x 2.8m, as well as 12 stand water pipes. In terms of selection of plant species, the project encountered problems in the available supply of seedlings and seeds in the locality. Hence, alternative species will be studied. Firebreaks

were also established and regularly maintained. One firebreak has a size of 0.8 length and 5 m wide. Site planting involved the participation of the different schools and universities. Other activities included the subdivision of plots for study with an individual size of 0.5 ha, and removal of unwanted trees in each identified study plot.

The project will end in November 2003. From this time onwards, the University of Brunei Darussalam will be able to continuously maintain and monitor the initiated activities for the future conduct of study and research.

Project Title: Collection, Establishment, Conservation and Documentation of Durio Species of Brunei Darussalam and Brunei Bay Region

Study Leader: Mr. Jumat Hj. Alim, Department of Agriculture, Brunei Darussalam

In Brunei Darussalam and the neighbouring state of Sabah and Sarawak, the genus *Durio* is widely appreciated, particularly *Durio* species other than *D. zibethinus*. There are 27 known species of *Durio* out of which 7 produce edible aril. All the seven species are found in Brunei and the neighbouring Malaysian states. Durian Kuning (*Durio graveolens*), Durian Pulu (*Durio kutejensis*) and Durian Suluk (*Durio* sp.) are among the popular species highly esteemed in Brunei for their special flavour, unique aroma and lingering aftertaste.

Most durian trees found in Brunei and the Brunei Bay Region originated from seeds and many trees are at least more than 50 years old. Studies and observations conducted in various durian-growing areas indicated that early settlers in search of fertile land for rice cultivation planted these trees. The settlers moved in family or community groups to establish settlements. Their main crop was rice for their staple needs. As the land became exhausted from continuous cropping, they moved to new plots leaving the fruit seedlings that grew by the house compounds to grow into trees. Collectively, these clusters of fruit trees are called "pulau buah". The settlers planted seeds from the best fruits they ate. As the trees grew into maturity the fruit trees segregated into multitude of non-descript trees that now constitute the genetic diversity of fruits found in Brunei and the Brunei Bay Region. *Durio* species are common probably because the fruit are delicious and the seeds planted received special care during their early growth and were able to compete and grow into huge trees in the abandoned settlements. Some *durio* species are common as under-storey trees in "pulau buah".

Brunei Darussalam has an immense diversity in



Durian

tropical fruits. *Durio* species are important and a number of indigenous species have special affinity to Bruneians and the people in the states of Sabah and Sarawak. The primary objectives of the project are to study the genetic diversity of the species, mount programmes to collect these fruits, evaluate the quality and establish the seeds in two research stations to conserve the genetic diversity.

This two-year project is divided into four interrelated phases. *Durio* species shall be conserved in two research stations in Brunei for future durian fruit improvement studies. Studies will generate more data and information on *Durio* species especially on graft compatibility between *D. zibethinus* as scion and indigenous species as rootstocks. Furthermore, collection and sensory evaluation will identify indigenous species with good eating quality and to be promoted as special Borneo durians. Data and information will be processed into annual reports and published in the proposed book on Durians of Brunei Bay Regions. In its first year of implementation, the project's summary of progress results are as follows:

- Study on the phenology of *Durio* species (flowering, fruiting, and distribution) was carried out during the fruiting season. From June to September, six *Durio* species were observed: *Durio zibethinus*, *D. graveolens*, *D. oxleyanus*, *D.*

testudinarium, *D. kutejensis*, and *D. dulcis*.

- Seeds were collected since February 2002 and then raised at the Birau Agriculture Research Station. As of June 2003, there are now 1,644 seedlings of *Durio* species, of which *D. graveolens*, *D. kutejensis* and *D. zibethinus* have the greatest number.

As part of the conservation effort of durian species of the project, a 12-ha land located at Birau Agriculture Research Station has been devoted as the "conservation site". The site was completely cleared for the establishment of terraces and planting holes before the planting activity. As of this report, work contracting for the preparation of planting holes is being processed.

- There are no specific recommendations yet on agronomic practices cited for the establishment of selected species having commercial potential but there is an ongoing study of the pest and diseases.

The study involves monitoring and observation of pests and infestation in the nursery. So far the insects identified were: scale insect (*Asterolecanium unguatum*), mealy bug (*Pseudococcus spp.*) and white fly (*Aleurodicus spp.*).

Leaf blight, leaf spot and anthracnose caused by the fungus *Rhizoctonia solani*, *Phymopsis durionis* and *Colletorichum gloeosporioides* respectively were the common disease observed. These incidences of pest and disease problems were kept under control with the use of recommended pesticides.

Based on recorded data of pest and diseases on investigated durian, the major pests are: *Durio* seeds borer, yellow weevil, scale insects and bark borer weevils. The major diseases are stem canker or patch canker, leaf blight, leaf spot and anthracnose. Practicing appropriate control measures through integration of cultural, physical and chemical control can minimise the problems.

- The objective is a compatibility study on different types of durian rootstocks on *Durio graveolens*, *D. zibethinus*, and *D. pulu*. It aimed at observing the effect of rootstocks of *Durio* species on the scions of three different species of durian: *Durio graveolens*, *D. zibethinus* and *D. kutejensis*.

At present, only 10 out of 28 grafted plants are growing successfully as a result of the grafted clones, BD104, on seven different species of durian rootstocks: *Durio graveolens*, *D. zibethinus*, *D. kutejensis*, *D. oxleyanus*, *D. testudinarium*, *D. dulcis*, and *D. species*.

The project proposes to publish a book on the "Durians of Brunei Bay Region". ■

THAILAND

Project Title: The Genus *Argostemma* Wall. (Rubiaceae) in the Malay Peninsula and the Peninsular Thailand

**Project Leader: Dr. Kitichate Sridith
Prince of Songkla University, Thailand**



Argostemma Wall

The herbaceous genus *Argostemma* Wall. (Rubiaceae), which was first identified by Wallich (1824), is confined to the humid primary forest in the tropics. There are approximately 100 *Argostemma* species confined to the Old World. In Thailand, Craib (1923, 1931) was the first who reported the genus in his "Florae Siamensis Enumeration". About 60 years later, Sridith (1999) revised the genus in Thailand and reported 31 taxa including four new species and one new variety.

The goals of this research project are to: gather all taxa and record the distribution patterns in both the Thailand and the Malay Peninsulas; and revise the genus *Argostemma* Wall.

After a year of implementation, the original publications of all the proposed name taxa of *Argostemma*

in Malay Peninsula and Peninsular Thailand have been collected. All publications concerning the genus *Argostemma* in the study area and adjacent areas have been taken into account. About 80% of herbarium specimens of the genus from the following herbaria: BK, BKF, K, KEP, KLU, L, PSU and SING, has been examined, including the surveys of natural populations both in Malay Peninsula and Peninsular Thailand.

Few taxa were recorded during the surveys of natural populations as the genus needs a very exclusive environment: moist evergreen forest (primary, undisturbed forest). Some taxon have tubers, of which the aerial part would develop only in the rainy season (e.g. *A. unifolioides*, *A. neurocalyx*). Revision work is ongoing and the details on the morphology including palynological data of each taxa have been carried out.

Detailed morphology studies from herbarium specimens and collections from field studies were conducted in order to prepare descriptions of each taxon together with line drawings and identification keys of the genus. For the second year of implementation, the project aims to complete the revision work and correct all the herbarium specimens studied in various herbaria. Publications on taxa of the genus *Argostemma* Wall. (Rubiaceae) including its distribution in the Malay Peninsula and the Peninsular Thailand are to be produced at the end of the project.

Acronyms Used

- BK** Herbarium, Department of Agricultural Education, Ministry of Agriculture, Bangkok, Thailand
- BKF** Forest Herbarium, Department of National Parks, Plants and Wildlife Conservation, Ministry of Natural Resource, Bangkok, Thailand
- K** Herbarium, Royal Botanic Gardens, Kew, Richmond, UK
- KEP** Herbarium, Forest Research Institute Malaysia, Kepong, Kuala Lumpur, Malaysia
- KLU** Herbarium, Department of Biology, University of Malaya, Kuala Lumpur, Malaysia
- L** Rijkherbarium / Hortus Botanicus, University of Leiden, The Netherlands
- PSU** Herbarium, Department of Biology, Faculty of Science, Prince of Songkla University, Hat Yai, Songkhla, Thailand
- SING** Herbarium, Botanic Gardens Singapore, Singapore

Project Title: Maintenance of Biodiversity Conservation and Cultural Practices

**Project Leader: La-aw Ampornpan
Srinakharinwirot University, Thailand**

The livelihoods of local populations both in Thailand and in Vietnam are dependent on forest products in varying degrees. The project aims to study the local use and knowledge of biodiversity; investigate the use of natural resources and socio-economic conditions in the area; and measure the influence of harvesting of forest products in relation to the ecological sustainability of the natural system.

The study areas selected for the project are Bans Bung and Huai Nam Phak in Na Haeo district, Thailand and Thanh Son and Thanh Luan Communes in Son Dong district, Vietnam. Na Haeo district is geographically situated in Phetchabun Range, in the Western Hills of Loei province. The forest types of Na Haeo are mix deciduous, tropical evergreen, dry dipterocarp, and pine forest. Results of the surveys showed that altogether 18 mammals, 27 birds, 23 fishes, 12 reptiles, 13 amphibians and 24 insects have uses for villagers in Huai Nam Phak and Ban Bung. Most of these animals are used as food, medicine and ornaments. There are at least 49 known terrestrial species of medicinal plants, and are eaten as antidotes. Surveys from the Thanh Son and the Thanh Luan communes showed five rare species (*Cinnamomum balansae* Lecomte, *Nageia wallichiana* (Pre) Kuntze, and *Podocarpus pilgeri* Foxw., *Erythroleum fordii* Oliv. and *Amomum longiligulare* T.L. Wu), 189 medicinal species, 164 timber species and one new species (*Hoya grifihii* Hok.f.) added to the flora of Vietnam. The investigation resulted in a list of species of flora in the Western Yen Tu. The productive value is divided into eight groups that include wood, tannin, essential oil and resin, medicinal use, human food, fodder, construction materials, wrapping/covering and handicraft materials and as ornamental.

Analysis of remote sensing images and other records disclosed that the Western Yen Tu reserve possesses a considerable area of evergreen forest, even biggest in Vietnam (covering 70%). Based from the provincial records of Bac Giang, the reserve has 789 vascular flora species, of which 496 are medicinal plants; this proves that Yen Tu is one of the richest areas of medicinal plants in Vietnam. The living standard in Yen Tu is low, the infrastructure is poor and many families suffer from food shortage every year. Commercial, technical and cultural exchange is almost stagnant partly due to poor road system and lack of electricity. Due to poor living conditions and traditional habits, local people continuously extract non-timber forest products. Poor knowl-

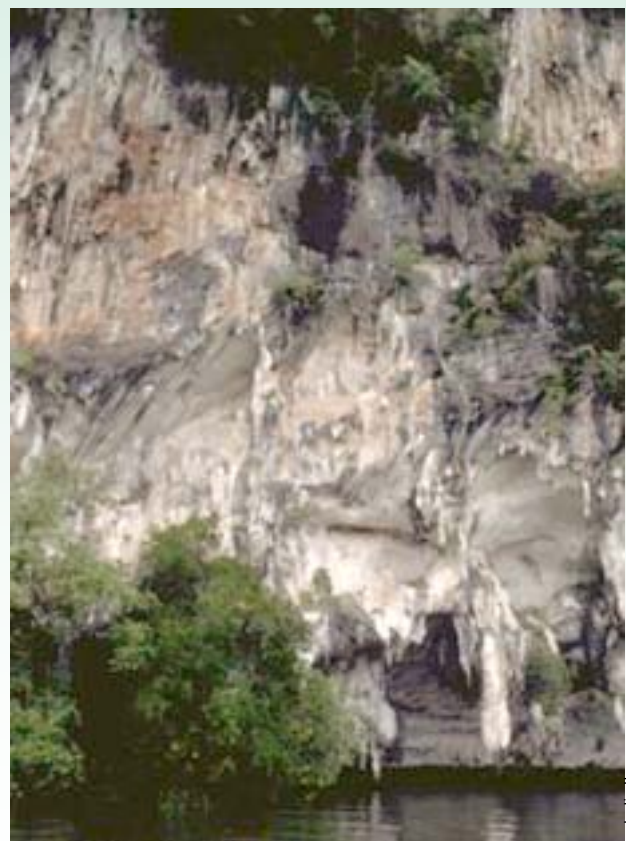
edge and awareness towards the conservation of resources lead to the destruction of their environment on which they depend upon.

Recently, the awareness of the locality towards environmental protection has improved with the conduct of a series of public education activities. Villages have built the commitment to conserve biodiversity. Forest guard teams were formed and being led by the veterans. Continuous education is still necessary for the sustainable use and development of their forest ecosystem.

Project Title: The Effects of Human Impacts on Cave and Karst Biodiversity: Thailand Component

**Project Leader: Dr. Chaweewan Hutacharern
Forest Insect Group, Royal Forest Department,
Department of National Parks, Wildlife and
Plant Conservation (DNPW), Thailand**

Caves and karst are widespread throughout Southeast Asia and are potential reservoirs for biodiversity. The biodiversity of the caves of Phangnga, Thailand is less known and suffers from tourism activities and water borne pollution. There is now a growing awareness amongst land managers and scientists of the uniqueness and significance of caves and karst and its biodiversity. This was recently demonstrated when



Tham Lom Cave

Jan Leslie Harry

two major cave study projects were funded entirely by the Thai Government, through the Thailand Research Fund, although neither investigated biodiversity. In August 1999, a Cave Resources seminar held in Bangkok highlighted many of the problems faced by caves in Thailand and concluded that without improvements in knowledge and coherent management, further decline can be expected.

The primary objective of this research project led by the Forest Insect Group of the Royal Forest Department, Department of National Parks, Wildlife and Plant Conservation (DNPW), Thailand is to examine how human disturbance impacts on faunal diversity in stream caves in southern Thailand.

For the first year of implementation, two preliminary field trips were completed. Some 42 caves with a total length of 17980 m were examined – 22 on the first trip and 20 on the second. Of these 42 caves, 21 (total length = 7995 m) were surveyed for the first time. A database of 75 stream caves were established. The database records aspects of cave environments that were believed to be most relevant to the site selection criteria and factors (i.e. length, relative disturbance, catchment size, etc.). Using this database in conjunction with local knowledge and literature, the project selected seven caves for sampling. These caves and their locations are:

- 1) Tham Phung Chang (Phangnga)
- 2) Tham Tapan (Phangnga)
- 3) Tham Lot/Tham Thong (Phangnga)
- 4) Tham Nam 1 (Phangnga)
- 5) Tham Jet Khot (Satun)
- 6) Tham Khong Kha Lot (Phattalung)
- 7) Tham Than Nam Lot Yai (Chumphon)

Quantified sampling was conducted in three habitat strata viz. floors, walls, interface and at 12 stations in each cave. Processing of specimens from these habitat strata is now underway. A total of 475 fish specimens representing 29 species (14 families) were also collected, identified, weighed and measured.

Below are useful tips for practicalities of cave work and collecting cave animals:

Practicalities of cave work:

- When working in a cave, there should be at least three people, but four is preferable so that each person would have a buddy.
- Inside the cave, you should also pay attention



Karst formations at Phang Nga Bay

to other interesting things that may be unrelated to your work such as archaeological artefacts as these may be of great interest to others.

- Some habitats are unhealthy such as those with guano; if you use an aspirator in such habitats it is better to use a mechanical aspirator rather than a manual sucking one because of the danger of lung infection.
- If you disturb either wood or rocks while collecting, you should always return them to the same place.
- Tying plastic bags is better than using rubber bands.
- Cloth bags are better than plastic bags for keeping soil samples for long periods. Keeping soil samples in plastic bags should not exceed two days.
- Do not mix soil samples, litter or guano in the same bag because each is from different fauna habitats.

Animal collection

- The most interesting habitat in caves is in humid areas, especially in areas with guano.
- Spiders and other large arthropods are best caught with a plastic bag or by hand.
- Baiting is a useful technique for collecting cave animals.
- Do not mix millipedes with other animals because some millipedes excrete chemicals that may damage other specimens.
- There is little value in collecting larvae because in most cases they cannot be identified.
- Blowing into crevices or holes is often useful as it forces animals to run outside where they could be easily collected. ■

CAMBODIA

Project Title: **Biodiversity Assessment of Stoeng Treng RAMSAR Site**

Study Leader: **Mr. Sok Vong, Department for Nature Conservation and Protection, Cambodia**

This one-year project is a collaboration of different local government and non-government organisations in Cambodia. It is aimed at conducting a preliminary assessment of biological resources particularly plant, fish, mammal, bird and reptile species, in Stoeng Treng RAMSAR Site; identifying major threats to biodiversity conservation; and providing policy recommendations for future management of the RAMSAR Site. Collaborating institutions include the Department of Nature Conservation and Protection, Faculty of Fisheries, the Royal University of Agriculture, Wildlife Conservation Society, and the Department of Fishery. Succeeding discussions will deal on the background of the project and the initial assessments of biological resources particularly the bird, mammal and plant species within the Stoeng Treng RAMSAR Site.

Project background. Cambodia has over three million hectares of either permanently- or seasonally-inundated wetlands and some 80% of the population depending on wetland resources for their livelihood. Cambodia therefore is of high priority for action. Activities began with the translation of two important wetland publications into Khmer. This was followed by surveys of some of the country's most important wetlands, including Tonle Sap Lake. Through these activities, strong cooperation was established with the Ministry of the Environment, with which a multi-sectoral national workshop for the development of a National



Tonle Sap Lake

Wetland Action Plan was successfully implemented in the early part of 1995.

As a result, in 1999, Cambodia became a Contracting Party to the RAMSAR Convention – a major achievement for the programme. UNESCO has informed the RAMSAR Bureau that on 23 June 1999, Cambodia completed the necessary formalities for its accession to the Convention. As amended by the Paris Protocol of 1982 and the amendments to Articles 6 and 7 (the “Regional Amendments”, 1987), Cambodia thus became the 116th Party to the Convention, with the treaty coming into force for Cambodia on 23 October 1999. Three wetlands of international importance were designated at the time of accession: the Boeng Chhmar and Associated River System (28,000 ha), the Koh Kapik and Associated Islets (12,000 ha) and the Middle Stretches of the Mekong River North of Stoeng Treng (14,600 ha).

“Middle Stretches of the Mekong River North of Stoeng Treng” is a stretch of the river characterised by a strong turbulent flow with numerous channels between rocky and sandy islands that are completely inundated during high water and higher alluvial islands that remain dry. It lies about 5 km from the town of Stoeng Treng where the Tonle Sap joins the Mekong northwards to the south of the Laos border. The site qualifies under the old Criterion 1(d) on wetland types that are unusual in the biogeographical region, as well as under the old Criterion 2 © and 2(2) on the special value as habitat for plants or animals at a critical stage of their biological cycle. The river bed and its islands as Wetland RAMSAR site is under the jurisdiction of the Department of Nature Conservation and Protection, Ministry of Environment; the surrounding areas are sparsely populated. The site is extremely important for biodiversity and also for transport (as there are few roads in the areas), and the flooded forest provides refuge for rare species of fish, dolphins, and birds. It promotes the wise use of the wetland “Wise Use Principle”.

However, there are no researches on the biodiversity, the natural resources, or inventory within the site that would determine how many, and what species of bird, plant, mammal, fish and reptile are found there as well as a map of their distribution. There is no information on whether species are migratory or endemic, rare or endangered, and their significance regionally or globally. In other words, there is no management or specific conservation plan as well as zoning for management specific purposes for sites.

Bird species. The first survey was taken in the upper Mekong River Ramsar Site, Stoeng Treng Province,

northeast of Cambodia, covering 14,300 ha. There were 132 species recorded. The list includes globally threatened and near threatened species such as Grey-headed Fish Eagle (*Ichthyophaga ichthyophaga*), Green Peafowl (*Pavo muticus*), Alexandine Parakeet (*Psittacula eupatria*), Hill Myna (*Gracula religiosa*) and Great Adjutant (*Leptoptilos dubius*). Habitat loss and degradation and hunting/poaching are considered the direct threats to bird species. In terms of conservation issues, hunting and wildlife poaching, especially of *Psittacidae* and *Columbidae*, for food and trade are the most serious ones. Sharp strong sounds coming from boats are also considered a disturbance to birds.

Mammal species. Assessments on mammals have been on existing threatening conditions such as the loss of habitat, hunting for meat and trading, and lack of education. Among the assessed species were Sunda Pangolin (*Manis javanica*), Long-tailed Macaque (*Macaca fascicularis*), Asian wild dog (*Cuon alpinus*), Southern Serow (*Naemorphedus sumatraensis*), East Asian Porcupine (*Hystrix brachyuran*), Wild Boar (*Sus scrofa*), and Sambar cervus.

Plant species. Surveys were conducted using the random of quadrats in the different habitat types such as dry deciduous forest, mixed deciduous forest, bamboo thickets, and flooded forest. The project assessed the vegetation structure, life-form attributes, tree density and para-taxonomic identifications. The Operational Taxonomic Unit (OUT) was used as a technical tool to count the abundance of plant species and other plant forms such as herbs, grasses, epiphytes, semi-epiphytes and lianas.

Project Title: Ecotourism Management Option for Improved Waterbird Conservation in the Core Areas of Tonle Sap Biosphere Reserve
Study Leader: Dr. Neou Bonheur, Tonle Sap Biosphere Secretariat, Cambodia

The Project aims to: study the population, species diversity, behaviour, and ecological needs of rare waterbirds; assess the impact of ecotourism on waterbird ecology and its carrying capacity; study ecotourism potential and economic benefit; and develop a management policy for ecotourism promotion. This paper discusses the Tonle Sap Lake and its significance to biodiversity and some conservation issues.

Tonle Sap Lake. It lies in the central floodplain of Cambodia territory with a total catchment of 80,000 km². The Lake is surrounded by six provinces, which

have a total population of 3.41 million. The topography is relatively flat within national roads N5 and N6, ranging from one to 10 meters above sea level. The water regime is characterised by the high water fluctuation between the dry and wet season, which varies from one to nine meters with the volume increasing from 1.3 to 70 billion m³. Similarly, the Lake surface also changes from 2,500-13,000 km², resulting in wide flooded areas that even include the national roads. It has been mentioned that the Lake originated about 5,000 years ago (Shinji T 1998), when the Tonle Sap Lake began its connection with the Mekong Rivers.

The Tonle Sap represents one of the richest wetland ecosystems in the world, providing a robust resource base for the country's economy and people's livelihood for centuries now. The unique hydrological regime of the Tonle Sap and the Mekong waters plays a significant role not only in the perpetuation of productive biodiversity, such as fish, wildlife, and forest, but also in the present land use pattern and diverse cultural landscapes.

Cambodian culture is adopted and flourished in harmony with the Tonle Sap Lake and Mekong, which serve as a source for spiritual and material needs. The present farming and fishing activities, taste, and traditions are closely connected with the rise and fall of the Tonle Sap waters. The ancient sculpture depicted at the base reliefs of Bayon Temple bears witness to the dependence of Cambodia people on the Tonle Sap Lake. Today, about half of the Cambodia population directly or indirectly benefit from the Lake's resources.

Biodiversity Significance and Conservation Issues. The immense seasonal flooding caused by the inflow of the Mekong waters and tributaries plays a very important role in the reproduction and maintenance of the abundance and richness of biodiversity in the Tonle Sap Lake. The flooded vegetation comprising submerged grass, floating aquatic plants and emerged shrubs and tall forests is considered the most important feeding and breeding habitats for a great diversity of life. Nearly 60% of the Lake's floodplain is covered by flooded vegetation listing about 190 species (McDonald 1996). The flooded forests are widely used by local communities for different purposes such as firewood, fishing, construction and medicine. The flooded forest is also converted to farmland for rice and other crop productions.

Fish is the most abundant and richest biological feature of the Tonle Sap Lake. Fish production is estimated at 170,000 tons per annum, accounting for

60% of the total inland fish output. Of the 1,200 fish species identified in the Mekong River, about 500 fish species are believed to be from the Lake. Fisheries-related activities provide a major source of income to about 10,000 fishermen living in the inundated areas of the Lake. With the prevailing peaceful condition, the number of fishery-dependent people is gradually increasing, thereby putting the fishery resources under a growing pressure.

The forest habitat together with abundant fish is an attractive home for a large number of wildlife species, some of which are globally significant. Of particular interest is the presence of large waterfowls such as pelicans, adjutants, painted storks, fishing eagles and white winged ducks. Different mammal and reptile species are subjected to intensive hunting by local communities for subsistence livelihoods.

Considering the ecological, economical, and socio-cultural values of the Lake, the Royal Government of Cambodia designated the whole Tonle Sap as Biosphere Reserve in October 1997. The Lake has been divided into three zones: three core areas, a buffer zone, and a transition zone. The three core areas are the most important for biodiversity conservation. The biosphere reserve concept provides an improved institutional, legal and policy framework for conservation and sustainable use of natural resources. It paves the way for the conservation of biodiversity and critical habitats.

Following the designation, the Ministry of Environment, in collaboration with relevant agencies, international and local NGOs, has initiated conservation programmes for some selected areas. The first Environment Research Station was established as a pilot project in Prek Toal Core Area with the primary objective of promoting environmental activities at the grassroots level. With the assistance of UNESCO and the Wildlife Conservation Society, significant progress has been made towards the conservation of wildlife, especially waterbirds in Prek Toal. Observation posts were constructed inside the forests for monitoring and safeguarding the nesting sites of waterbirds. Several major steps have been undertaken especially by FAO regarding conservation of flooded forests and fisheries. However, there is still much work to be done to overcome constraints and risks encountered by the Tonle Sap Lake.

Fisheries are the central issues of biodiversity conservation in the Tonle Sap Lake. The present fishery management is based on three fishing categories: fishing lot, middle scale fishing, and family fishing. Regulation and organisation of the flow of fishery resources among relevant stakeholders in a rational

and equitable manner is a determining factor of the flow of other resources.

The fishing lot system is normally auctioned for exclusive rights to fishing with the objective to generate revenue. With limited resources and weak enforcement, it is unlikely to impose strict control over the catch, which is generally driven by market demand.

The community fishery organisation has recently been introduced in the Lake. Based on communal ownership, the fishery communities are given the rights to manage and exploit the resources for the benefit of all community members. But the present legal status has yet to be adopted and is far from efficient. The major problem relates to the rights granted to communities for the control, exploitation, and sharing of the resources. As fish is a fugitive resource, capture of this resource from the communities' managed areas needs special regulations and admission. For example, communities in the upstream may wish to block the fish from migrating to the downstream area to increase their catch. The downstream communities, on the other hand, would not be happy with less catch because of the upstream blocking, and thus may lead to disincentive for future participation. Resources control is not an easy task for communities without sufficient financial and human resources.

The fishery domain is not clear with other land uses, such as agriculture and conservation areas. Unclear land tenure in the inundated areas together with uncontrolled agricultural encroachment leads to the degradation of forest and water quality. Some fishing lots overlap with the present core areas of Tonle Sap Biosphere Reserve, where their fishing operations contradict with conservation plans. For example, pumping the streams or ponds for fish catch dries up the areas, resulting in loss of water and food for other wildlife to survive. Some fishing practices require cutting and burning the forest that causes degradation of fishery and wildlife habitats. A large proportion of inundated communities depend on other resources including wildlife, firewood, and agriculture as subsistence to fish. Collection of birds' eggs and chicks continues to be practiced by communities. The rangers in the Prek Toal area, have for example, confiscated some 1,400 eggs of cormorants in 2001 and, about 100 of pelicans' eggs in 2002. The balanced use of these resources requires coherent policy and knowledge. Introduction of alternative livelihoods can be sustained, provided compensation and generated income can outstrip conventional practices. Ecotourism is considered one of the alternatives as a win-win solution to conservation, though careful adaptation is needed. ■



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Bukit Timah

NATURE RESERVE

SINGAPORE

By Sunia Teo, Benjamin Lee and Karen Bartholomeusz
National Parks Board, Singapore

Introduction

Step into Singapore's nature reserves and you will be simply amazed by the biodiversity there. Despite being a tiny, highly urbanised island – the main land measures only about 600 km² – the variety of flora and fauna that greets the visitor upon his forest exploration is nothing short of impressive.

In spite of many competing demands for the island's limited land resources, the government has recognised the abundant and rich flora and fauna and made provisions for key biodiversity areas to be granted legal protection. Hence, Singapore now boasts four gazetted nature reserves occupying a total of 2,279 hectares of precious land.

Of the four nature reserves, two are found in the central part of the island – Bukit Timah Nature Reserve (BTNR) and the Central Catchment Nature Reserve (CCNR) – collectively

known as the Central Nature Reserves. With their rich diversity, both the BTNR and the core areas of CCNR are magnets for biodiversity research. Sungei Buloh Wetland Reserve and Labrador Nature Reserve were gazetted on 01 January 2002. The 130-ha Sungei Buloh Wetland Reserve, situated in the north, is a wetland reserve covering mainly mangroves, and to a lesser extent, freshwater ponds. It is a stopover site for migratory birds, making it an excellent place for birdwatching. Labrador's 300-metre rocky shoreline along Singapore's southern tip sustains rich marine life. This article will focus on the Bukit Timah Nature Reserve.

History of Bukit Timah Nature Reserve

Rising 164 m above sea level, the summit of Bukit Timah is the highest point on Singapore. Although its name means "tin hill" in English, the hill's chief geological feature

is granite and not tin. Some believe that its present name actually stemmed from a European mispronunciation of the word *Temak*, the Malay name for a genus of tall rainforest trees in the mighty dipterocarp family, *Shorea*. The Seraya tree (*Shorea curtisii*) belongs to the dipterocarp family and is a characteristic tree in the tropical rainforest, including Bukit Timah and the Central Catchment.

Although Bukit Timah was officially established as one of the first forest reserves in 1883, the hill was protected as far back as the 1840s for climatic reasons. Many visited the cool summit of Bukit Timah to escape from the sweltering heat down below. The main road leading up to the summit, which is the favoured route for exercise buffs today, was constructed especially for the early colonial visitors.

In a Class of its Own

Even after the creation of forest reserves, all except Bukit Timah were worked for timber. Bukit Timah was accorded “special”

status, possibly owing to the glowing tributes of its biodiversity given by the many naturalists who visited it in the 1800s, in particular Alfred Russel Wallace. Not only was he one of the first to work at Bukit Timah, he also happened to be one of the best, and certainly the most famous. Wallace was duly impressed by what he saw, and recorded his experiences during his visits.

When the reserves were later deleted in 1937, the protection of Bukit Timah’s flora and fauna was retained. In 1951, Bukit Timah received further protection under the Nature Reserves Ordinance. Now, the protection of Bukit Timah is enacted under the National Parks Act, administered by the National Parks Board (NParks) in 1990.

Flora and Fauna

The 164-ha BTNR retains the only substantial area of primary rainforest left in Singapore. A walk through the reserves takes the visitor along winding forest trails covered in dense tropical foliage. Along the way, visitors may



Profiles



see an astonishing variety of plant, animal and insect life, typical of a humid equatorial climate.

The forest has been a botanical collecting ground for more than a century, with the first known specimens of many species of Malayan plants obtained from it. Dr. David Bellamy, a renowned conservationist, once pointed out that the number of plant species growing in BTNR is more than that in the whole of North America!

One of the dominant tree families is the Dipterocarpaceae. This important family yields the bulk of commercial tropical hardwood timber and the signature tree of our coastal hill dipterocarp forest would be the Seraya (*Shorea curtisii*). Understorey plants growing on the forest floor, such as the beautiful Black or Bat Lily (*Tacca integrifolia*), are adapted to the low light intensity.

The edge of the forest is a good place to view rattans and other climbers. Some of the epiphytic ferns, for example, the Bird's Nest Fern, are found growing on the trunks

and larger branches of the large trees. The lianas or woody climbers grow from the ground to the canopy, twining itself around host trees for support.

The forest is also home to 160 species of animals. Insect life is abundant, and the actual number is estimated to be anywhere between 10,000 and 73,000! Geckos can be seen on tree trunks along with the Black-bearded Flying Lizard (*Draco melanopogon*). A large variety of snakes such as the Reticulated Python (*Python reticulatus*) and Paradise Tree Snake (*Chrysopelea paradisi*) can be found, but they are all shy of humans.

Birds are more often heard than seen. The most intrusive noise is the incessant 'chonk-chonk' of the Stripes Tit-babbler (*Macronous gularis*). The most common bulbul is the Olive-winged Bulbul (*Pycnonotus plumosus*) whose drab plumage contrasts with the black and blue of the Fairy Bluebird (*Irena puella*). Of all the birds, the most conspicuous is the Racket-tailed Drongo (*Dicrurus paradiseus*). A large black body with a long racket-tipped tail makes it unmistakable.

A myriad of insects provides a backdrop for the variety of invertebrates. During the day, the drone of cicadas seems perpetual. Grasshoppers, stick insects and beetles can all be found in the low bushes. Butterflies like the Common Posy (*Drupadia ravindra*) often provides a flash of colour. Spiders are found in abundance, some of which do not build webs but jump on to their prey from long distances. On the forest floor, the inch-long Giant Forest Ant (*Camponotus gigas*) is evident, along with millions of termites whose armylike columns can be seen everywhere. Many of the animals, especially the mammals and reptiles, are often difficult to spot as they are shy and blend in easily with the forest environment. Keen observers may spot the Common Treeshrew (*Tupaia glis ferruginea*), the Malayan Flying lemur (*Cynocephalus variegates*) and with just a bit of luck, the extremely rare Malayan Pangolin or Anteater (*Manis javanica*). BTNR's well-known residents, the Long-tailed Macaques (*Macaca fascicularis*), are bold creatures and a trip to the reserve would not be complete without spotting these playful primates!



Guidelines for Visitors

Singaporeans are learning to appreciate the thriving wildlife in their very own backyard. Thanks to the accessibility, especially BTNR, the reserves are popular with families, school groups and nature lovers. The Bukit Timah Nature Reserve, a mere 12 km from the city, is a favourite retreat for the many regulars who enjoy a good daily workout on its steep slopes. Begin your forest exploration with an orientation visit at the Visitors Centre.

A self-guiding exhibit features essential information about the native flora and fauna of the nature reserves. The Visitors Centre is open from 8:30 am to 6:00 pm daily. Here you will also find visitor amenities like washrooms, a telephone, first aid and a specialty shop.

If you have questions or need help, our rangers at the Ranger Counter will be pleased to offer useful information and recommend a suitable trail. Be sure to pick up a brochure there, which contains a map of the reserve.

Car parking is available at the Visitors Centre from 5:30 am to 7:30 pm daily. However, as lots are limited, and as the reserve is especially popular on weekends, public transport may be the better alternative.

The Nature Reserve is ideal for hiking and nature appreciation. Be sure to wear light clothing as the humidity is high. Wear comfortable walking shoes as the trails have many steps.

Bring along a water bottle and some insect repellents, as there are no refreshment kiosks at the summit.

It is wise to keep to the designated walking trails. There are four walking trails that are designed for hiking only. There is also a challenging mountain biking trail along the periphery of the reserve.

Observe all signs and information boards that are provided for your safety and enjoyment.

Take home nothing but photographs. The nature reserve, and all its plants and animals, are protected.

Fishing and the feeding of animals are also not allowed.

Do seek the advice of staff, rangers or nature wardens whom you may meet along the way. For enquiries, please call our Visitors Centre at (65) 64685736 or visit our website at www.nparks.gov.sg. ■

Philippines Celebrates Clean Air Month in November

The Philippines Department of Environment and Natural Resources (DENR) called on members of the public to stop air pollution as the country celebrated Clean Air Month in November. Called "Let's All Act to Clean the Air," the event launched an intensified, all-out multi-sectoral support programme to promote awareness on issues concerning air pollution and the government's programmes on clean air. To raise public consciousness, the DENR held a series of awareness-raising activities, including transport and media fora, orientation meetings on the Clean Air Act for various stakeholders, free emissions-testing and other measures to broaden the participation of government, business, the academe and civil society in cleaning the air.

Air pollution is caused by increased emissions of carbon monoxide, volatile organic compounds, oxides of nitrogen and sulfur, and particulate matter from sources that burn fuels for energy. Major approaches meant to ensure clean air include the initiative of then Senator Heherson Alvarez in 1992 – the Healthy Air Pact – a voluntary reduction of lead in fuel by the country's major oil companies that paved the way for the introduction of unleaded gasoline in the market. In 1997, then President Fidel V. Ramos signed Presidential Proclamation No. 1109 declaring the month of November of every year as Clean Air Month. And in 1999, Congress passed the Philippine Clean Air Act, setting emission standards that will help curb air pollution both from stationary (power plants, factories and industries) and mobile sources (cars, jeeps, buses and other motor vehicles).

During the World Summit on Sustainable Development (WSSD) in South Africa, the Philippines joined the global community in signing a declaration advocating the use of renewable, indigenous and cleaner energy sources to arrest global warming. The country was also recognized at the Earth Summit for using natural gas through the

With financial assistance from various financial institutions including the Asian Development Bank (ADB), the DENR also issued Department Administrative Order No. 2002-23, establishing the Air Quality Management Fund (AQMF). The order formally activated a special account in the National Treasury to ensure continued funding for the



DENR Secretary Heherson T. Alvarez looks on as Esther Perez de Tagle, President of the Concerned Citizens Against Pollution (COCAP) signs the Manifesto for Support for the Clean Air Program of President Gloria Macapagal Arroyo during the launching of the Esterol Biodiesel facility at the DENR compound in Quezon City, Philippines.

Malampaya Deep Water Gas-to-Power Project off the coast of Palawan, which won the World Business Summit Award for Sustainable Development Partnerships. Other alternative fuels that will replace the more polluting coal and fossil fuels include biodiesel. This is a type of fuel used in Europe and the United States as a clean-burning alternative fuel derived from vegetable oils, particularly coconut oil. It is one of the best substitutes for petroleum diesel in the market today, which complies with standards set by the Clean Air Act.

Clean Air Act. The AQMF can be utilised for activities that will improve the quality of air throughout the country.

Over the years, the country has made positive strides in the fight to clean the air. Yet more efforts should go to instilling a culture of responsible caring for the environment, which cannot be done by the DENR alone. Hence the call to all stakeholders, including local communities, schools, civil society, LGUs and non-government organisations (NGOs), to ensure that all citizens enjoy the right to clean air. ■

Celebrating International Year of the Mountains 2002

The United Nations declared 2002 the International Year of the Mountains (IYM) to increase awareness of the need to protect fragile mountain ecosystems and improve the well-being of mountain people, many of whom are among the world's most impoverished and food insecure.

The IYM evolved from the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, where mountains became the focus of Chapter 13 of Agenda 21. The United Nations designated the Food and Agriculture Organisation (FAO) as task manager for coordinating the implementation of Chapter 13 and lead agency for the IYM. The partners of FAOs for the IYM include the: United Nations Environment Programme (UNEP), United Nations University, United Nations Educational, Scientific and Cultural Organization, United Nations Development Programme, International Centre for Integrated Mountain Development,

Mountain Forum and the Mountain Institute.

From 29 October to 1 November, more than 600 delegates from 60 countries participated in the Bishkek Global Mountain Summit in Bishkek, Kyrgyzstan, the culminating global event of the IYM. The government of Kyrgyzstan organised the Summit with support from UNEP and other partners. At the Summit, the governments of Italy and Switzerland committed support to enable the International Year of the Mountains Coordination Unit at FAO to continue its work in 2003. This support will allow the unit to help other countries develop national strategic plans for the sustainable development of their mountains, as well as mountain-friendly policies and laws. Another key outcome of the Summit was the Bishkek Mountain Platform, which builds on the many substantial declarations developed at other major global events on mountains. The purpose of the Platform is to provide guidance to governments

and others on how to improve the livelihoods of mountain people, to protect mountain ecosystems and to use mountain resources more wisely.

As the year came to a close, FAO reflected on the achievements that came about as a result of the activities that focused on celebrating the IYM. One of the most significant achievements is a change in the people's understanding and attitude towards mountain ecosystems and issues due to a global awareness-raising campaign. This in turn has led to a growing concern about the effects of climate change and unsustainable development on both mountain ecosystems and mountain communities. Another major achievement is the rise in national commitment to sustainable mountain development. Thanks to the efforts of the 77 national committees that led the observance of the Year, real change in mountains is now a priority in countries around the world. Finally, the Year has strengthened the partnership for sustainable mountain development that has evolved since the 1992 Earth Summit in Rio de Janeiro. The International Partnership for Sustainable Development in Mountain Regions was launched on 2 September at the World Summit on Sustainable Development in Johannesburg, South Africa. It was launched by FAO together with the UNEP and the Government of Switzerland, on behalf of 15 member countries of the International Year of Mountains Focus Group. Already, 30 countries, 15 inter-governmental organizations and 14 major groups have signed on to the Partnership.

FAO also recognised that many countries don't have the institutional environments, expertise, financial resources, information and knowledge to undertake sustainable mountain development. To overcome these barriers to action, FAO will be helping countries strengthen their institutional and human capabilities to lead and undertake sustainable mountain development beyond 2002.



Giant's Castle Nature Reserve, South Africa

Photo by Hugh Lowrie



Mt. Guiting-Guiting Natural Park, Sibuyan, Philippines

In addition, FAO will help to link those who need assistance with those who are able to provide it. There is a need to improve the way efforts are coordinated by better connecting countries, donors, providers of development services and programmes, non-governmental organisations, UN agencies, civil society and private sector.

The UN is also debating a draft resolution to guide FAO's and its partners' priorities and roles in the follow-up to the IYM. One possible outcome of the resolution is the designation of 11 December as International Mountain Day.

The International Year of the Mountains in 2002 was a real catalyst for change. It increased global

awareness of how important mountains are to life on earth. It stimulated the establishment of national committees in 78 countries that are actively promoting mountain development. And it built, expanded and strengthened alliances through the creation of the International Partnership for Sustainable Development in Mountain Regions.

The challenges facing mountains and mountain communities remain as big as mountains themselves. Fortunately the IYM has provided the opportunities to shape and implement lasting solutions to mountain problems. Today, a growing network of partners - from governments to UN agencies, major groups and the private sector - are working together to ensure long-term action that will improve the lives of mountain people, protect fragile mountain ecosystems and promote peace and stability in mountain regions. ■

Source:

International Year of the Mountains website (<http://www.mountains2002.org/home.html>)

National Biodiversity Reference Units (NBRUs) Directory

BRUNEI DARUSSALAM

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The ASOEN: Learning from European Experiences

■ By Lauro S. Punzalan

Biodiversity conservation practices vary from one country to another; every state has its own unique biodiversity and a distinct way of protecting and maintaining it. On a regional basis, the ASEAN and the European Union (EU) have their own way of dealing with biodiversity conservation issues. It is important for both to increase their consciousness on the existing practices in biodiversity conservation in other parts of the world in order to learn and adapt relevant and appropriate practices and policies. This is a major concern of the ASEAN Senior Officials for the Environment (ASOEN), representing each member country.

The ASOEN, also acting as the Steering Committee (SC) of the ASEAN Regional Centre for Biodiversity Conservation (ARCBC), coordinates and approves the project's work plans and reports. The members expressed their desire to learn from Europe's experience in developing and applying common policies to address regional biodiversity issues. Thus, a study tour to Europe for ASOEN members was conducted from 23-29 June 2002. This study tour is both appropriate and timely in its aim to further strengthen the conservation of biodiversity in the region.

The main objectives of the study tour were to:

- Familiarise the participants with the various practices of the EU member countries in the development and use of common policies to address biodiversity conservation and other environmental issues at

the regional, national and project levels.

- Observe some procedures in formulating and/or implementing policies, specifically on biodiversity conservation and other environmental issues; and
- Gain first-hand experience of the application of biodiversity conservation policy.

The study tour to Europe was participated in by the ASOEN and the ASEAN Working Group Chairmen and their representatives from

as Paris, France; Brussels, Belgium; the Hague, Amsterdam, the Netherlands.

In Paris, the group visited the Paris National Museum of Natural History that was established on 10th June 1793. The museum is renowned for the brilliance of its teaching and research and collection that are being enriched every year through many scientific expeditions.

High-ranking officials at the French Ministry of Environment informed the group about the European decision-making process as



Briefing of the ASEAN Delegations by the French Ministry of Environment on the European decision applied to biodiversity and environment, Paris, France.

Cambodia, Indonesia, Lao PDR, Malaysia, Philippines, Thailand and Vietnam. Representatives from the ASEAN Secretariat and the executive agency (Department of Environment and Natural Resources, Philippines) of the project also joined the tour. The ASEAN Co-Director and some staff represented ARCBC.

The European Bureau for Conservation and Development (EBCD) based in Brussels, Belgium through its Director, Despina Symons facilitated the process of the study tour to several European countries such

applied to biodiversity and the environment and on the legislations in the protection of biodiversity. They also presented and discussed the position of France on the Convention on Biological Diversity (CBD). A representative from the French Nature's Directorate talked about French legislation in the protection of biodiversity and harmonisation of the European legislations in this field. The Ministry provided the ASOEN members a book entitled "Biodiversity in France: Action Programme for Fauna and Flora", and other materials.

At the European Commission in Brussels, resource persons from the Environment Directorate-General discussed environmental decision-making in the European Community and on the CBD in the EU. The Commission also provided some related documents and materials.

A member of the European Parliament, the Vice-President of the Environmental Committee also explained the position of the Parliament on biodiversity. On the other hand, the liaison officer and biodiversity coordinator of the European Environmental Bureau (EEB), a non-government organisation (NGO), discussed the role of NGOs in the implementation of legislations and policies on biodiversity and environmental protection and conservation.

In the Dutch Ministry of Agriculture, Nature Management and Fisheries, the Director-General welcomed the group. Several ranking officials of the Ministry briefed the group on various topics such as the CBD, the implementation of the EU Habitats and Birds Directive and EU funding support mechanisms for biodiversity conservation.

The group visited the Waddensea RAMSAR site, an area of outstanding value and the largest European wetland, covering portions of the Netherlands, Germany and Denmark. The Director of the Department North, Ministry of Agriculture, Nature Management and Fisheries briefed them about the Waddensea area and on the Dutch nature policy.

The Ministry provided copies of the book entitled "Nature for People, People for Nature", a policy document for nature, forest and landscape, biodiversity and the Netherlands, other government policy documents as well as other related documents and materials. ■

Lauro S. Punzalan is the Chief of the Networking and Institution Building Branch at the ASEAN Regional Centre for Biodiversity Conservation.

Surfing the Web... of Life

Global Invasive Species Programme (<http://jasper.stanford.edu/gisp/>) aims to lay the groundwork to address invasive alien species in science, education, management and policy through collaborative international action. The site provides information on the goals and history of GISP, its partners, publications, as well as links to other organisations working on invasive alien species.

The **IUCN-The World Conservation Union Invasive Species Specialist Group** (<http://www.issg.org/>) aims to reduce threats to natural ecosystems and the native species they contain by increasing awareness of invasive alien species, and of ways to prevent, control or eradicate them. The ISSG is part of the Species Survival Commission (SSC) of the World Conservation Union (IUCN), and is a global group of 146 scientific and policy experts on invasive species from 41 countries. ISSG provides advice on threats from invasives and control or eradication methods to IUCN members, conservation practitioners, and policy-makers. The group's activities focus primarily on invasive species that cause biodiversity loss, with particular attention to those that threaten oceanic islands.

The Food and Agriculture Organization's **Database on Introductions of Aquatic Species (DIAS)** (<http://www.fao.org/waicent/faoinfo/fishery/statist/fisoft/dias/mainpage.htm>) was initiated in the early 1980's. It primarily considered only freshwater species of fish and formed the basis for the 1988 FAO Fisheries Technical Paper No. 294. The database has been expanded to include additional taxa, such as molluscs and crustaceans, and marine species. In the mid 1990's a questionnaire was sent to national experts to gather additional information on introductions and transfers of aquatic species in their countries. The database now contains about 3,150 records.

The **USGS Nonindigenous Aquatic Species website** (<http://nas.er.usgs.gov/>) is located at the Center for Aquatic Resource Studies, and has been established as a central repository for accurate and spatially referenced biogeographic accounts of nonindigenous aquatic species. The site

provides scientific reports, online/realtime queries, spatial data sets, regional contact lists, and general information. The data is available for use by biologists, interagency groups, and the general public.

The Baltic Sea area is known to host about 100 aquatic alien species from North America, Ponto-Caspian region, Southeast Asia and other parts of the world. In the same vein, the Baltic may also be a donor area, since its species may be exported over the environmental barriers to other geographical regions. To foster interregional cooperation in gathering and dissemination of information on alien species, the **Baltic Sea Alien Species Database** (<http://www.ku.lt/nemo/mainnemo.htm>) aims to a) provide a qualified reference system on alien species for the Baltic Sea area, available online for environmental managers, researchers, students and all concerned; b) update the information on the Baltic Sea alien species, their biology, vectors of introduction, spread, impacts on environment and economy through the online questionnaire involving the data flow from research institutions and responsible environmental authorities; c) encourage the exchange of data among different geographical regions and thereby to serve a node in the Global Information System for Invasive Species.

The **Center for Invasive Plant Management** (<http://weedcenter.org/>) represents a coalition of agencies, organisations, and individuals interested in managing invasive plants and maintaining healthy ecosystems in western North America. The Center's goals are to enhance land manager and public education, coordinate regional research, facilitate partnerships, increase multidisciplinary communication, and implement practical management programmes. The Center for Invasive Plant Management is designed to bridge education, communication, and research by promoting participation among diverse interests as regional, multidisciplinary proposals and programmes are developed and implemented. This team structure will ensure a broad view of long-term needs, a systematic approach to invasive plant issues, and the practical application of research results. ■

Biodiversity Information Sharing System (BISS) focuses on ASEAN Protected Areas

■ By Imelda C. Pangga

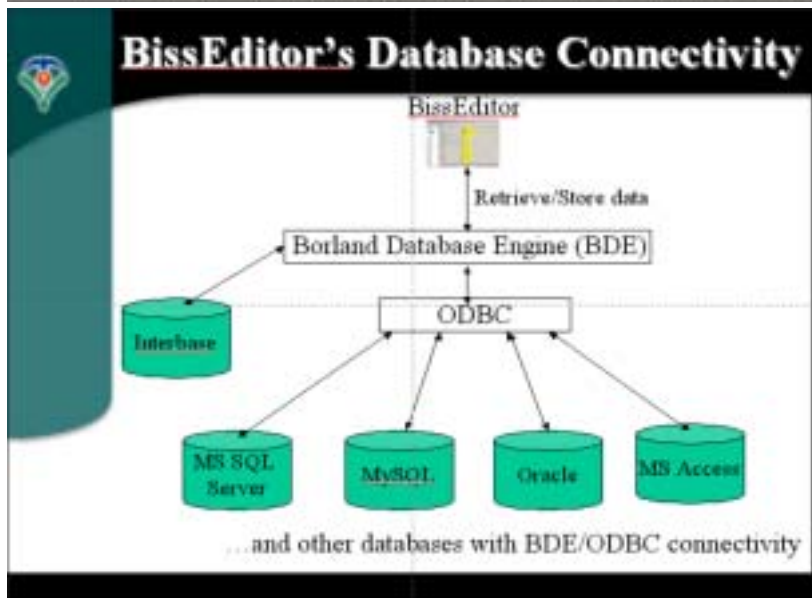
The ASEAN Regional Centre for Biodiversity Conservation (ARCBC) is a network of institutions designed to strengthen biodiversity conservation in the ASEAN region. The Centre is located in Los Banos, Philippines and linked to focal agencies working on conservation of biodiversity among the ASEAN Member Countries (AMC). It began operations in 1999 and is jointly funded by the European Union and the ASEAN.

ARCBC currently manages and maintains a database consisting of protected areas and species of flora and fauna of the ASEAN and biodiversity institutions, experts and training resources data. The ARCBC metadatabase is accessible through a website (www.arcbc.org).

The Centre developed a state-of-the-art data management system that is easily transferable to the NBRUs or biodiversity focal agencies in each ASEAN country. The database is web-ready and could be used as an effective database platform suitable to the needs of the NBRUs and the ARCBC itself.

ARCBC developed the following software products for making on-line databases:

- 1) ABISS Web-database module – Full biodiversity data search and retrieval engine on any number or type of items stored in the database. It has a mapping feature that can show a map of a region showing point data from the database with any number of zoom levels. Individual points can be queried to have access to the underlying data (e.g distribution of species).
- 2) GenSQL – A data transfer utility which uses Borland Database



- Engine (installed with it)
- 3) Remote Datapump – enables the transfer of data tables between two different databases, or to update data from another table in a remote or local server (web-based)
- 4) BISS Editor – provides easy access to records and datasets in a SQL database.

The website shows the searchable database of plant, butterfly, amphibian, bird, reptile, freshwater fish. On-line species data includes 2396

birds, 945 mammals, 655 amphibians, 1995 freshwater fish, 1652 reptiles, 33411 plants. A total of 1518 protected areas are currently on-line.

All of these products were made out of free software and maintenance use is free of charge. These were then provided to the NBRUs to be used in managing their country data sets. ■

Imelda C. Pangga is the Chief of the Database Branch at the ASEAN Regional Centre for Biodiversity Conservation.

TRAINING RESOURCES DATABASE ENTRIES

Capsule reviews

■ By the Training and Extension Branch, ARCBC

INVASIVE ALIEN SPECIES: A TOOLKIT OF BEST PREVENTION AND MANAGEMENT PRACTICES

Edited by Rüdiger Wittenberg and Matthew J. W. Cock
Global Invasive Species Programme, 2001
ISBN: 0 85119 569 1



This toolkit provides an overview, advice by example, and sources for further information on best management practices for invasive alien species. One of

the main aims of this book is to assist and direct those involved with biodiversity conservation and land management in managing invasive alien species. It contains numerous case studies that focus on invasive species affecting biodiversity, and many examples drawn from traditional sectors such as agriculture and forestry, reflecting the diverse problems caused by invasive alien species.

Download the book at:

<http://www.cabi-bioscience.ch/wwwgisp/100Toolkitfin.pdf>

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IUCN GUIDELINES FOR THE PREVENTION OF BIODIVERSITY LOSS CAUSED BY ALIEN INVASIVE SPECIES

IUCN 2002
ISBN: 2-8317-0648-3

This document presents draft guidelines that are concerned with preventing biodiversity loss caused by biological invasions of alien invasive species. The guidelines intend to assist government and management agencies to give effect to Article 8(h) of the Convention on Biological Diversity. They address four substantive concerns of the biological alien invasion problem: (1) improving understanding and

awareness, (2) strengthening the management response, (3) providing appropriate legal and institutional mechanisms, and (4) enhancing knowledge and research efforts.

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WETLAND MANAGEMENT HANDBOOK FOR SOUTH EAST ASIA

Simba Chan, Philip Benstead, Jonathan Davies, Robert Grubh
Ministry of the Environment, Japan 2001



This handbook is intended for wetland managers in Southeast Asia. It was written in a simple and basic manner making it a useful reference that is interesting,

easily understood, and applicable to the region. Organised into four main chapters, the handbook discusses topics that include: introduction to wetlands, data collection and interpretation, management planning, and wetland management. A List of Threatened Wetland Species in Southeast Asia (by IUCN) and Bird Census and Monitoring Techniques are some supplements included as appendices.

For more information, contact:
Wildlife Division
Nature Conservation Bureau
Ministry of the Environment
1-2-2 Kasumigaseki
Chiyoda-ku
Tokyo
Japan 100-8975

NATURAL RESOURCE DAMAGE ASSESSMENT MANUAL

GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas, 1999

This manual presents economic concepts and methods for Natural Resource Damage Assessment (or Appraisal) (NRDA) that could be employed in a wide range of situations in tropical ecosystems. It reviews concepts and methods for appraising damages from transboundary marine oil spills and discharges of priority pollutants. The manual stresses practical applications and procedures that can be used to implement NRDA methods and uses examples and exercises to illustrate these methods.

For more information, contact:
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MONITORING AND MANAGEMENT STRATEGIES FOR HARMFUL ALGAL BLOOMS IN COASTAL WATERS

Donald M. Andersen, Per Andersen, V. Monica Bricelj, John J. Cullen, J. E. Jack Rensel
2001



Based from an original technical report prepared by the government of Hong Kong, the authors prepared this report as an attempt to make it available

globally. It contains a compilation of information that can be useful to others who are faced with harmful algal blooms (HAB). Includes topics on the basic components of HAB management systems, monitoring and management methods, HAB monitoring programmes, and mitigation and control of HAB.

For more information, contact:
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SUSTAINABLE TOURISM IN PROTECTED AREAS: GUIDELINES FOR PLANNING AND MANAGEMENT

By Paul F. J. Eagles, Stephen F. McCool, Christopher D. Haynes
IUCN 2002
ISBN: 2-8317-0648-3

These guidelines aim to build an understanding of protected area tourism, and its management. They provide a theoretical structure, but are also intended to help managers in practical ways. The underlying aim is to ensure that tourism contributes to the purposes of protected areas and does not undermine them.

For more information, contact:
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FINANCING PROTECTED AREAS: GUIDELINES FOR PROTECTED AREA MANAGERS

Edited by Adrian Phillips
IUCN World Commission on Protected Areas, 2000
ISBN: 2-8317-0544-4

This guidebook is intended to provide protected area (PA) managers with information about financing their PAs and where to look for finance beyond existing sources. It is divided into 3 parts. Part A starts by demonstrating the need for both public and private financing to ensure the continued provision of private and public goods and services from PAs; and then develops a step-by-step process that PA managers can use to create business and financial plans tailored to the needs and strengths of their PA. Part B discusses the mechanisms for generating revenue flows from both public and private sources and



gives an overview of potential grant-based sources of financing. A short selection of innovative case studies is given in Part C.

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GUIDELINES FOR COMMUNITY-BASED ECOTOURISM DEVELOPMENT

WWF International, 2001

These guidelines identify some general principles, and highlight some practical considerations for community-based ecotourism. They seek to provide a reference point for field project staff, and to encourage a consistent approach. The guidelines are intended for use by WWF staff, partner organisations and other agencies. They are based on experiences obtained from WWF projects, and from published literature and case studies. A list of helpful reference sources is included.

The book is available on-line at:
http://www.panda.org/resources/publications/sustainability/indigenous/Guidelines_en.pdf
For more information, contact:
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PAYING FOR PARKS: A GUIDE TO CONSERVATION FINANCE FOR POLICY MAKERS, CONSERVATION ORGANIZATIONS, PROTECTED AREA MANAGERS, AND DONORS

Edited by Ruth Norris
A collaborative publication of IUCN - The World Conservation Union, The Nature Conservancy, Peace Corps

This guide is a useful starting point for users ranging from NGOs to national agencies to donors and loaners, which will stimulate discus-

sion and contacts. Useful as a guide for financial planning and as a basis to experiment with developing a variety of sources of income, monitor the results carefully, and continue to invest in developing those that look most promising, especially at the national level. A good source of information for finance advocates.

Download the document at:
http://www.geocities.com/shores_system/p4p/p4p_text.html

For more information, contact:
IUCN Publications Services Unit
181a Huntingdon Road
Cambridge CB3 0DL, UK or
IUCN Communications Division
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CH-1196 Gland, Switzerland

ADAPTING ENVIRONMENTAL EDUCATION MATERIALS

Peace Corps, 1999
ISBN: 0-89492-108-8

This manual is intended for environmental educators and is aimed at providing guidance on how to adapt appropriate environmental education materials. The first few chapters explain the process of adapting materials, which includes review and evaluation, and steps for adapting. The second section presents specific examples in which good materials were adapted to be relevant to diverse settings. The third part of the manual contains a training design and several training plans that can be used to introduce and practice adaptation techniques in workshops for educators. The appendix contains selected readings and resources for further investigation of the topic.

This manual is available from:
Peace Corps
Center for Field Assistance and Applied Research Information Collection and Exchange,
1111 20th Street
NW- Fifth Floor,
Washington DC, 20526
<http://www.peacecorps.gov>
Can also be downloaded at:
<http://www.peacecorps.gov/publicati>

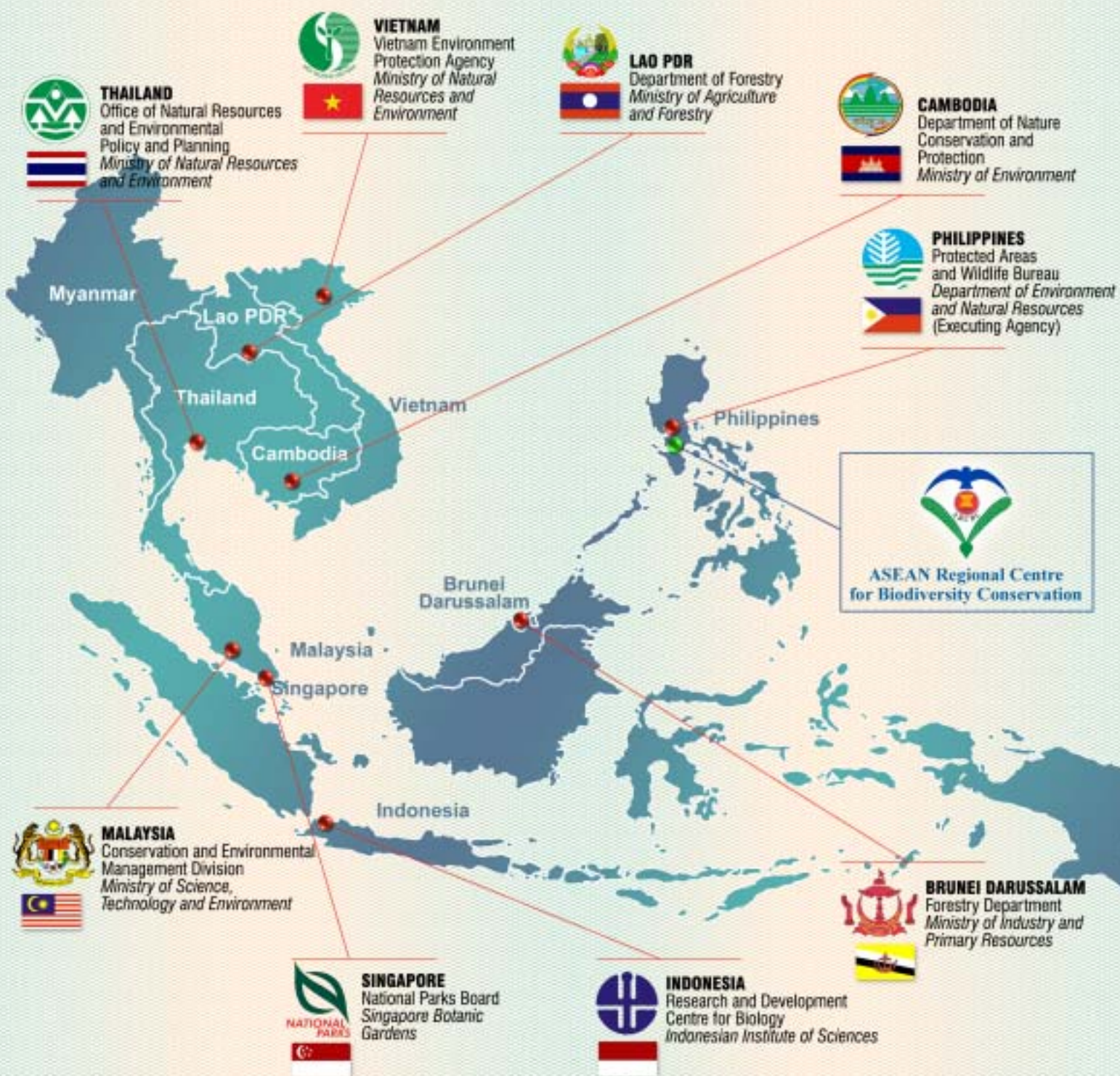


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ASEAN Regional Centre for Biodiversity Conservation

National Biodiversity Reference Units' Network



ARCBC is a joint cooperation project between ASEAN and the European Union

