



# Biodiversity in Thailand

Visut Baimai

Fellow of the Royal Institute, Academy of Science  
Faculty of Science, Mahidol University, Bangkok

## *Abstract*

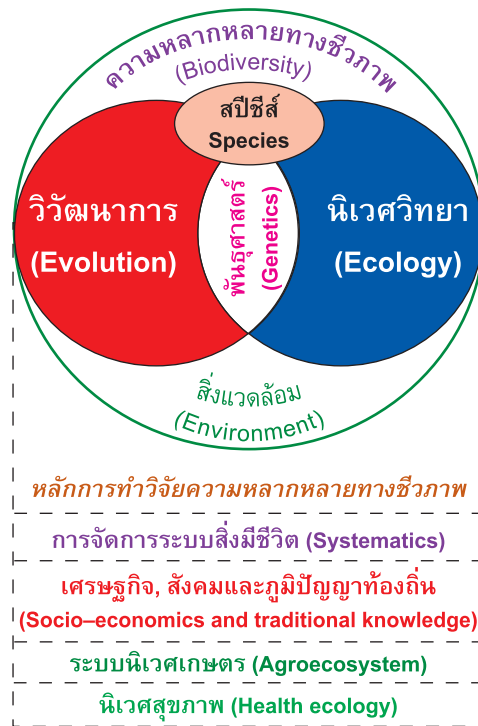
Thailand is a relatively small country, but she is rich in biodiversity, comprising approximately 6-10% of the total species known thus far. In the past, 70% of the total land area was covered with various kinds of tropical forests providing terrestrial and aquatic habitats for life forms in complex ecosystems. This natural biology that surrounded the local community has influenced the development of folklore, cultural diversity and traditional knowledge. Such local wisdom has been perpetuated by being passed down from generation to generation. The Thai people lived peacefully and sustainably, surrounded by the balanced and green environment, for many centuries until the 1960s, when the Thai government launched the first National Economic and Social Development Plan. Such modernization in industry and agriculture accompanying globalization trends in capitalism and unsustainable development led to deforestation and environmental problems, including climate change and global warming. As a consequence, there has been a tremendous loss of biodiversity and ecosystems. Many species have become endangered and some are at critical population levels and prone to extinction if action is not taken to save them. Such loss of biodiversity is likely to have tremendous effects—often unpredictable—on the productive lives of all living things including ourselves. A basic knowledge of these living things is needed in order to facilitate conservation and management and to better understand how to use biological resources in a sustainable manner. Therefore, the Special Program for Biodiversity Research and Training (BRT) was established in November, 1995, under the joint sponsorship of TRF and BIOTEC, to support basic research in tropical biology as well as studies on policy development and management of biodiversity in Thailand.

**Key words:** biodiversity, culture, traditional knowledge, conservation, natural capital, sustainable development.



The United Nations declared 2010 as the International Year of Biodiversity to coincide with the 2010 Biodiversity Target of the Convention on Biological Diversity (CBD) adopted at the World Summit on Sustainable Development (WSSD or “Rio+10”), in Johannesburg, South Africa, in August 2002. The celebrations of the International Year of Biodiversity will raise public awareness of the importance of biodiversity in many countries throughout the world including Thailand. Thus, this year is a unique opportunity to emphasize the vital role of biological diversity in sustaining life on Earth and supporting ecological services as well as human well-being and reducing poverty.

Biodiversity is the variety of life forms-microorganisms, flora and fauna including humans-at all levels of organization from genes to populations, species and ecological systems existing throughout the world. Such diversity of life is a legacy of evolutionary processes (Figure 1). This variety of life has long been and continues to be an essential resource for human survival in terms of food, medicines, housing and clothing as well as ecological services including aesthetics and ecotourism. Thus, the development of civilizations and cultural evolution has had synergistic relations with the natural biological world.



**Figure 1** Biodiversity and evolution

The natural world of biological diversity is concentrated in tropical forests and coral reefs, including those that exist in Thailand. Thailand is a relatively small country with a total area of about 513,000 km<sup>2</sup>. Thailand also has long coastlines of some 2,600 km facing the South China Sea to the east and the Andaman Sea on the west side. In the past, 70 percent of the total land area was covered with various kinds of tropical forest including broad-leaved evergreen, dry dipterocarp and pine forest, mixed deciduous forest, peat swamp forest and mangrove forest along coastlines (Figure 2). About 1/3 of the coastal areas are bordered by mangrove forests. These variations of forest type provide terrestrial and aquatic habitats for numerous life forms in complex ecosystems (Figure 3). Thailand's tropical forests support some 12,000 species of vascular plants, roughly 15,000 known species of animals and about 10,000 known species of microorganisms. It is believed that more than 100,000 species of living organisms in these forests await discovery. Thus Thailand is situated in one of the richest areas of the world with regard to biological resources.



**Figure 2** Different types of forest in Thailand



**Figure 3** Flora and fauna of Thailand



This tremendous variety of living things has long been and continues to be an essential resource for human survival. Thai people directly use microbes, fungi, plants and animals in their surroundings as sources of agricultural products, traditional medicines, clothing, housing and tools, and many other species are used indirectly as sources of pets, recreation, ecotourism and essential ecological services. “Ecological services” include the benefits often taken for granted: water in the atmosphere, rivers and ground, soils, recycling of our wastes, and protection from the extremes of climate. The development of civilizations and cultural evolution has had a synergistic relation with the natural biological world that has long been taken for granted.

Thai society depends on an enormous variety of vegetables, spices, fruits and flowers occurring naturally or in cultivated fields. Most cultivated fruits and vegetables have close wild relatives which persist in fields and forests. Thai food includes a wide variety of dishes which are particularly healthy because of the variety of herbs and spices they contain. Thai cuisine, in fact, ranks among the world’s greatest culinary achievements. This cuisine proclaims artistic creativity, variety and bold tastes besides its benefits to health. It is based on the ingenious use of native biodiversity.

Wild plants of agriculturally important species contain the genetic resources needed to breed crops for resistance to pests and pathogens. Varieties of rice, for example, have been developed to be grown for floating farming, in paddy farming and in dry conditions in the highlands (Figure 4). A number of local species of



**Figure 4** Activities in rice field in Thailand



vegetables and tropical fruits, for example, lemon grass, chilli, mangoes and sugar cane, have been used by local people throughout Thai history and have become associated with the traditional lifestyle. In addition, natural products from many species of plants have been used as pesticides. Crude extract from the kernel of *Azadirachta indica* A. Juss. var. *siamensis* Valetton (Thai neem) contains azadirachtin (triterpenoid group) which has been used as an effective pesticide against many species of agricultural pests including cockroaches, locusts, fleas, ticks and plant hoppers.

The people of Thailand have used herbs and medicinal plants as sources of drugs for traditional remedies of ailments throughout this country's long history. Hence, ethnomedicine has developed and has evolved, tested through time, into the intricate art of folk medicine. Such indigenous knowledge has been perpetuated by being passed down from generation to generation within ethnic tribes. For instance, *Curcuma longa* Linn., has been used for treatment of peptic ulcer and dyspepsia, *Diospyros mollis* Griff., has been used to eliminate hookworm and *Clinacanthus nutans* Lindau, is used for treatment of burns, eczema and herpes simplex. The best known example is *Croton sublyratus* Kurz (Family Euphorbiaceae) which has been used by local people for a long time as an effective treatment for peptic ulcer.

Descriptions written on palm leaves concerning herb usage in folk medicine (Samud Khoi, in Thai), by various ethnic groups, is evidence that the ancestral inhabitants of this region had developed their own systems of traditional medicine long ago. These ancient descriptions of folk medicine are very valuable documents detailing the development of traditional Thai medicine and Thai medicinal plants.

The Thai people lived peacefully and sustainably surrounded by the balanced and green environment, for over 400 years, until the 1960s when the Thai government launched its first National Economic and Social Development Plan. As a consequence of this series of national development plans implemented during the past 50 years, Thailand has lost biodiversity and bioresources at an alarming rate. Tropical forests have decreased sharply from 70 percent to only about 25 percent now. The mangrove and peat swamp forests have diminished more dramatically. The rivers and estuaries of the country are suffering even more damage, as a result of upland deforestation, industrial pollution, dams, dredging, canalization and shoreline obliteration. Rivers are extremely rich in fishes and invertebrates, but they are common, multiple use environments and no one takes responsibility for managing or conserving their biota.

The widespread reduction of terrestrial and aquatic habitats for all life forms is inevitably leading to tremendous loss of biodiversity, and many species have suffered



due to stochastic as well as human-caused changes in the natural environment. Many species have become endangered and some are “critical”, that is, in imminent danger of extinction if action is not taken to save them. Many examples are known among the birds of Thailand, which are perhaps the best known components of our biodiversity. Recent records show that among the 946 known species of birds found in Thailand, 7 species have become extinct, 37 species are critical, 69 species are endangered and 248 species are vulnerable). Other species of animals are also facing a similar fate due to loss of habitats by deforestation and other human activities such as clear-cutting and unregulated logging as well as hunting for food and for trade.

An abundant diversity of microbes, fungi and slime molds, and lichens has recently been discovered from forests in different parts of Thailand, but by far the greatest number remain to be discovered. Systematic studies and bioprospecting assays of these bioresources are currently underway in the laboratories of the National Center for Genetic Engineering and Biotechnology (BIOTEC).

Access to these bioresources basically depends upon scientific knowledge in tropical biology, which in turn can be used as guidelines for selecting the most promising species and sites for bioprospecting. However, the most fundamental and pressing questions about our biodiversity deal with systematics and taxonomy. How many species of plants, animals and microorganisms exist in different ecological settings in Thailand? How are they related? Where do they occur? What microbes and fungi are essential for ecological services such as maintaining soil fertility? These questions must be addressed for a better understanding of our biological diversity and the way to protect and manage it.

Until recently, there has been very little support for these kinds of basic research from the government of Thailand. Systematics and taxonomy, population biology, genetics and ecology, as well as biological surveys and species inventories, have long been neglected. Thus, researchers in these fields had to find their own financial support from funding agencies outside the country. This was not always an easy task for junior or even some senior biologists. Now the situation is changing, partly due to the environmental awareness of the Thai people, and the impact of the Earth Summit, particularly the Convention on Biological Diversity (CBD), in Rio de Janeiro, Brazil, in June 1992. Thai people have also become increasingly aware of the significance of ecological services. That awareness usually arose following disasters such as landslides, drought, severe flooding, salinization, loss of riverine fishes, etc., resulting from unwise development. Academic and industrial researchers also have become more aware of the economic importance of biological diversity



which serves as all genetic resource for agricultural crops, pharmaceutical products, and for new approaches in biotechnology as well as valuable sources of traditional medicine.

It has become clear in these endeavors that lack of knowledge of the taxonomy, distribution and ecology of native species will continue to be a major impediment to the discovery and development of useful animals, plants, and microorganisms, particularly those living in tropical forests. Realizing these problems, the Biodiversity Research and Training Program (BRT) was established in 1995 under the sponsorship of the Thailand Research Fund (TRF) and the National Center for Genetic Engineering and Biotechnology (BIOTEC). The major objective of the BRT program is to promote research on and conservation and sustainable use of bioresources. An initial impetus for the establishment of the program was the despair of the nation's leading natural product and chemistry researchers at not being able to properly identify botanical and microbial subjects of research, and the slow progress of inventory of the nation's fauna, flora and microbes. There was also considerable concern that potentially important biodiversity resources vital to the nation's economic well-being were not being well managed and protected. The BRT provides funding for researchers and graduate students in seven major program areas: systematics, population biology, ecology and evolution, socio-economics and traditional knowledge, data management, utilization of bioresources, and policy for biodiversity management and conservation. The BRT has promoted multidisciplinary research with emphasis on taxon-based, area-based, issue-based, and user-based projects.

The BRT has become the nation's main source of support for ecological and evolutionary research. The impacts of these projects on the nation are quite impressive when evaluated by a number of criteria, including publications of scientific papers and books and of magazines for general audiences for public awareness of bioresources, the numbers of graduate students trained, improvement of university graduate programs, new species described, etc. The BRT Program is now at the 15-year mark with a total budget of about 600 million baht. With such obvious indicators of success, it is expected that the BRT will become a major part of a new National Center for Biodiversity Research and Training to be established in the near future.



## References

- Abhabhirama A, Phantumvanit D, Elkington J, Ingkasuwan P, 1987. *Thailand Natural Resources Profile*. Thailand Development Research Institute, Bangkok.
- Thailand Country Study on Biodiversity*, 1992. Ministry of Science, Technology and Environment, Bangkok.
- Anderson EF, 1993. *Plants and People of the Golden Triangle: Ethnobotany of the Hill Tribes of Northern Thailand*. Silkworm Books, Chiang Mai, Thailand.
- Graham M, Round PD, 1994. *Thailand's Vanishing Flora and Fauna*. Finance One Public Co., Ltd., Bangkok.
- Kriengkraipetch S, 1989. Thai folk beliefs about animals and plants and attitudes toward nature. In: *Culture and Environment in Thailand, a Symposium of the Siam Society*, p. 195-211. The Siam Society, Bangkok.
- Lekagul B, Round PD, 1991. *A Guide to the Birds of Thailand*. Darnsutha Press, Bangkok.
- Saralamp P, Temsiririrkkul R, Chuakul W, Riewpaiboon A, Prathanturarug S, Suthisisang C, Pongcharoensuk P (eds.), 1996. *Medicinal Plants in Siri Ruckhachati Garden*. Amarin Printing and Publishing Public Co., Ltd., Bangkok.
- Smitinand T, Santisuk T, 1981. The spices and essential oil crops of Thailand. *Nat. Hist. Bull. Siam Soc.* 29: 85-120.
- Treesucon U, Round PD, 1990. Report on threatened birds in Thailand. *Tiger Paper* 17: 1-9.





# The Journal of the Royal Institute of Thailand (JRIT) English Issue

## Submission Guide for Authors

JRIT publishes original contributions of research papers, reviews, brief reports, commentaries, and other categories of academic articles.

## Style and Policy Guide

- Cover Letter and Signatures
- Format Requirements
- Article Structure
- References
- Tables, Figures and Illustrations
- Abbreviations

## Cover Letter and Signatures

All manuscripts should be accompanied by a cover letter with the following information:

- The title of the paper
- First and last names of all contributing authors
- A statement that the material is original and that the material has not and will not be submitted for publication elsewhere so long as it is under consideration by the JRIT.
- Signatures of all contributing authors
- Title and present position

## Format Requirements

- Papers submitted should follow the article structure.
- The footnote should be in Times New Roman 10 point type, single-spaced.
- The text should be in Times New Roman 12 point type, fully double-spaced, leaving a margin of 1 inch on all sides. Table and figure legends, tabular material and references are also double-spaced. The paper should be between 8–10 pages.
- Number all pages consecutively, starting with the title page.



- The paper should be submitted to the Editorial Board in three copies and an electronic file as a text file (e.g. doc).
- Figures should be numbered and stored in separate files with legends included in the main text file.
- Either English or American spelling can be used but should be consistent for the entire article.

### **Article Structure**

Each article should contain the following :

- Title
- Short title for page headings
- Authors and their affiliations
- A concise abstract (not more than 300 words)
- Key words
- Main text divided into sections e.g. Introduction, Materials and Methods, Results, Discussion, Conclusion
- References (of all articles cited in the text)
- Table and Figure captions (numbered in sequence as they appear in the text)

### **Abstract**

The abstract should be concise and informative, not more than 300 words. It should not only indicate the general scope of the article but also state the main results and conclusions.

### **Ethical Guidelines**

Experimental investigation papers must state in the Materials and Methods section that

- 1) informed consent is obtained from all adult participants and from parents or legal guardians of minors, including the name of the appropriate institutional review board having approved the project
- 2) the maintenance and care of experimental animals comply with the Thai National Institute of Health Guidelines for the humane use of laboratory animals or the equivalent country authority or agency
- 3) approval is obtained from the relevant ethical committee.



## References

References in the text are listed by giving the last names of authors (if there are more than two, use “et al.”), the year of publication and the page number. References at the end of the article must be given in alphabetical order and all authors must be listed; never use “ et al.” . Authors are indicated by their last names followed by a space and their initial(s) or first name as the case may be. Authors’ names are separated by commas only. The year of publication follows the final name, preceded by a comma. The title of the book should be in italics and followed by the place and name of the publisher. The page numbers are written out in full. Consult Index Medicus or other sources for the correct abbreviation of the journal cited.

### Examples of References at the end of the article:

#### Articles:

Chotivanich KT, Udomsangpetch R, Mcgready R, Stephane P, Newton P, Pukrittayakamee S, Looareesuwan S, White NJ, 2002. Central role of the spleen in malaria parasite clearance. *J Infect Dis*, 185: 1538-1541.

#### Books:

Olive EA, 1995. *Lymphatic Filariasis Infection and Disease*. London: Academic Press, 129-131.

#### Chapters:

Migasena P, 1982. Liver flukes: Relationship to dietary habits and development program in Thailand. In: *Adverse Effects of Foods*. Patrice Jellife EF, Jelliffe DB, eds. Plenum Publishing Company, 307-312.

#### Electronic References:

- Online books, monographs, journal articles must come with full website address and retrieval date.
- Online electronic books, monographs, and transcriptions of printed works:  
George Borrow, *The Zincli: An Account of the Gypsies of Spain* [online text], Project Gutenberg<[ftp//ftp.ibiblio.org/pub/docs/books/gutenberg/etext96/znccli10.txt](http://ftp.ibiblio.org/pub/docs/books/gutenberg/etext96/znccli10.txt)>
- Online journal articles, abstracts, reviews, and databases:  
Brent Cunningham, The World Sees News through New York Eyes’, *Columbia Journalism Review*, Mar./Apr. 2001 <<http://www.cjr.org/year/01/2/cunningham.asp>>



### **Tables, Figures and Illustrations**

- Tables should be numbered and referred to in the text by their numbers. Table captions should be brief, with descriptions of experimental detail(s) given directly beneath, in parentheses. Column headings, the units of measurement, and any numerical factors should be placed at the head of each column. Units should be contained within parentheses, e.g. distance (cm).
- JRIT requires figures in electronic format. Images fall into one of these two categories: bitmap images (e.g. photographs, scans) and line art: (e.g. histograms, line drawings)

### **Figure Permissions**

Figures from other sources should be fully acknowledged in the caption and written permission sought for both prints and electronic reproduction before being used. Permission must also be sought for online images and animations.

### **Abbreviations**

Abbreviations should be given in full at the first mention. In the list of references, widely recognized abbreviations for journals should be used. If in doubt, give the full title of the journal.

### **Address for Submission**

The Editor of JRIT,  
The Royal Institute,  
Sanam Suea Pa, Dusit, Bangkok 10300, Thailand.  
Tel: 0 2356 0466-70, ext. 3015, 4025, 5020, Fax: 0 2356 0485  
e-mail : rijournal@royin.go.th



