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Biodiversity Research and Training Program: Ten Years of Progress

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ABSTRACT: The Biodiversity Research and Training Program (BRT) began funding research on many aspects of biodiversity in 1995. We summarize the achievements of the program over its first 10 years of operation in terms of students trained, publications produced and other indicators, and comment on the success of the program in achieving its objectives. The achievements so far have been impressive, but are uneven in terms of the research areas furthered, taxonomic groups studied, and institutions affected. Suggestions are made for future funding priorities to broaden the reach of the program over areas and institutions not well covered. Targeted development of research manpower and training activities in priority research areas and in weak institutions is seen as critical.

KEYWORDS: biodiversity, ecological research, manpower development, publications, training.

INTRODUCTION

The Biodiversity Research and Training Program (BRT) was established in 1995 under the sponsorship of the Thailand Research Fund (TRF) and National Center for Genetic Engineering and Biotechnology (BIOTEC). A major 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's physical home is in BIOTEC, and its strong support by the "users" of biodiversity explains the rather broad definition of "biodiversity research" embodied in the program. The BRT has promoted multidisciplinary research with emphasis on taxon-based, area-based, issue-based, and user-based projects.

In its first two five-year phases of operation (1995–2005), the BRT has provided a total of 438.5 million baht for 1,055 research and training projects (Table 1). It 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 books and scientific papers, numbers of graduate students trained, improvement of university graduate programs, new species described, etc. The BRT Program is now at the 10-year mark, and it is time to evaluate its effectiveness and impact on Thailand. We do not pretend to be able to do this completely, but we will take the opportunity provided by the publication of this volume to summarize some obvious indicators of success, comment on some of the program's shortcomings, and provide suggestions for making the program more effective in the future.

The objectives of BRT have never been formally announced, and have been altered somewhat through the years. They have been numerous: to provide research support in biodiversity-related subjects, to train more biodiversity researchers, to help describe and inventory the native flora and fauna, to preserve and use traditional knowledge of biodiversity, to carry out research on the uses of biodiversity, to promote education about biodiversity (especially at the local level), and to promote wise management of biodiversity resources and environment. The program has not

Table 1. Number of projects and budget (in millions of baht) during 10 year period (1995–2005) of BRT operation.

Project types	Phase 1	Phase 2	Total
Scientific research	152 (207.8)	156 (98.0)	308 (305.8)
Graduate study	258 (31.6)	203 (25.2)	461 (56.8)
Special programs	1 (30)	1 (20.5)	2 (50.5)
Training courses	64 (5.1)	119 (7.5)	183 (12.6)
Data management	24 (6.7)	77 (6.1)	101 (12.8)
Total	499 (281.2)	556 (157.3)	1,055 (438.5)

attempted to provide indicators of success in all these endeavors.

Some Indicators of Success

We summarize here some obvious indicators of success of the first ten years of BRT, taken from BRT reports published in Thai in 2005[1] by Baimai and Tantalakha.

1. Publications

BRT has placed a lot of emphasis on publication of research results because, without publication in international journals, research knowledge will have few lasting or widespread effects. Scientific knowledge is cumulative, and cannot advance without reference to previously published research. In fact, we can put it bluntly by saying that research that is not published might as well have not been done. The program has encouraged publication by using it as a criterion for renewal of grants, and by publishing an annual proceedings volume for preliminary publication of results by researchers.

A total of 535 scientific papers have been published based on research during the first two phases, 456 papers in international and 79 articles in national journals (Table 2). The BRT has also published 43 books (mostly in Thai language), 220 technical papers in the Proceedings of the BRT Annual Conference, and 307 titles of abstracts (Thai and English) in the annual proceedings. International publications began appearing about 1997 and have increased steadily. During the past few years they have been appearing at about 80 per year, as the rate of increase has slowed somewhat (Fig 1). The publication record is underestimated because of the lag time between research initiation and publication; there are many more publications in the 'pipeline'.

An analysis of 456 publications by BRT in 2005 revealed a breakdown by subject area as follows:

Table 2. Outputs of the BRT during the 10 year period (1995–2005).

Type of output	Number
Publications (papers)	535
- International	456
- National	79
Proceedings (articles)	220
Books	43
Graduate students	461
Postdoctoral fellowships	6
New species	548
Type specimens	3,539
Reference collections	>20,000

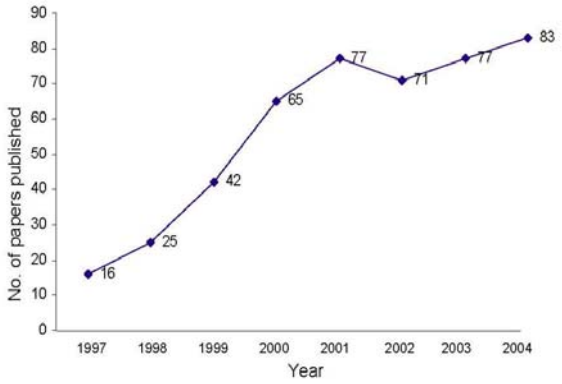

Fig 1. Graph showing numbers of papers published per year in international journals during the 10 years of BRT operation.

invertebrates (126), bioresources utilization (83), plants (65), fungi and lichens (46), vertebrates (24), plankton and algae (25), fossils (paleontology) (25), genetics (23), ecology and environment (21), and miscellaneous microbes (18). The list is crude because some of these categories overlap. The list nevertheless shows some imbalances. Approximately half of the publications deal with taxonomy, mostly descriptions of new species, and a disproportionate number emanate from a relatively few research groups on invertebrates (e.g., land snails, insects) and vascular plants, who publish mostly with foreign collaborators. There are relatively few publications in the important areas of population biology and ecosystem ecology. Many other biodiversity fields supported by the program are unrepresented.

An analysis of publications by institution of research also shows serious imbalances, with a disproportionate number coming from a few strong institutions. The approximate numbers are as follows: Biotec (about 100), Chulalongkorn University (68), Chiang Mai University (57), Khon Kaen University (49), Mahidol University (44), Kasetsart University (35), Department of Parks and Wildlife and Department of Mineral Resources (Paleontology Section) (22 each). The relatively high numbers at a few universities reflect the presence of a relatively few active taxonomic research groups in these institutions. Six other universities have a total of 46 publications. A total of 20 institutions (all but one governmental or government-supported), including 11 state universities, are represented.

2. Biological Specimens

A total of 548 new species of flora and fauna, including microorganisms, were described in international journals. Some 3,539 type specimens and more than 20,000 general reference specimens have been deposited in reference collections at state universities and other research institutions in Thailand.

Active research groups have made significant progress in increasing our knowledge of the diversity of fungi, vascular plants, land snails, and insects in particular.

3. Young Researchers

A total of 461 graduate students successfully obtained degrees (mostly M.Sc. degrees) in fields of systematic biology, ecology, and natural resources from Thai state universities with BRT support. Many of these young biologists are promising researchers who are destined to follow in the steps of aging and/or retiring professors. They will populate the still-expanding university system of the country.

These young researchers have set up their own group called TYPIN (Thai Young Professionals Initiative) in order to pursue their collaborative research efforts in biodiversity in Thailand. They have their first meeting this year to discuss research and other areas of interest. It may be noted that young biologists in the fields of ecology and evolution are still lacking in Thailand.

4. Institution Strengthening

As a result of the continuing support of BRT, several groups of biologists at some state universities, including Khon Kaen, Chiang Mai, Prince of Songkla, Chulalongkorn and Mahidol Universities receive additional financial support from the government to carry out their research activities by setting up "Centers of Excellence in Biodiversity" in the respective institutes. The BRT continues to collaborate with these research centers by providing support to graduate students. This program seeks to increase and improve the foundation graduate courses supporting biodiversity research. Such an academic development at several state universities has the potential to greatly enhance biodiversity research and training in Thailand. For example, a microbe Culture Collection Center and an Insect-Fungi Collection Center have been developed at BIOTEC as networking centers in these fields. An Algae and Plankton Society of Thailand has been founded as a satellite organization of the BRT. Both BRT and BIOTEC directly support a long term ecological research and monitoring project at BIOTEC on large forest dynamics plots, which has conducted training programs in plot methodology for other interested researchers.

5. Partnerships

The BRT has extended scientific cooperation with some national organizations, particularly the PTT Group and the Department of Environmental Quality Promotion, Ministry of Natural Resources and Environment. In addition, BRT promotes the biodiversity-based networking and learning process with local people, school teachers and students at the local community level emphasizing biodiversity conservation and restoration of community forests for their own benefits and livelihood. The BRT also supports the collaborative efforts between the Thai and French biologists via the CNRS (Centre National de la Recherche Scientifique) for research in paleonthology in Thailand.

6. Public Relations

The BRT has regularly made press releases through public media including newspapers, nature magazines, radio, and television for public awareness of the threats of biodiversity loss, the importance of biodiversity conservation and the sustainable utilization of bioresources. Information is available at the BRT website: http://brt.biotec.or.th. Furthermore, some researchers under sponsorship of BRT have played an important role in production of a guide book of CITES (Convention on International Trade in Endangered Species) and a resource book on Thailand Biodiversity Monitor 2004. These two books were published in Thai and English.

Discussion

The achievements of the BRT Program are so far impressive, and the program has significantly stimulated much research in the areas of systematics and ecology. It has increased awareness of the importance of biodiversity to the country as a whole, and has promoted research on the sustainable use of bioresources. As measured by the numbers of students trained and publications produced, the program is having an impact on the direction of biological research in Thailand.

In recent years, the program has turned to the problem of increasing local awareness of biodiversity at the village level and increasing the role of local residents in the conservation and use of their resources. The program has not found methods of measuring its impact in this area and does not have very specific objectives. It has been found that local people in some areas are already aware of the values of local biodiversity and have taken steps to manage plants and animals near them. Often the problems at this level are political and economic, and BRT finds only a limited role to play. The program also has little or no impact on the conservation of natural resources and the environment that falls under the purview of other well established agencies such as the Department of Parks, Wildlife and Plant Conservation, and the Office of Natural Resources, Environmental Policy and Planning. Here the major function of BRT is to train persons knowledgeable in biodiversity and to improve the capacity for research on biodiversity, which is weak at these agencies. The program has had its major impact in the state universities which produce nearly all the

researchers in the kingdom.

Judging from the numbers of proposals submitted and the publications produced, the impact of BRT support is not even across all the disciplines relating to biodiversity. This is a problem related to the past training and recruitment of scientists in the state universities, and cannot be rapidly changed by the BRT's priorities. Areas of research, that are weak and not attracting enough good students, include population biology, conservation biology and ecosystem research. They are poorly represented in the publications list. These fields perhaps are more difficult to work in and publish in without strong supporting research departments with critical masses of research faculty. Also lacking are publications in the social sciences, including economics, concerning natural resource use and local management. The program has attempted to support projects focused on local communities, and area-based research, but the publications do not yet reflect this policy. The social sciences in general have a weak publication record in Thailand, and Thai social scientists tend to regard their work as relevant only to the Thai context and not international in character. However, if social and economic research is to be "scientific", it must contribute to the cumulative body of knowledge and become more international and globalized like the natural sciences.

A further problem reflected in the analysis above is the uneven distribution of research across universities and other institutions. The total number of colleges and universities in Thailand is at least 134, which includes 24 public or state universities, 41 Rajabhat Universities which serve as teacher-training colleges, 59 private universities, and 10 Rajamangala Universities which are technology institutes[2]. At least 18 of the state universities have Ph.D. programs, but only 11 of the state universities are represented in the publication list. Nearly half of the international publications on the list were produced by the top three institutions. BRT is attempting to reach out to the Rajabhat Universities for participation in projects, but few of these have research programs. Virtually all research activity (in all fields of science) is concentrated in the largest state universities and a few government-supported institutes and agencies. Improving the basic research capabilities of Thai universities is beyond the ability and budget of BRT, but the program can play a role in stimulating research programs in its own area of interest.

There is also an uneven distribution of research across taxonomic groups, and readers may rightly question why some important groups are being neglected. The problem of documenting all the animals, plants and microbes in Thailand is immense. Thailand possesses approximately 7 percent of the species or organisms on the Earth[3], but the country's biodiversity is very poorly documented. This percentage of Thai species that have been described varies greatly from group to group, with the vascular plants being better known than the microbes and fungi, and the vertebrates (especially the birds) being much better known than the insects and other invertebrates. For example, Thailand has at least 10,000 species of vascular plants out of the world's total of 272,000[4,5]. The great majority of these are known, but many are difficult to identify or find because the Thai inventory, published in the *Flora of Thailand* series, is only about half completed. BRT is funding research on inventory and revision of the Thai flora because of the great importance of plants to many other fields of biodiversity study. The inventory of fungi is also receiving priority because of the importance of this group to bioresources development[6], and the incomplete state of our knowledge. Approximately 2,000–3,000 species of fungi have been documented in Thailand, accounting for only 2.5% of the species described worldwide[7], but the total number of species in Thailand is certain to be many times this number. In the insects, the proportions of species that have been described vary from order to order, but overall it may be as low as 10 percent of the true number.

The slow pace of inventory of the biodiversity of Thailand (as well as that of the Earth as a whole) indicates that it will not be completed in the foreseeable future, or before much of our biodiversity becomes extinct. The pace of taxonomic research is limited by a world-wide shortage of qualified taxonomists, who are highly specialized. There is only one system of biological classification and it is completely international and adheres to a single set of world-class standards. In Thailand, most successful taxonomic experts have been trained in Western universities and have maintained close collaboration with their foreign mentors and colleagues. For these reasons the distribution of taxonomic research is spotty and not comprehensive.

With all these limitations of the BRT program in mind, we offer some suggestions about how the program may become more effective in the future. The program does not have a fixed set of methods or goals and is altered each year as the need arises.

1. Help generate and support graduate training programs in selected fields of study. As BRT funds are relatively limited, support may come mainly in the form of help in information services, curriculum design, promotion of foreign collaboration, and seminars. The goal would be to facilitate the formation of viable research groups in important areas of ecological and evolutionary biology and resource studies. Short term training programs and seminars can help prospective researchers initiate projects and keep up-to-date in their fields. An analysis of the fields of study and research

topics of BRT student awardees needs to be made, as well as their career paths.

2. Support efforts to promote interaction and collaboration among Thai researchers in particular fields, to encourage mutual support and training activities. We must overcome the isolation of researchers, especially young ones, in upcountry institutions that have not achieved a critical mass. The ecology symposia carried out at King Mongkut's University of Technology, partly supported by BRT, has made a promising start in promoting interest in young researchers[8].

3. Promote international collaborative efforts and training. Virtually all successful research projects benefit from international collaboration and support. Supporting foreign researchers' activities in Thailand will help local scientists keep up with new developments in their fields, and help to rekindle enthusiasm for research.

4. Support and training for national biological collections and museums. Systematic collections are essential for biodiversity research, and when properly curated, they provide stimulation and gratification to both collectors and users of the collections. They also become the focus of international collaboration.

5. Provide additional help, and perhaps rewards, to young researchers in writing and publication of research results.

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