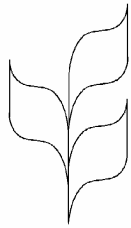




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Ninth meeting
Montreal, 10-14 November 2003

**PRELIMINARY REPORT OF FIRST GLOBAL TAXONOMY INITIATIVE
WORKSHOP IN ASIA**

Note by the Executive Secretary

The Executive Secretary is circulating herewith, for the information of participants in the ninth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice, the preliminary report of first Global Taxonomy Initiative workshop in Asia, entitled "Building Capacity: Bangladesh to Bali and Beyond". The report is being reproduced in the form and the language in which it was submitted to the Secretariat by the editors on behalf of the workshop participants.

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Building Capacity: Bangladesh to Bali and Beyond

Preliminary Report of First Global Taxonomy Initiative Workshop in Asia

Putrajaya, Malaysia, September 2002

Executive Summary

Asia is a region of extraordinary biological richness and diversity, and includes megadiverse countries such as Indonesia, which has within its national boundaries some 17% of the world's species. The countries of the region have all signed and ratified the Convention on Biological Diversity, and recognise the importance of conservation, sustainable use and equitable access to the genetic benefits of their biodiversity. Through the Convention process, and at various Conferences of the Parties and meetings of the SBSTTA¹ representatives of these countries have identified, among other issues, the 'taxonomic impediment' – the shortage of taxonomic information, expertise and resources that hinder implementation of the CBD. As a result they have been active in setting up the Global Taxonomy Initiative as part of the Convention, in order to address this issue. The workshop reported on in this document was an opportunity for taxonomists and other biodiversity specialists in the region to identify particular issues of the region that should be addressed under the aegis of the GTI, and to plan ways of carrying out the necessary work.

There was a strong call for more interaction with CBD processes, and for CBD Focal Points to respond to COP decisions V/9 and VI/8 and ensure the appointment of GTI Focal Points where this had not already taken place, and for those Focal Points to be closely and proactively involved with implementation of the GTI Programme of Work.

There have been several attempts to assess the taxonomic needs of the region, including a major initiative in and around this workshop. Within many individual countries taxonomic needs in terms of the Convention are still to be assessed, in response to COP decisions V/9 and VI/8, although preliminary reports were presented to the workshop. The results of the regional and national efforts prepared for the workshop, although still requiring more input for a variety of user group at national and regional levels, indicate major problems in meeting the needs that have and will be identified under the CBD.

No single country has the expertise or funding to fully document all its biodiversity, although as a basis for management and to ensure adequate access to genetic resources and protection of rights at national and sub-national levels (CBD Art. 15) such knowledge is vital. There is a need to document biodiversity across the region immediately, and particularly in a number of ecosystem types that are under massive threat from a variety of anthropogenic causes. Taxonomy, in the context of the GTI, is also fundamental to work on other CBD issues including invasive alien species, indicators of biodiversity, and bio-safety.

¹ Subsidiary Body on Scientific, Technical and Technological Advice.

There is an inadequate pool of taxonomic experts and support staff, with dwindling prospects for the replacement of an aging personnel. Inadequate staffing levels were cited as one of the four major stumbling blocks for implementation of the GTI by 89% of respondents to a region-wide questionnaire. There is a clear need to address the demography of taxonomic expertise and provide employment prospects and training for younger staff. Meeting these training needs must in part be carried through to universities, where new courses and encouragement for students to take taxonomy options are needed. Other training options must also be investigated across the region.

Another issue regarding staffing is the inadequacy of coverage of taxonomic groups within the region. Comparison of distribution of expertise with that of collections, and with the numbers of species in the different types of animals and plants covered, shows strongly that there are too few taxonomists to cover adequately the 'lower' organisms, particularly invertebrates, non-vascular plants, and micro-organisms.

Building partnerships within the region will be fundamental for a major increase in our taxonomic capacity, as noted in COP decision VI/8. Regional cooperation will provide a cost-effective solution for all countries involved, not only in increasing our knowledge base but also in maintaining the wealth of data and collections we have already amassed. Some models of regional activities are available, for example ASEANET (a technical cooperation network for taxonomy covering all organisms), AneT (a network covering just one group of organisms, ants), and Species 2000 Asia Oceania (a collaborative group creating databases of the region's animals, plants and micro-organisms). EASIANET is another network covering all organisms that has recently been established on the basis of implementing the GTI. While some new facilities will need to be created, the various existing initiatives can be built upon to deliver information to their members, as well as research products. Such information will include, for example, regional directories of taxonomists, collections, type photographs, training courses, species and specimen databases, and research and collecting permit requirements. Greater involvement in these networks will be facilitated by improved communication, which itself is dependant on improving access to communication media, particularly the internet. Such networks require sustained financial support if they are to function for the region.

There is also a regional need for the maintenance of living cultures of micro-organisms. This is expensive and there is a strong need for funding; one solution is to support a single main regional culture collection for microbes and micro-fungi, with special collections maintained in each country that needs them.

There is a clear need across the region for improved facilities, both in terms of buildings and institutions and for specialised equipment, particularly in information technology, including fast internet connectivity. The need is also for sustainability, since a number of institutes have aging equipment that cannot be used.

While some problems will take decades and be costly to address, there are many ways in which our regional capacity can be significantly improved at minimal cost. For instance, the primary published information describing Asia's native species, and the type specimens of those species, are currently difficult to access, and this is a major hindrance to delivering taxonomic information as required. Through global collaboration with Northern Institutions, where much of the information is contained, it will be possible to provide electronic access for Asian scientists to work on current problems.

Many of the needs for CBD implementation that should be addressed with the support of taxonomists in the region will involve cross-border collaboration and multinational research efforts. Cooperation at governmental levels is required to ensure appropriate memoranda of understanding to facilitate this process, building on the mechanisms for the GTI outlined in the Bonn Guidelines on Access and Benefit Sharing (COP decision VI/24). New and innovative ways to expedite the collection and exchange of specimens between scientists working in this region will provide one small step in breaking down barriers

that at present hinder the conservation, sustainable use and equitable access to the genetic benefits of biodiversity.

Funding levels for taxonomy in support of the CBD need to be increased greatly, and 95% of respondents to the questionnaire indicated that this was a major hindrance. Improved funding will enable the issues of high running costs and inadequate infrastructure, including poor access to means of electronic communication to be addressed, as well as facilitate appropriate research and biodiversity documentation.

Good agreement exists in the scientific community on what research priorities should be, and these are set out in the report as a preliminary Global Taxonomy Initiative programme of work for Asia. Developing and implementing this programme will require the involvement of both taxonomic and environmental management communities, and increased links to government and convention processes.

1. The Global Taxonomy Initiative and regional workshops

The Convention on Biological Diversity (CBD) was established in 1992 with the objectives of conservation, sustainable use, and the fair and equitable sharing of benefits arising from utilisation of the genetic resources of biodiversity. To achieve these objectives, and in particular addressing topical regional issues such as invasive species, biodiversity indicators and bio-safety, there is an unequivocal need for taxonomic information. This need has been recognised since the first meeting of the CBD's Subsidiary Body on Scientific, Technical and Technology Advice (SBSTTA) in Paris in September 1995, and has led to the adoption of the Global Taxonomy Initiative (GTI) as part of the Convention.

The GTI has been the subject of several 'decisions' of the Conference of the Parties (COP) to the CBD: III/10, IV/1.D, V/9 and VI/8 (from the third, fourth, fifth and sixth meetings of the COP respectively). The text of these can be found at <http://www.biodiv.org/decisions>. At its sixth meeting, the COP endorsed a programme of work for the GTI² and emphasized the need to coordinate its implementation with existing national, regional, sub-regional and global initiatives, partnerships and institutions. Parties and other governments were urged to promote and/or carry out the programme of work, designate national focal points for the GTI, provide updated information about legal requirements for exchange of biological specimens, and about current legislation and rules for access and benefit-sharing in terms of the needs for the GTI, and to initiate (where this has not been done) the setting-up of national and regional networks to aid the Parties in their taxonomic needs in implementing the CBD.

Many issues are best addressed on a regional rather than national level, since species and ecosystems often extend across national boundaries, and cooperation regionally will best suit the identification and resolution of issues that can only be solved by concerted effort. Resources may be optimised on a regional or subregional basis, to avoid unnecessary duplication and operate in the most cost-effective and scientifically efficient manner. Understanding this the Parties to the Convention called for regional meetings to identify and prioritise taxonomic needs in terms of the implementation of the Convention, and to suggest activities necessary to meet them, noting the importance of building on institutions and initiatives already in place. This preliminary report presents the findings of a meeting held in Putrajaya, Malaysia, 10-13 September 2002, which was the third in a series of workshops on the GTI (the first held in Central America³, the second in Africa⁴), and the first to be held in Asia.

² see <http://www.biodiv.org/decisions/default.asp?lg=0&dec=VI/8> or pages 113-142 of the PDF file at <http://www.biodiv.org/doc/decisions/cop-06-dec-en.pdf>

³ Herrera, A. (ed.), 2001, *Development of Taxonomic capacity in Central America. Global Taxonomic Initiative, Convention on Biological Diversity*. 57pp. Instituto Nacional de Biodiversidad, Costa Rica.

The report will be published in full by NIES (Global Taxonomy Initiative in Asia ed. J. Shimura, ISSN-1341-3643), Japan, in 2003.

2. Workshop composition and programme

The representation of 128 participants from 22 countries and economies (Appendix 5), included taxonomists across all taxonomic disciplines, representatives of taxonomic and other networks, policy makers, government officials, and bioinformatics specialists from a wide range of disciplines. This enabled discussion of broad issues facing the region in relation to describing and documenting its biodiversity, as a prerequisite to sensible management for sustainable use, conservation and equitable access to the benefits arising from the utilisation of the genetic resources of biodiversity.

The workshop provided a strong basis for developing a true picture of the current taxonomic capacity in Asia, and for formulating the most urgent priorities to address these issues. Unfortunately some countries could not be represented, including Cambodia, Laos, Myanmar, North Korea, Pakistan, Papua New Guinea and Sri Lanka. However, input has been sought from these countries via a mailed questionnaire on resources and impediments.

The workshop opened with a day of plenary presentations, including brief statements on the current status of taxonomic study in each area. These statements complemented a questionnaire-based survey carried out before the workshop, and the combined assessment is presented in Appendix 1.

This report provides a synthesis of the results of the assessment and the outputs from a series of working groups held throughout the workshop to discuss different aspects of the taxonomic situation in Asia, and a set of proposals to meet the needs identified.

3. Findings of the Workshop

The findings summarised below are expressed, where action is needed, as a preliminary GTI programme of work for the Asian Region (Appendix 3). In general it was felt that Asia currently does not have the capacity to understand and manage its biodiversity. For the past two centuries, taxonomic description of Asian taxa has most actively occurred outside the region. The past 50 years has seen many of Asian countries develop rapidly in an economic sense, but a concurrent development in independent scientific capacity to describe and document this region's natural resources has not always occurred. The region suffers from very poor coverage of scientific expertise in many taxonomic groups, especially lower organisms. Consequently the knowledge base for many groups is currently well below the level necessary for sound decision-making for conservation or sustainable use.

3.1 The GTI in Asia

The workshop was one of the first opportunities available for many Asian taxonomists to gain first hand information on the GTI and the CBD. The taxonomic community in the region, and biodiversity

⁴ Klopper, R.R., Smith, G.F. Chikuni, A.C. (eds), 2001, The Global Taxonomy Initiative: documenting the biodiversity of Africa. Proceedings of a workshop held at the Kirstenbosch National Botanical Garden, Cape Town, South Africa (27 February -1 March 2001). *Strelitzia* 12: xiii + 202pp.

scientists in general, have had relatively little direct exposure to the Convention and to the GTI in particular. That the opportunity provided by the workshop was needed was shown both by the manner in which the verbal reports were compiled, and the answers to the questionnaire. In the returned questionnaires, for example, more than one in four respondents felt unsure of what taxonomic resources were required to meet CBD implementation. There appears to be a poor recognition at institutional/organisational level of the relevance of taxonomy for implementation of CBD, and in general understanding of CBD activities and issues, and the focus of the GTI, are not as wide as will be needed. For the GTI to be successful it is essential for much greater depth to be achieved in promoting the link between biodiversity policy and science in all countries and economies. Significant outreach activities are required to address this issue. Importantly, the recently established LOOP of BioNET-INTERNATIONAL, EASIANET, was predicated on the implementation of the GTI programme of work, and this has also been a strong driver in the activities of the longer-established ASEANET.

One measure that countries could adopt immediately to address the situation is increasing the support and use of 'focal points' to proactively work with and disseminate information to the scientific community. All parties to the CBD have agreed to establish GTI focal points, yet few countries in Asia have so far designated them. How each focal point functions at a national level will best be developed through consultation between government officials and the broader taxonomic and environmental management communities, and for the focal points to provide a useful service to both the taxonomic fraternity and the broader community it will be necessary to provide this role with appropriate resources. Each focal point needs to be monitored to ensure they are targeting the correct audience. National taxonomic and natural history societies are willing to be more actively involved in the GTI but currently lack the mechanisms for engaging practically with the Convention, and the development of strong working relationships with GTI focal points will significantly improve the implementation of the GTI Programme of Work throughout the region. Notably, National GTI Focal Points from several Countries were actively involved in preparing the workshop and ensuring its success⁵.

The results of the questionnaire and the national reports showed, irrespective of the level of understanding of the Convention process, that within the region taxonomic resources are not currently adequate to provide sufficiently detailed knowledge on the components of biodiversity and for the implementation of the Convention on Biological Diversity.

The meeting highlighted the fact that Asia is blessed with great biodiversity riches, yet our science base is one of the poorest in the world, and our biota is inadequately known and covered by current research. A massive resurgence in regional taxonomic effort that focuses on documenting this region's diverse environmental zones is needed if we are to cope with the ever increasing demands on the environment here. However, taxonomy suffers from a poor image in Asia compared to other disciplines such as biotechnology. This is coupled with an apparent reluctance of funding bodies to fund taxonomic projects, despite the fundamental role of these in understanding biodiversity.

3.2 Responding to user needs in CBD 'thematic areas' and 'cross-cutting issues'

Within specific sectoral areas (such as invasive species and agriculture), detailed taxonomic information will always be required for effective management. Linked to these specific needs there are opportunities for collaboration nationally, regionally and globally between taxonomists and the relevant sectoral interests – the users of the taxonomic products. The CBD has established a range of 'thematic areas' and 'cross-cutting issues', many of which require taxonomic support for adequate implementation. In particular, the workshop recommended that taxonomists take a greater role in dealing with the

⁵ Australia, Germany, Indonesia, Japan, Malaysia, Netherlands, Thailand

cross-cutting issue of *invasive alien species*, which are an established problem in the area. There is now a growing appreciation of this issue, which has been largely overlooked by both governments and taxonomists alike. Coordination of effort across political boundaries is a promising approach to dealing with this global, multidisciplinary problem.

The workshop agreed that within the thematic areas of the CBD the necessary focus for increased taxonomic effort should be on ecosystems that have higher levels of endemism and are most threatened within the region. These include terrestrial limestone communities, caves, swamps, island and marine ecosystems, lakes and rivers. Many other systems also need urgent attention if we are to manage our biological resources optimally.

Similarly, greater action by taxonomists is needed on recognition and identification of *endangered species* and those of *potential economic use* (significant trade and quarantine species), plus their relatives.

The needs highlighted are reflected in the draft programme of work for the GTI in Asia developed through the workshop (Appendix 3).

As one measure that would assist in responding to needs in this context, the workshop recommended the formation of an international (regional) committee, including representatives of the extant networks, and national GTI or CBD focal points, to organize training, establish standards for data collection, and coordinate training workshops for sectoral issues, starting with quarantine and agriculture. Regional collaboration is needed to ensure adequate specimens/cultures are available for easy identification and for further taxonomic research in these groups. Regional trade agreements provide a significant opportunity to mobilise taxonomic effort to proactively build capacity to meet the increasing need for scientifically credible baseline information on the status of species.

3.3 Collaboration and networking among taxonomists

There are a number of examples of regional cooperation and projects in the region, many of these being very active and contributing towards regional needs (e.g. ASEANET; and see Appendix 2). However, there are areas where networking of taxonomists and other biodiversity scientists could still be improved, with many of the current interactions based on previous colonial ties. All participants agreed that strengthening the networks within the region would create huge benefits at little cost, providing enhanced opportunities for exchange of information and ideas. At the same time, links need to be maintained with taxonomists outside the region to ensure adequate coverage of all taxa.

Communication and collaboration among taxonomists in the region needs to improve. This includes greater outreach to voluntary and retired taxonomists who also have a huge contribution to make. Existing networks and initiatives (Appendix 2) are important, although these may be hampered by funding restrictions and under-used. Personal communication between individuals is important, but poor electronic access hinders even this in many cases.

Simple measures to support better exchange of information can be achieved relatively easily. The workshop recommended as high priorities:

- Establishment of a regional directory of taxonomic institutions, experts and fields of expertise to encourage collaboration across the region.
- Establishment of a regional society of systematic biologists, which would link to appropriate national societies (such as the Biodiversity Research Group of Bangladesh) to provide a broader coalition of scientists to help promote the role of biodiversity science in the region, as well as to improve contact between scientists.

- More stable funding for established networks such as ASEANET, EASIANET, PACINET and Species 2000 Asia Oceania.

There are a number of existing initiatives, such as ASEANET, EASIANET, Species 2000 Asia Oceania, that could be further involved in delivering regional directories of taxonomists, collections, type photographs, training courses, species and specimen databases, and research and collecting permit requirements, and already provide examples of how this can be done. The delegates agreed that at least one Website⁶ could usefully be set up to provide on-line links, although it was strongly noted that other means of communication are needed as well.

Support has been forthcoming from governments to establish Technical Cooperation Networks (BioNET-INTERNATIONAL LOOPS) in East and Southeast Asia and the South Pacific (and is underway in South Asia). However, the financial and political commitments needed to continue effective coordination and programme development of such networks has been lacking. In addition, some networks have been established by individual researchers (e.g. AneT⁷) with little support from or involvement with government processes. With even marginally increased support and encouragement from governments the existing scientific research community will be able to operate more effectively and target their work at the needs highlighted by the GTI.

3.4 Imbalances in numbers of collections, experts and species

Whilst there are a fair number of collections within the region, these cannot be used without sufficient research and support staff, and taxonomists are hampered in their work without ready access to reference collections. The regional survey undertaken prior to the workshop shows both an absolute and a relative numerical inadequacy in the pool of taxonomic experts and support staff; these both being major obstacles to meeting the increasing demands for comprehensive and up to date information. Across all institutions staffing is inadequate, in terms of total numbers of full-time taxonomists and support staff, age structure, and spread of expertise across the taxonomic spectrum.

In general, the Asian region suffers from very poor coverage of scientific expertise in many taxonomic groups, especially lower organisms. The regional knowledge base for many groups is currently well below the level necessary for sound decision-making in terms of implementation of the Convention on Biological Diversity. To understand clearly the nature of the problem of addressing the paucity of taxonomic data available for Asian species it is not only necessary to look at the overall number of experts in the region, but also the current lack of experts in many groups. A simple analysis of the number of taxonomists compared to the estimated number of species in each major group of organisms shows the lack of trained scientists generally, and the highly skewed focus of research currently.

The relatively high number of taxonomists studying vertebrates and vascular and non-vascular plants is not considered adequate to cover the known species (both named and as yet undescribed) in these groups. There is a much more severe deficit of taxonomists for protozoa, micro-fungi, micro-algae and bacteria/archaea. Similarly, there are too few experts studying invertebrates in the region. Increasing research on the lower taxa, particularly micro-organisms, will substantially increase taxonomic knowledge of known organisms, and should raise the rate of description of new species. Importantly it is the role of lower organisms in many ecosystem processes that is poorly understood, and better comprehension of the species is the first step in increasing our understanding of their ecology, and therefore of enabling appropriate management in the context of the CBD.

⁶ <http://www-gti.nies.go.jp> is now being used

⁷ Asian Network for Ants

3.5 Maintaining the succession of knowledge and skills base

The results of the questionnaire demonstrate clearly an aging taxonomic workforce in Asia. However, in order to maintain an optimal understanding of the species present both at national and regional scales, continuation of specialised knowledge of specific techniques, morphology and species characteristics is required. Much of this knowledge is not available in published form, but is most effectively passed on from one individual expert to another, together with the materials kept at the specimen/culture collections. To ensure this handing-on of knowledge, institutions holding collections need to employ a mixture of older and younger taxonomists. This step will require an appropriate level of funding to increase the number of taxonomic positions and ensure a steady stream of younger taxonomists entering the profession.

In addition, encouragement of younger people to take up taxonomy as a career is needed to address these shortages. Despite being at the core of understanding and managing biodiversity, taxonomy suffers from a poor image, and a new campaign is needed to counter this and to boost university teaching of the discipline, which has been in decline for some time.

Better education in taxonomy and biodiversity is important to improve public awareness of biodiversity issues and increase the number of young taxonomists. Ideally this should start at secondary school level; however currently this happens in slightly less than a third of the secondary schools in the region. A higher level of education in taxonomy is necessary to understand and improve knowledge of Asian biodiversity. More graduate and post-graduate training in taxonomy is needed within the region, and better training opportunities are needed to encourage young students. Other possibilities already being employed at some levels include PhD and MSc courses in other countries and in-house short courses on particular topics. Regional scientists should continue to be involved in collaborative projects with specialists from elsewhere to build on and develop expertise. Regional cooperation has already been initiated at an institutional level in Asia where in-country conditions are not adequate, especially in microbiology, but overall, there is a paucity of courses in the region dealing with taxonomy.

In addition to training of students who will form the next generation of specialists, training is also needed to extend the skills of existing taxonomic staff. Training of parataxonomists is also important.

3.6 Taxonomic infrastructure and equipment

The need for significant improvements in physical conditions for collections was seen as an urgent need throughout the region. Provision is needed for caring for 'orphan' collections in all countries. Some centres could act as regional repositories for particular groups. For selected small to medium collections, the establishment of improved collection conditions (simple and cheap methods for improving collection security) could proceed with minimal funding and could then be used as pilot for others.

Basic infrastructure for specimen collection and study, including collecting and drying equipment and facilities, compound microscopes, specimen cabinets, freezers and refrigerators, is available at most institutions but needs upgrading in many cases. Availability of equipment and facilities for relatively advanced technology in taxonomy is variable, as is funding for training technicians and for operational costs.

Tissue culture facilities, cryo-preservation facilities, and molecular equipment for taxonomy are inadequate in many institutions. The expense of obtaining and maintaining this equipment is another factor limiting the regional capacity to study lower organisms and micro-organisms, compared to the larger and better-known animals and plants. This more restricted infrastructure for microbial cultures is

probably a major reason that the graduate and post graduate level of education in microbiology is largely provided at foreign institutes, where resources are better. This further compounds the inadequate number of taxonomists in microbiology in Asia as many scientists then stay abroad in order to work in their field of expertise.

Increasing the infrastructure for microbial culture collections is needed. Regional cooperation for supporting proxy preservation of cultured strains and safe deposit of important strains at the established facilities in the region within the lawful mechanism of access and benefit-sharing between the collaborating countries is also important until an adequate infrastructure can be built up throughout the region.

The ever-increasing cost of library books and journals is of concern generally since taxonomy relies so heavily on publications both old and new. In one country, no foreign journals have been bought since 1990. Providing electronic, on-line access to taxonomic information and resources currently not available in Asia is more cost-effective than collecting such rarely available and very expensive books and journals to build up a library at each collection. However, there is a major issue in the availability of adequate computer equipment and internet access.

Computers and Internet connections are available at most of the surveyed institutions, but often not to an adequate level. Connection to the Internet is of course highly important for email and access to the rapidly accumulating taxonomic information on the Internet. However, it is also vital for creating local taxonomic electronic resources. Taxonomists need to build up regional datasets to fill the knowledge gap: to digitize data from each collection to manage the specimens/cultures; to make their own data available to colleagues at remote institutes; and, more importantly, to participate in global data projects for broader aspects of science relevant to understanding biodiversity and supporting conservation.

A general need expressed in the region is for upgrading and extending both facilities and equipment since these are generally aging or outgrown. Resources are very limited in some cases, with some countries mentioning the lack of funds for such items as laboratory or computer equipment.

3.7 Location of and access to reference specimens

Many scientists at the meeting expressed concern over the continuing restricted access to scientific material (collections and literature) held elsewhere in the world, particularly in developed countries. The issue is particularly acute with respect to type specimens. Because many types of Asian species are held in collections outside the country of origin, and often outside the region itself, Asian researchers cannot always examine them. To compound the problem, the collection where the specimen is kept may not be known. Even when the repository has been located, researchers often need to travel overseas in order to make comparative studies; this cost can be significant, and is known to prevent some studies of Asian biodiversity from taking place. Improving access (particularly electronically) to such taxonomic material is a priority. Some institutions are moving quickly to provide access and repatriate data, but there is no coordinated approach and few resources to make it happen, with current efforts undertaken on a case by case basis.

There is a clear need for collections to be databased at a variety of levels: particular collections held; overall coverage; species held; and specimen data. These databases, once compiled, should be made available in electronic and other suitable formats. The need is not only for collections held outside the region, but also for those within the region, both because some collections within the region hold material from other Asian countries, and this will be a step to providing a regional facility. When data sharing of this nature takes place, whether through the web or by direct provision from collections, knowledge of the quality of the data is vitally important to users. The level of quality of identifications (including for example the name and date of the identifier, and history of name changes in the database, and whether

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changes were based on expert re-identification of the specimens concerned or whether it was a change based on a review of name changes in the literature) is essential. Equally important is knowledge of the quality of the locality data, which ideally should be geo-referenced. It is also important to know whether the database is based on individual specimens collected and preserved or whether it is based on field survey data without voucher specimens.

Collections that hold type specimens are urged to provide high-resolution images of type specimens, ideally through the Internet and also on CD-ROM. This is already happening in some cases, but needs to be rapidly expanded to meet increasing need. However, although electronic dissemination of images and other information is important, effective and efficient delivery of taxonomic information is hampered by poor access in Asia to electronic communication, information-gathering and dissemination, now taken for granted in much of the developed world. Not only is the technical infrastructure inadequate, much of the physical infrastructure is in decline in the region (including aging buildings and equipment).

Provision by northern institutions of duplicate specimens to the country of origin and to other countries where the organism occurs should be promoted, with the commitment by countries of origin to adequately curate specimens to agreed international standards. However, projects to preserve reference specimens/cultures in Asia will only be effective if the basis of the collections concerned is as comprehensive a set as possible of reliably-identified specimens to serve as vouchers. In the absence of this pre-existing resource there will need to be an increased collaboration of taxonomists regionally and globally to develop it.

For micro-organisms, a living culture is able to be duplicated at any collection if appropriate media and conditions can be maintained. This allows the preservation of duplicates in different collections and it makes access to types easier as long as strains are distributed widely between collaborators. However, to keep the characteristics of the strains, a good cryo-preservation facility is necessary.

3.8 Agreements on research access and benefit-sharing

Agreements are needed on access to data and information, specimen collection and deposition, intellectual property rights, and benefit-sharing at government level as well as at institutional level. This could be either as a blanket agreement (a memorandum of understanding – MOU) at the national level covering all scientific projects, or on a project-by-project basis at institutional level. In all cases MOUs should ideally be developed in the spirit of collaboration. Separate MOUs would be needed for bio-prospecting and commercialisation. The workshop recommended that institutions in each country be designated to handle MOUs.

The location where specimens are to be deposited should be specified in an MOU. This will depend on the type of specimen: plant, animal or microbe. It may be useful to designate an institution as a national repository for each group of organisms in each country, as called for in CBD COP decision V/9. Generally holotypes and single specimens collected during the course of a study should be deposited in the country of origin. Paratypes and isotypes should be deposited in more than one location if possible. In any case, free access should be guaranteed to types and microbial type strains for all taxonomists. Specimens in some countries are sent elsewhere for identification and there is free exchange of duplicates – this practice should be encouraged to make use of the world's limited pool of taxonomic experts.

The current permit system for collection of biological data is cumbersome and sometimes a major barrier to scientific study. It needs to be simplified in order to facilitate implementation of the GTI. The meeting strongly supported the designation of a 'competent national authority' in each country and economy, which would provide a streamlined approach to obtaining permission for taxonomic research

(see Convention on Biological Diversity (A&BS) Bonn guidelines 11L, 34, 36F, 42E and 63B on collection and use of specimens for taxonomy)⁸.

3.9 Disseminating the results of taxonomic research

The needs of users of taxonomic products must be more clearly ascertained and documented, which in turn will generate appropriate innovative uses for collections and their data.

More publications are needed at all levels of knowledge to make the results of taxonomic research widely available to all users: from specialist taxonomic publications to local field guides, CD-ROMs, general information on-line, etc. These should cover marine as well as terrestrial ecosystems.

3.10 Publicising the role of taxonomy

The public image of taxonomy is extremely important. The fact that taxonomy underpins many aspects of biological sciences (including those important to implementation of the Convention on Biological Diversity, and such issues as biotechnology) is not always appreciated. There is an urgent need to reach out to decision-makers and prospective students alike. Taxonomists need to be more interactive with these groups and with the media to reach the general public to ensure support for this basic activity.

All taxonomists should take a more active public relations role as individuals, and make themselves known to people who need taxonomic expertise (and who have funding to support our activities). For example, the delegates at the regional workshop of Global Invasive Species Programme (GISP) held in Bangkok in 2002 included very few of those present at the Asian GTI workshop, and participants should make contact with these participants to discuss possible collaboration on invasive species.

3.11 Funding

Across all aspects of the taxonomic impediment in Asia the lack of sufficient funding was identified as a major constraint, and in particular it was highlighted that there is currently insufficient funding for people, infrastructure and projects. There is apparently some reluctance among funding bodies to fund taxonomic projects, especially dealing with lower organisms.

Some users are charged (cost recovery) for access to collections e.g. research workers with big grants and industry, but much of the funding to support collections ultimately has to come from governments.

3.12 Major taxonomic needs in Asia: conclusion

The survey results summarised in Appendix 1 clearly showed four major stumbling blocks for taxonomy in the region:

- Lack of research funds (95%)
- Inadequate staffing levels (89%)
- High running costs (84%) and
- Difficulty of access to taxonomic literature/libraries (80%).

⁸ <http://www.biodiv.org/decisions> - see decision VI/24

In addition, continuing maintenance and upgrading of equipment and facilities are needed. Each taxonomist's effort devoted to understanding biodiversity has been significant, but taxonomists require regular published output to be eligible for research grants/funds and thereby to make more effective use of the available infrastructure and to increase the availability of equipment in laboratories. Employment of qualified staff from younger age groups requires improved education systems that cover taxonomy from primary to graduate and post-graduate level and adequate employment opportunities in both in-country and regional research institutions. This will facilitate filling the gaps in taxonomic knowledge over the broad spectrum of biodiversity. Internet technology is one partial solution to the problem of access to taxonomic information, including image data of type specimens kept in remote institutions and access to literature/libraries elsewhere. While in total the problem is large, each component can be addressed but will truly require regional cooperation with a long term vision to ensure the region is equipped to meet the needs of biodiversity conservation into the future.

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Appendix 1. Survey of current regional capacity and gaps⁹

The Conference of the Parties to the CBD has requested all Parties to work together to ascertain regional taxonomic capacity. To facilitate an understanding for the Asian region a survey of taxonomic resources and needs was carried out in 2002 by the National Institute for Environmental Studies, Japan. A questionnaire on taxonomic needs and capacity was sent to major taxonomic institutes, GTI focal points and CBD focal points in the region prior to the 1st GTI Asian Regional Workshop. By the end of July 2002, 69 organisations from 17 countries and economies in the region¹⁰ had completed the questionnaire, and an interim analysis of these responses was presented at the workshop to facilitate discussion. This result is not a compilation of national or country-wide assessments but is a compilation of the answers from the Asian institutes and organisations that responded to the questionnaire. Details of the responding institutions, organizations and initiatives, and if the individual experts and the organisms studied by them, will be provided on the World Wide Web server for the GTI in Asia (<http://www-gti.nies.go.jp>) after agreement is obtained from individual respondents.

The survey continued until December 1st, 2002 to increase the coverage of organisations in the region (these extended results will be published elsewhere). The results will be updated on the GTI in Asia website.

To supplement the questionnaire representatives of 14 countries and economies¹¹ presented brief verbal reports during on the workshop on the status of their taxonomic infrastructure and staffing. No set format was required and these reports varied widely in content and style, and consequently, no tabulation was possible. Elements of these reports are included in the information given below, by topic, and discussed in Section 3 above.

Status of taxonomic resources in Asia in terms of CBD implementation

Ninety-seven percent of the respondents to the questionnaire believed that taxonomy was “not adequately addressed” in their country. However, to the question ‘Is your staff adequate to address CBD issues?’ 70% answered ‘No’, and 28% answered ‘Not sure’. The verbal reports generally dealt similarly with basic taxonomic capacity as opposed to capacity specifically in terms of CBD implementation. Much of the analysis below therefore reflects taxonomic capacity as a general resource, although given that such capacity is a vital basis for GTI and other CBD implementation, the results can and must be taken as indicatives of the region’s potential ability and issues in responding to CBD implementation needs.

⁹ Acknowledgements – Data were analysed and put into report format by Dr Junko Shimura. She thanks Ms Manami Matoba and Mr Yoshihiro Sato for their work on digitising information and the compilation process. She also thanks Mr Ian Cresswell, Mrs Karen Wilson and Dr Christopher Lyal for correction of English language and important suggestions through the discussion on GTI.

¹⁰ Responding organisations are distributed as follows: Brunei (1), China (2), Hong Kong (1), Indonesia (9), Japan (7), Malaysia (2), Mongolia (2), Myanmar (1), Pakistan (6), the Philippines (4), Singapore (1), Sri Lanka (2), Taiwan province of China (2), Thailand (25), Vietnam (3). The number in parentheses indicates the number of organisations that had replied to the questionnaire *by the end of July 2002*.

¹¹ Bangladesh (Badrul Amin Bhuiya); China (Hui Xiao); Hong Kong (Kevin Hyde); India (Haque M.A.); Indonesia (Dedy Darnaedi); Japan (Ma koto M. Watanabe); Malaysia (Mashhor Mansor); Mongolia (Tsetseg Baljinova); Philippines (Domingo Madulid); Singapore (Ruth Kiew); Republic of Korea (In Kyu Lee); Taiwan province of China (Kwang-Tsao Shao); Thailand (Wichien Yongmanitchai); Vietnam (Nguyen Xuan Hong).

Communication and networking

Better regional communication and networking are needed to make best use of the taxonomic resources available (see below). Often poor communication was reported between Asian countries; this may have come about at least partially because traditionally regional communication has been based on strong links between individual Asian countries and institutions in industrialised countries with strong historical colonial links.

Research results and general biodiversity information, the products of the taxonomic process, need to be communicated more widely. Projects have started in some countries to do this electronically, notably for specimen data or images. However, this is still of limited use to many people in the region, as illustrated by a recent Biodiversity Asia Network survey of participants in a workshop. This survey found that none of the taxonomists surveyed, belonging to seven countries of the Southeast Asian region, had heard of international initiatives such as the Species Plantarum Project, GTI, Species 2000, or the Taxonomic Impediment or the Darwin Declaration. In addition, only 9% of these taxonomists had access to the Internet although 80% had access to email. Two countries pointed out that they have few computers and could not afford Internet access. Political restriction of access may also be a problem in other cases. This indicates that, prior to more widespread availability of the Internet, other means of communication need to be used in the short term while seeking to improve electronic, on-line communication and access to information and in the Asian region.

A benefit of greater national and regional collaboration will be the better taxonomic coverage of the spectrum of organisms, since no single institute or country or economy can cover this fully by itself. Producing regional directories of biological collections, taxonomists and current projects will be a first step. Promoting professional societies (Appendix 2), and informal networks of specialists in a particular group of organisms, will also help. Regional groups such as, ASEANET, AneT and SEABCIN are tackling some of these issues. Within countries other initiatives have been set up within the region to address communication needs. The Biodiversity Research Group for Bangladesh was established recently to promote discussion and contacts; it already has 200 members and is starting a checklist of species in the country. In China there are a range of on-line products, e.g. a list of Chinese taxonomists and their areas of expertise, Fauna of China, and specimen information (including types), and the government has funded hard-copy publication of the Fauna of China, the Flora of China, the Cryptogamae of China and other taxonomic works. In Malaysia the first National Expert Meeting and workshop on Malaysian Taxonomy Initiative was held in September 2002 to assess taxonomic needs and identify strategies to enhance taxonomy in the country. It was organised jointly by MOSTE, UKM, UMS and ASEANET. Despite these initiatives more widespread involvement is needed, involving among others the more recently developed networks such as EASIANET and a planned BioNET-INTERNATIONAL network for South Asia (SACNET).

Collections, experts and species numbers

Institutions holding the major taxonomic collections of their respective countries comprised 60% of those responding to the questionnaire.

Table 1 presents the numbers of specimen/culture collections in Asia for each group of organisms. One hundred and forty (140) collections of animal and plant specimens and microbial cultures were identified through the questionnaire (note that some of the 69 respondent organisations hold collections of more than one group of organisms, and that these are counted as separate collections). In some countries, a range of small to large biological collection facilities (herbaria, zoological collections and culture collections) exist but in many countries no single major national collection exists with a strong emphasis on collection storage and research with a larger, full-time taxonomic staff to maintain and conduct

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research on the collections. Thailand, for example, has 55 institutes housing small to large biological collections, amounting to about 5 million specimens in total, but there is no National Natural History Museum. Malaysia and the Republic of Korea also lack such national institutes.

The highest number of collections identified from the questionnaire exists for invertebrate animal specimens (41), followed by vertebrate animals (20), vascular plants (23) and non-vascular plants (12). Although fungi/yeast (20) may include macro-fungi, there appear to be about 40 collections for microscopic organisms in the region. The survey therefore demonstrates that collections do exist in Asia for all groups of organisms. However, the survey does not provide details on the relative size or status of the collection. It is anticipated that while collections exist for lower organisms this will contain a much lower proportion of species compared to the overall number of species predicted for that group in the Region.

Taxonomic group	Number of collections in region	% of described species	Number of specialists in region
Invertebrates	41	68.5%	255
Vertebrates	20	3.2%	148
Vascular Plants	12	16.8%	154
Non-vascular Plants	23	1%	102
Fungi/yeasts	22	4.5%	78
Protozoa	3	1.5%	5
Microalgae	9	2.5%	34
Bacteria/Archaea	10	0.5%	55

Table 1. Numbers of collections and specialists in the Asian Region according to major taxonomic group (data from questionnaire responses).

The percentage of described species is based on global figures as reported in 'Implementing the GTI: Recommendations from DIVERSITAS Core Programme Element 3, including an assessment of present knowledge of key species groups' (UNEP/CBD/SBSTTA/4/INF6).

All countries reported a problem with taxonomic staffing, judging it inadequate in total number, or uneven in age distribution, or uneven in distribution of researchers across the spectrum of organisms. In Japan, for example, there are only two experts on Protozoa but 268 studying arthropods and 61 studying vertebrates. There is also an imbalance in distribution of staff amongst biological collections, with, for example, 35% of herbaria in Japan having no active taxonomist working on the specimens and 39% having only one or two taxonomists – and without any support staff. Most other countries reported a great shortage of full-time taxonomists and/or of support staff.

From the questionnaire results it can be seen that the highest number of experts work on invertebrate animals (Table 1). Rather fewer experts study vascular plants and vertebrate animals. Almost half of the experts are zoologists, while botanists working on vascular and non-vascular plants number slightly less. There is an average of 2–4 experts working at each animal and plant collection, although relatively fewer in non-vascular plant collections than those of other types. Relatively few experts work on micro-organisms, although collections of micro-organisms do exist in the region. However, the average number of experts at each micro-organism collection was 0 (for protozoa) to 1 in round numbers (fungi/yeast, micro-algae, bacteria/archaea). The low number of experts for micro-organisms is a barrier to increasing coverage of all species.

When the number of experts in the region is compared to the estimated proportion of species in each major group of organisms compared to the total number of described species (Table 1), the problem is

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more clearly seen.

While some 148 taxonomists study vertebrates, 154 vascular plants and 102 non-vascular plants, these are not considered adequate to cover the known species (both named and as yet undescribed) in these groups. There is a much more severe deficit of taxonomists for protozoa, micro-fungi, micro-algae and bacteria/archaea. Similarly, experts on invertebrate animals are not in reasonable balance with the immense number of species in the region.

An important step to rectify the situation was taken in Indonesia with the recent GEF–World Bank project on biodiversity resources, supported by funding from other countries, has resulted in 19 new staff in the botanical and zoological institutes at Bogor with higher degrees, and one parataxonomist. Aspects of this project might be taken as a model for others.

Maintaining the succession of knowledge and skills base

Three linked issues are dealt with in this section: the demography of existing staff (also touched on in the previous section), the transfer of skills from those staff to their replacements, and the training of those replacements outside of an ‘apprenticeship’ system.

More than 60% of experts from responding institutions are over 40 years old (Fig. 1). This pattern is also observed when the data are examined by country or by group of organisms. The increasing average age of taxonomists was pointed out at the second meeting of SBSTTA¹², and is still true in Asia in 2002. At the 1st GTI Workshop in Asia no single country reported that an active program or policy had been implemented to address the issue that within 10-15 years the region will lose a massive amount of its scientific expertise as taxonomists retire. The current recruitment levels will not provide an adequate taxonomic base for sound decision-making into the future.

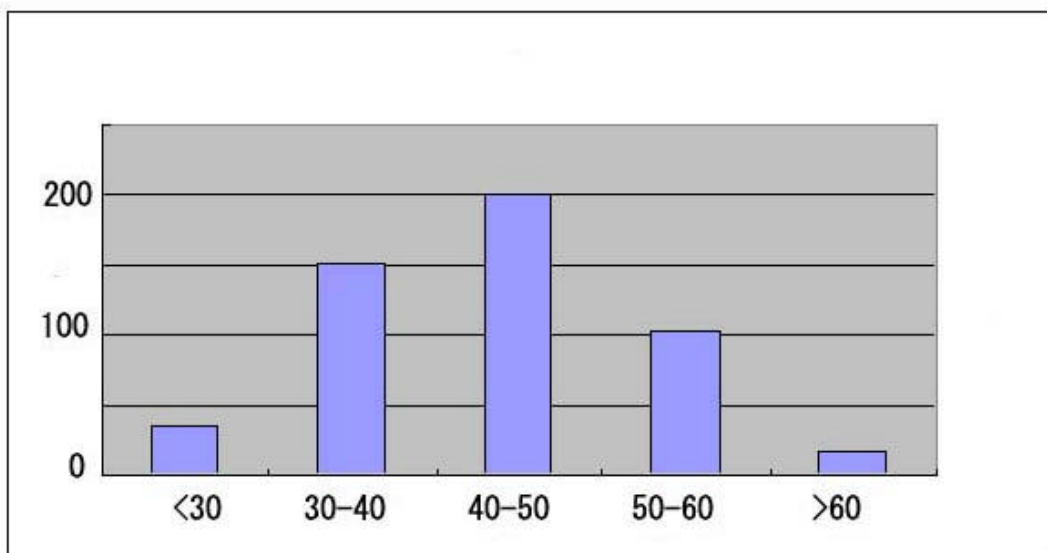


Fig. 1. Age distribution of experts at Asian taxonomic collections.

The y axis indicates the number of individuals. The total number of experts is 831.

¹² UNEP/CBD/SBSTTA/2/5.

To increase the number of young taxonomists, better education is important. This survey indicates that taxonomy is taught in only 30% of secondary schools and is generally regarded as a subject for university/college-level education. Graduate and post-graduate training in taxonomy is provided by institutes outside their country according to 15% of respondents; most of these courses focussing on lower organisms (invertebrates, non-vascular plants and micro-organisms). Some of these courses are in other Asian countries, whilst others are out of the region. Within the region several initiatives were mentioned: the University of Hong Kong is training higher degree students from across the region in mycology, within Indonesia a 6-8 week Regional Training Course on Plant Taxonomy is run at Bogor every 2-3 years, and in the Republic of Korea universities are starting PhD programs covering taxonomy.

Infrastructure

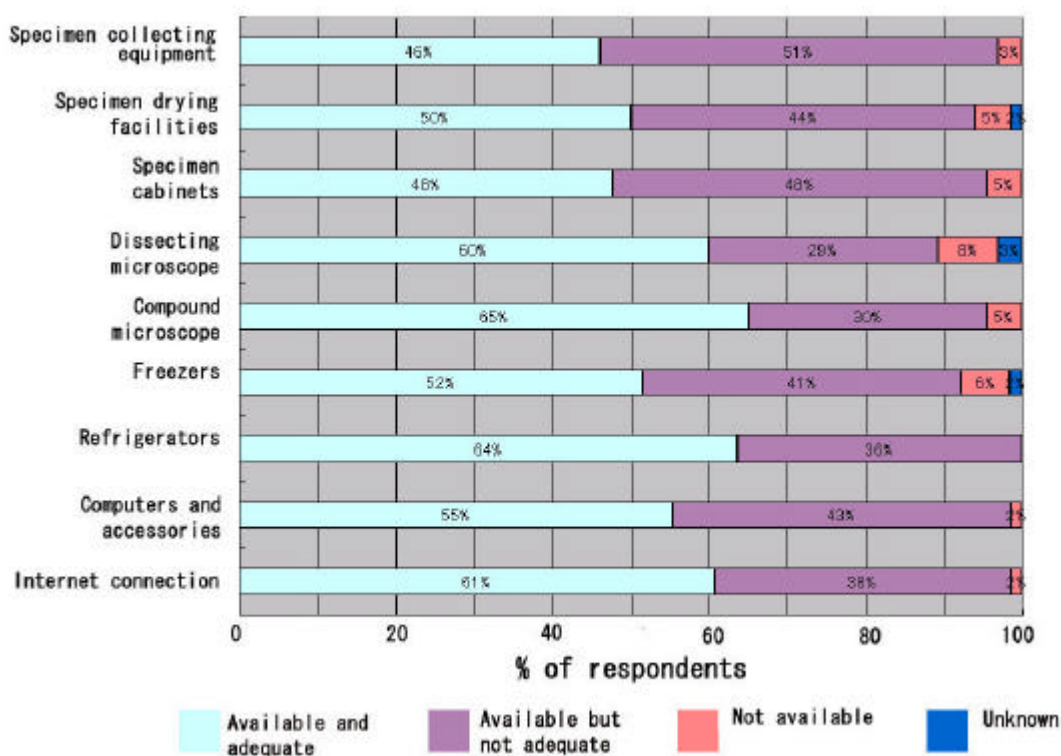


Fig. 2. Availability of basic equipment and facilities for taxonomic studies.

Facilities vary from minimal to good for a variety of historic and economic reasons. The survey sought information on the availability and adequacy in Asia of the major types of equipment required for all facets of taxonomy. Figure 2 provides a synthesis of the results (the total number of respondents varied from 64 to 66 depending on the particular item).

Basic infrastructure for specimen collection, including collecting and drying equipment and facilities, compound microscopes, specimen cabinets, freezers and refrigerators, appears to be available at almost all of the responding institutions, although 30–50% of the respondents stated that such equipment is available but not adequate.

Computers and Internet connections are available at 98% of the respondent institutions, although availability is sometimes not adequate (43% for computers and accessories, 38% for internet connection). In those institutions with inadequate connection, it is likely that the physical connection is possible but cannot be used by taxonomists due to lack of funding to pay access fees. In some cases, email access is available but browsing websites is not allowed due to limited access to a wide area network.

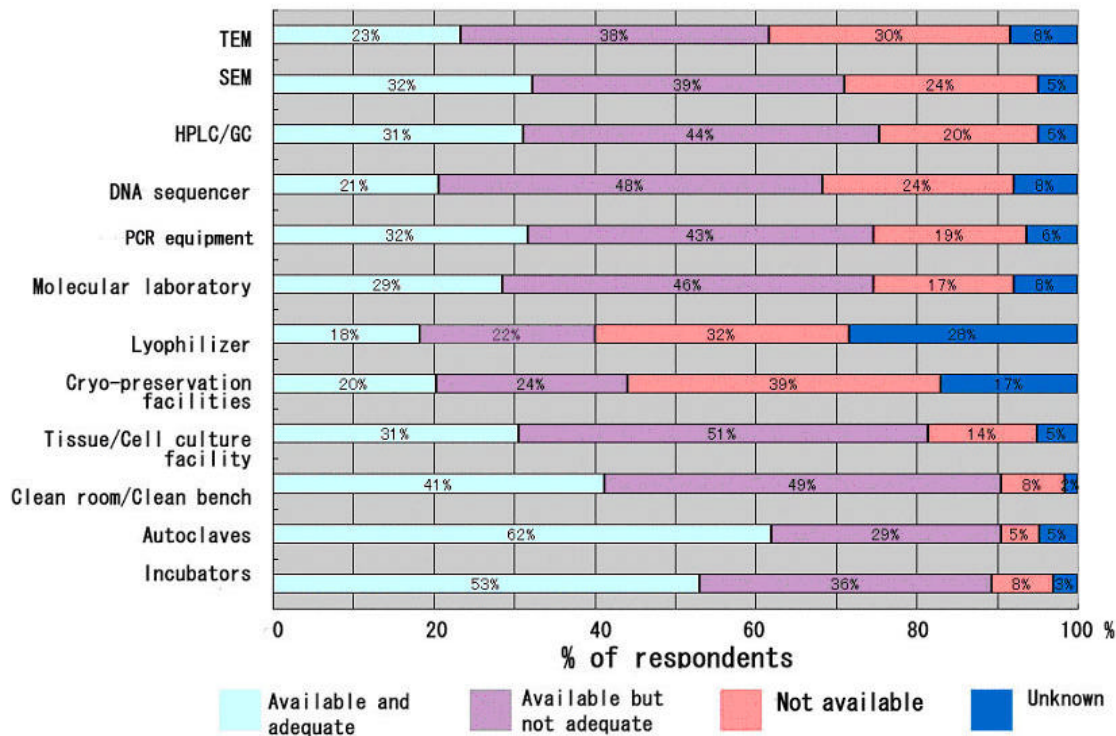


Fig. 3. Availability of equipment and facilities for advanced technology in taxonomy.

The availability of each kind of equipment indicated on the vertical axis is shown in the explanatory note at the bottom. The total number of respondents varies from 60 to 66 depending on the individual item. The figures on the bars indicate the % of respondents for each item.

Availability of equipment and facilities for relatively advanced technology in taxonomy is variable (Fig. 3), as is training for technicians. Scanning electron microscopes are available at 70% of these Asian institutions, and more than half of these also have a transmission electron microscope available. However, the collection-holding institutions that have electron microscopes stated that the TEM (39%) and SEM (36%) are not adequately used. It is understood that ongoing funding is not sufficient for the operational costs for electron microscopy and its accessories in many places, so that while the original purchase of the equipment has been made possible the lack of ongoing funding to operate it means that it stays out of the reach of many scientists, particularly younger scientists.

Tissue culture facilities, cryo-preservation facilities, and molecular equipment for taxonomy are not adequate at 30–60% of institutions. As described in the previous sections and as indicated by this inadequacy of equipment, the regional capacity to study microorganisms is limited compared to the animals and plants.

Several examples of governments responding to these needs were presented to the meeting. The Government of China has put major funding into new facilities for some of its biological collections. In India the government has started a program to improve taxonomic knowledge of neglected groups, and to help in this process has set up four coordinating centres, each with 46 collaborators. In Singapore the government has updated the Raffles Museum facilities and is currently building a new herbarium in the Botanic Gardens, whilst in the Republic of Korea the government has recently opened the Biodiversity Centre to promote taxonomic study.

Location of and access to specimens

Forty-five percent of responding institutions that held major taxonomic collections in their countries did not have their specimen/culture information in database form. Among the organisations with information already in electronic form, 66% of them do not have that information accessible on the World Wide Web.

Type specimens/cultures of all groups need to be accessible for taxonomic studies. However, respondents stated that many type specimens/cultures collected from their own countries are kept outside the country, particularly in the case of animals and plants.

Within the region there have been a number of recent initiatives to make collection data available. For example, Indonesia, Malaysia, Philippines, Singapore and Thailand are collaborating with the National Herbarium, Leiden, and the Department of Botany, Oxford University, on common access to herbarium specimen databases (SEABCIN project). In the Philippines the National Herbarium has started an on-line database of its specimens, while in Singapore the Botanic Gardens is putting images of the type specimens in its herbarium on-line. In the Province of Taiwan the government-funded TaiBNET has databased information on 30 000 species in the past year. Indonesia plans to release their collection management and mapping programs to other countries in the region at the end of this year. As soon as possible thereafter, a training course for taxonomists in this region to learn to how to use these programs would be of significant value.

The following information on collection databasing within countries was provided by participants.

Country/Economy	National collections	Data shared electronically between collections
Bangladesh	yes	
China	yes	Yes
Province of Taiwan	yes	Started on metadata using Species 2000 name database
Hong Kong	in some groups	
India	yes	
Indonesia	yes	Yes
Japan	yes	in progress in some groups
Malaysia	no	strong individual collections; data sharing started
Mongolia	yes	other individual collections
Philippines	yes	just started
Singapore	yes	
Thailand	in some groups	started in some groups
Vietnam	yes	in some groups

Table 2. Electronic databasing of national collections. Data from questionnaire responses.

Analytical and other software

Working group 5 examined the use of free software to increase effectiveness through utilizing broader data pools from collection databases. It focused on mapping software, and then expanded to other software as well as human resource networks to facilitate sharing of collection databases. Some of the results of their work is included in other sections of this report where more appropriate. Members of the working group provided information on map and gazetteer availability that is presented below in tabular form. Countries are omitted from the table if no information was available.

Country/Area	Maps	Gazetteers
China	Yes	Yes
Province of Taiwan	yes	Yes
Hong Kong	Yes	Yes
India	yes [purchase]	Yes
Indonesia	Yes	yes but not comprehensive
Japan	yes [purchase]	Yes
Korea	Yes	?
Malaysia	yes [purchase, expensive]	Yes but not recent
Philippines	yes	Yes but not comprehensive
Singapore	yes	Yes
Thailand	yes [purchase]	Yes but not recent

Table 3. Maps and gazetteers by country Data provided by participants

Mapping Software

A demonstration of UOMAP, a free software program in preparation, was given by Dr. Takeshi Sagara (The University of Tokyo) who is developing the program. The demonstration involved the freshwater collection database of the National Science Museum, Tokyo. When the program is completed, some time in the second half of 2003, it will be usable by researchers with collection databases and matching gazetteers.

Botanists in India are developing BIOCAP, a landscape-level mapping program. Indonesian scientists are developing INSTANTMAP for use with data from individual specimens, or field surveys, which is available from the Indonesian Biodiversity Information website. Many other mapping programs are being developed in other regions of the world including CAMRIS (USA). ARCVIEW is commercially available now, as are world maps for computer use.

In the future, for regional studies, mapping programs will need to be integrated, or raw data from shared databases utilized. An additional problem is that historical data sometimes involve more than small dot points, due to the inaccuracy of old data.

To facilitate future mapping with databases within the region, the following information on availability of maps and gazetteers by country is provided.

Other Software

Within the region, Microsoft Access software is being utilized in India to develop an interactive and user-friendly key for the identification of 50 species of mangroves. The next stage will include a key for up to 650 species. A mapping system of thematic layers (species diversity, richness, etc) is also being developed in India to determine high priority conservation areas. An identification program for 3900 bony fish species is being developed in the National Science Museum, Japan, and will be available on web around the end of 2002.

Appendix 2. Existing networks, initiatives and key partnerships in the Asian region relevant to the GTI¹³

Global networks and initiatives

Name	Acronym	URL
Asia and Pacific Plant Protection Commission	APPPC	http://www.eppo.org/WORLDWIDE/RPPOs/apppc.html
Biological Collection Access Service for Europe	BioCASE	http://www.biocase.org/
BioNET-INTERNATIONAL: the Global Network for Taxonomy		http://www.bionet-intl.org
Botanic Gardens Conservation International	BGCI	http://www.bgci.org.uk/
Clearing House Mechanism of the CBD	CHM	http://www.biodiv.org/chm/default.aspx
Convention on Biological Diversity	CBD	http://www.biodiv.org
DIVERSITAS		http://www.icsu.org/diversitas/
Expert Center for Taxonomic Identification	ETI	http://www.eti.uva.nl/
FishBase		http://www.fishbase.org
Global Biodiversity Information Facility	GBIF	http://www.gbif.org
Global Invasive Species Programme	GISP	http://jasper.stanford.edu/gisp/home.htm
International Association of Botanical Gardens	IABG	http://www.rbgkew.org.uk/bgci/iabg.htm
International Biodiversity Observation Year	IBOY	http://www.nrel.colostate.edu/IBOY
International Organization for Plant Information	IOPI	http://www.iopi.org
International Plant Protection Convention	IPPC	http://www.ippc.int/IPP/En/default.htm
International Pollinators Initiative	IPI	http://www.biodiv.org/decisions – see decision VI/5 on Agricultural Biological Diversity
International Working Group on Taxonomic Databases	TDWG	http://www.tdwg.org/
International Union for the Conservation of Nature	IUCN	www.iucn.org/themes/SSC/whats_new.htm
Microbial Resource Centre	MIRCEN	http://www.unesco.org/science/life/mircen_network.html
Millennium Ecosystem Assessment	MEA	http://www.millenniumassessment.org/en/

¹³ The lists presented here are not exhaustive, but was derived from the knowledge of the workshop participants; other initiatives and institutions are encouraged to communicate with J.Shimura at junko@nies.go.jp to ensure their addition to the list available to the region.

Name	Acronym	URL
Ocean Biogeographic Information System	OBIS	http://www.marine.rutgers.edu/obis
The Species Analyst		http://tsadev.speciesanalyst.net/
Species 2000 UNESCO'S Man and the Biosphere Programme	UNESCO-M AB	http://www.sp2000.org http://www.unesco.org/mab/

Regional networks and initiatives

Name	Acronym	URL
Asian network for ants	AneT	www.geocities.com/aneT_diwpa/
ASEAN Regional Center for Biodiversity Conservation	ARCBC	www.arcbc.org.ph
ASEAN Taxonomic Network (LOOP of BioNET-INTERNATIONAL comprising 10 ASEAN countries, with E. Timor to come)	ASEANET	www.mardi.my/aseanet
Asian Network of Microbial Researches	ANMR	
Biodiversity Information Sharing Service	BISS	http://arcbc.org.ph/new.biss.htm
Australian DIWPA		http://ecology.kyoto-u.ac.jp/~gaku
Crustacea Net – (Web-based system of interactive keys and information about world Crustacea – coordinated by Australian DIWPA (cv))		http://www.crustacea.net
Department of Agriculture, Fisheries and Forestry, Australia	AFFA	http://www.affa.gov.au/index.cfm
DIVERSITAS in the Western Pacific	DIWPA	http://diwpa.ecology.kyoto-u.ac.jp/index.html
East Asian Taxonomic Network (Loop of BioNET-INTERNATIONAL comprising China, Japan, Mongolia, N and S Korea)	EASIANET	http://easianet.ecoport.org
East Asian Network for Taxonomy and Biodiversity Coordinated from S Korea	EANeTBC	
Expert Center for Taxonomic Identification	ETI	www.eti.uva.nl/database/WTD.html

Name	Acronym	URL
International Association of Botanical Gardens Asia Division	IABG	www.rbgkew.org.uk/bgci/iabg.htm
IUCN/SSC Specialist Groups (e.g. South Asian Invertebrates, Invasive Species)		www.iucn.org/themes/ssc/whats-new.htm
Microbial Resource Centre (Bangkok)	MIRCEN	http://wcdm.nig.ac.jp/CCINFO/CCINFO.xml?383
MykoWeb — linkages to other mycological sites – does not cover this region very well		http://www.mykoweb.org
National Geography of Inshore Areas	NaGISA	yshira@seto.kyoto-u.ac.jp or kawai@kobe-u.ac.jp
Pacific Basin Information Forum (just starting)		http://www.pbin.nbii.gov
Pacific Northwest Information Node Pacific Taxonomic Network (Loop of BioNET INTERNATIONAL)	PACINET	http://www.pnwin.nbii.gov
Plant Resources of South East Asia	PROSEA	http://www.prosea.nl/
South Asian Taxonomic network (LOOP of BioNET-INTERNATIONAL under development)	SACNET	
SE Asian Botanical Collections Information Network	SEABCIN	http://storage.plants.ox.ac.uk/brahms/projects/seabcin.html
SE Asian Biodiversity Information Network	SEABIN	
Species 2000 Asia Oceania Website of SE Asian Biodiversity		www-sp2000ao.nies.go.jp sea.nus.edu.sg/organisations/museums/index.ht

Projects with regional or international input

Name	URL
Flora of China	http://www.flora.huh.harvard.edu/china/
Flora Malesiana	http://www.nhncml.leidenuniv.nl/pubs/index.htm#fmal
Flora of Ceylon	http://www.infolanka.com/flora/
Flora of the Province of Taiwan	http://www.pnh.com.ph/
Flora of Philippines	
Flora of Thailand	http://www.forest.go.th/Botany/Flora/Treated_flora.htm
Pacific–Asia Biodiversity Transect (PABITRA) (parallel to DIWPA – IBOY project)	http://www.botany.hawaii.edu/pabitra

JSPS Biodiversity studies in coastal waters of E and SE Asia (Japanese Society for the Promotion of Science)	
GTI pilot project in Asia (Global Environmental Research Fund, Ministry of Environment, Japan)	http://www-gti.mes.go.jp

National networks, bodies and reference centres

Country / Economy	Institute	Acronym	URL
Bangladesh	Biodiversity Research Group of Bangladesh	BRGB	
Bangladesh	Culture collection at Institute of Food and Nutrition, University of Dhaka		
Bangladesh	Herbarium	BNH	
Bangladesh	Herbarium	BRRI	
Bangladesh	Herbarium	BARI	
Bangladesh	ICDDR, Dhaka, (Culture collection)	ICDDR	
Bangladesh	National Botanical Garden, Dhaka		
Bangladesh	National Herbarium		
Bangladesh	National Museum		
China	Chinese Biodiversity Information System	CBIS	
China	Department of Ecology and Biodiversity, University of Hong Kong		
China	Institute of Zoology, Chinese Academy of Sciences, Beijing		
Province of Taiwan	Taiwan Biodiversity Information Facility (includes databases to local experts; species checklist;	TaiBIF	http://gbif.sinica.edu.tw

Country / Economy	Institute	Acronym	URL
	organism database; literature database)		
Indonesia	Herbarium Bogoriense		
Indonesia	Indonesia National Biodiversity Information Network	NBIN	
Indonesia	Museum Zoologicum Bogoriense		
Japan	Biodiversity Center of Japan		http://www.biodic.go.jp/index_e.htm
Japan	National Institute for Environmental Studies		http://www-gti.nies.go.jp http://www.nies.go.jp
Malaysia	Ministry of Science, Technology and the Environment	MOSTE	http://www.moste.gov.my
Malaysia	National Oceanography Directorate	NOD	http://www.moste.gov.my/kstas/nod/default.htm
Malaysia	Quarantine Center, Ministry of Agriculture		
Thailand	National Biological Control Research Center		

Useful on-line databases etc

Name / contents	Comments	URL
GTI National Focal Points		http://www.biodiv.org/world/parties.asp
CBD National Focal Points		http://www.biodiv.org/world/parties.asp
CBD SBSTTA Focal Points		http://www.biodiv.org/world/parties.asp
Chinese Institute of Zoology	Databases included: Taxonomic codes to the Chinese fauna; Species inventory database of Chinese animals;	http://www.ioz.ac.cn

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Institute of Crop Germplasm Resources, China	Endangered and protected species database of Chinese animals; Chinese biodiversity references; Experts; Medicinal animals in China; Chinese biodiversity database index; Fauna Sinica; Zoological journals published in China http://icgr.caas.net.cn
	http://sdinfo.forestry.ac.cn
	http://sdinfo.coi.gov.cn
Institute of Mycology, CAS	http://www.im.ac.cn
	http://www.biodiv.org.cn

Systematic Societies in Asia

Country/ Economy	Societies	Comments
Bangladesh	yes	Biodiversity Research Group of Bangladesh (BRGB)
Bhutan	?	
Cambodia	?	
China	yes	taxonomists listed on Web
Province of Taiwan	yes	taxonomists listed on Web
East Timor	?	
Hong Kong	no	
India	yes	informal, just started
Indonesia	yes	some taxonomists listed on Web
Japan	yes	Union of Japanese Societies for Systematic Biology just established; some taxonomists listed on Web Union of Japanese Societies for Natural History also covers the societies for taxonomy
Laos	?	
Malaysia	yes	just started
Mongolia	?	
Myanmar	?	
North Korea	?	
Pakistan	?	
Papua New Guinea	?	
Philippines	yes	Association of Systematic Biologists of the Philippines established in 1982
Singapore	?	
Republic of Korea	yes	
Sri Lanka	?	
Thailand	no (needed)	some taxonomists listed on Web
Vietnam	no	

Appendix 3. Implementation of the Global Taxonomy Programme of Work in Asia

This preliminary Programme of Work to implement the GTI in the Asian region was developed by the workshop. It is presented under the headings used in the Programme of Work of the GTI as adopted by the CBD COP¹⁴. Where possible the core needs, in so far as they are known, are briefly discussed, some national and regional actions proposed, key partnerships identified, and both short-term and long-term activities given. Very little detail is given in Operational Objectives 4 and 5, since much of the identification of issues there must come from people working in the conservation, sustainable use and access and benefit sharing areas. However, some access and benefit-sharing issues are covered, and there is a treatment of some issues concerned with Invasive Alien Species. In many cases the actors to carry out the recommendations have not been identified, and it is for the wider taxonomic community in the region to work to implement the programme. This is only a first attempt at the process of producing a Regional Programme of Work, and wider consultation including experts from other sectors may lead to its further development.

GTI Operational Objective 1 – Assess taxonomic needs and capacities at national, regional and global levels for the implementation of the Convention.

Planned Activities 1 and 2: Country-based and Regional taxonomic needs assessments and identification of priorities.

Whilst these are separate ‘planned activities’ in the GTI programme of work, the needs are strongly bound together in the Asian region, and to avoid duplication the two are considered together.

1. Core needs

In order to identify the requirements for taxonomic information, skills and infrastructure for full implementation of the CBD, a needs assessment is required. Ideally this should be undertaken both at country level and at the regional level. Such an assessment does not deal in taxonomic resources in isolation, but in terms of user needs for the implementation of the Convention.

2. National and regional actions

Delegates should establish with their GTI National Focal Point or CBD National Focal Point whether or not taxonomic needs assessments have been carried out. If not, steps should be taken to obtain funding for one. The national reports provided by participants at this workshop will be of great assistance in preparing final country assessments.

On the regional level, the initial survey reported here should be extended to be complete and comprehensive (although the report summary presented above already makes it clear that some initial activities are required). In compiling the regional needs assessment use should be made of the national assessments as they become available, and of the preliminary national data presented here. Two other recent reports, compiled by ASEANET and AFFA Australia should also be drawn upon: “Needs assessment in taxonomy of arthropod pests of plants in countries of South East Asia: Biosystematics,

¹⁴ <http://www.biodiv.org/decisions> (go to decision VI/8)

Collection and Information Management”¹⁵ and “Needs assessment in taxonomy and biosystematics for plant pathogenic organisms in countries of South East Asia”¹⁶.

One of the important components of both national and regional needs assessments will be to make contact with initiatives actively dealing with biodiversity issues at these levels, both from the point of view of identifying needs to be met through development of taxonomic resources and with a view to forging partnerships to meet the needs identified.

The opportunity afforded by the needs assessments to forge contacts across sectors, and between taxonomists, other biologists, environmental managers, and Focal Points, should be built upon to encourage further collaboration and to assist the Focal Points in their task of reporting on action in their countries.

3. Key partnerships

National Focal Points for the GTI, CBD, GEF, UNEP and UNDP; government Departments charged with implementing the CBD; regional and sub-regional taxonomic networks, including ASEANET and EASIANET; national, regional and global bodies concerned with aspects of convention implementation. (see Appendix 2)

4. Short-term activities

- a) The questionnaire on taxonomic capacities and needs circulated prior to the workshop to be extended and analysed. Delegates were requested to return extra questionnaires to Dr Shimura (by 1st December 2002) for analysis and presentation to SBSTTA 8 in March 2003.
- b) The results of the questionnaire at the time of the workshop to be put on the workshop web site. Given that some taxonomists lack internet access, copies should be sent to all delegates here to distribute in their own areas. This element was to be completed within 6 months of the workshop.
- c) A directory of the major national and international initiatives and organisations dealing with biodiversity in the region to be assembled, building on the data presented here in Appendix 2. The information to be collected will include institutional names (and acronyms), institutional remit, and contact details.
- d) Delegates to contact their national CBD / GTI Focal Points and discuss the GTI and the need for taxonomic needs assessments.
- e) In the design of the assessments, very particular note should be made of the users of collections. Their needs have to be ascertained, and new innovative uses for collections and their data identified if necessary to meet them.

Planned Activity 4: Public Awareness and Education

1. Core needs

The public image of taxonomy is extremely important. The fact that taxonomy underpins the conservation, sustainable use and IPR issues of biodiversity, as well as other areas of research such as biotechnology, is not widely appreciated. In contrast, taxonomy has a relatively poor image in the area when compared to these other activities, despite its important role in those subjects. There is an urgent

¹⁵ I.D. Naumann & M.Md. Jusoh, 2002, produced by ASEANET and Agriculture, Fisheries and Forestry – Australia (AFFA).

¹⁶ Graeme Evans, Keng Yeang Lum & Leanne Murdoch, 2002, produced by ASEANET and Agriculture, Fisheries and Forestry – Australia (AFFA).

need for taxonomists to interact more with a wide range of stakeholders, including government, decision-makers, environmental managers, conservationists, students and educational establishments, the general public and the media to ensure understanding and support for taxonomy as a basic activity. The Global Taxonomy Initiative itself is generally poorly understood, and its significance in terms of action under the CBD needs to be explained to the appropriate sectors, including other CBD-related initiatives. This latter issue is also addressed below under Planned Activities 5 and 6.

2. National and regional actions

Most of the activities listed below need to be undertaken by individual taxonomists or taxonomic and related institutions. Some activities are appropriate to be undertaken at the national or regional level by, *inter alia*, GTI National Focal Points and regional networks and initiatives.

3. Key partnerships

GTI National Focal Points, Regional networks, EASIANET, ASEANET, AneT, UNESCO, GISP and other regional networks and initiatives.

4. Short-term activities

Contact to be made by participants with delegates to the regional workshop of Global Invasive Species Programme (GISP) held recently in Bangkok to discuss joint issues, significance of taxonomic expertise and information and possible collaborative projects (q.v.).

The long-term strategies laid out below in all cases do not need a lead time to implement, and delegates from the workshop, and other taxonomists, should take the initiative to make the appropriate contacts and highlight the significance of taxonomy to implementation of the CBD, the rationale for the GTI, and the issues for the region arising because of the taxonomic impediment.

5. Long-term strategies

a) Value of taxonomy to other biologists, conservationists etc

- All taxonomists within the region, or working with the biota of the region, must take a more active and sustained PR role as individuals, and make themselves known to people and other biodiversity-based projects who need, whether knowingly or unknowingly, access to taxonomic expertise (including those who have funding to support taxonomic activities).
- Taxonomists should take steps to develop appropriate contacts and target their work to ensure they are involved in the project design stage of other biodiversity projects, and not just brought in during subsequent phases to identify specimens.
- Community awareness / education packages on taxonomy should be developed and disseminated.

b) Disseminating information about the Global Taxonomy Initiative.

- Delegates at this workshop will know more about GTI than anyone else in each country/economy, so need to be active in local CBD implementation to make each government's job easier. They should immediately contact appropriate government officers in their countries, and workers in appropriate sectors.
- Information should be placed on relevant Web pages explaining the importance and attractions of taxonomy. Delegates both individually and through their home institutions and society memberships etc. could create and maintain these.
- Employ a communicator for ca.2 years to package the GTI message on taxonomy in a reader-suited language. The body to carry this out has not been identified.
- Brochures and posters on the GTI programme of work to be made available to a wider audience, especially in zoos and botanic gardens. The GTI Programme Officer of the SCBD to make

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literature available on request; GTI Focal Points to be contacted by delegates to supply SCBD with needs.

- c) Publicising the taxonomic impediment as it applies to Asia
- Publicise the point that taxonomists are aging and few of the younger generation are going into the field of taxonomy, so that action can be taken locally to provide career opportunities to young taxonomists. This can be undertaken by delegates at workshop and taxonomic institutes.
 - Relay the message regarding the taxonomic impediment to the National Academy of Sciences of each country, and to scientific societies, so that they lobby relevant decision-makers. This to be the initial responsibility of delegates at workshop and taxonomic institutes.
 - Funding on the longer term may be available from UNESCO and environment-friendly businesses.

GTI Operational objective 2 – Provide focus to help build and maintain the systems and infrastructure needed to obtain, collate and curate the biological specimens that are the basis for taxonomic knowledge.

Planned activities 5 and 6. Global and regional capacity-building to support access to and generation of taxonomic resources, and strengthening of existing networks for regional cooperation in taxonomy.

Capacity building needs identified by the workshop were, in many cases, appropriately dealt with through existing networks on a regional or sub-regional basis. The two planned activities of the GTI programme of work are most appropriately covered together. There are numerous examples of regional cooperation and of regional projects in Asia, many of which are very active and contributing towards regional needs. These range from regional networks (e.g. for sharing data, or for providing funds for small projects) to projects documenting the diversity of flora and fauna on a regional basis. In some of these projects, the collaborations are conducted through country-to-country initiatives. One key point is that personal contacts between researchers are important and often much collaboration can be achieved through such contacts.

1. Core needs

For convenience, the many needs identified by the workshop, and through the country reports are summarised below under the headings ‘Collections and collection management’, ‘Communication’, ‘Human resources’, ‘Funding’, ‘Identifications and names’, ‘Information’, ‘Infrastructure’, ‘Long-term sustainability’ and ‘Technology transfer’. In general, interactions between institutions and countries across the region, especially in terms of joint research and collecting, and exchange of specimens, need to be simplified.

Collections and collection management

Taxonomic work in support of the CBD cannot continue and be developed without the taxonomists having access to functioning collections, these being an essential tool to support activities. The following needs were identified:

- a) National reference centres within each of the countries in the Region (as noted in CBD COP decision V/9 paragraph 2c).
- b) Local taxonomic centres, at least initially.
- c) Maintenance of microbial cultures (like other collections) is expensive and there is a strong need for funding to maintain such facilities. One possibility is to develop a regional culture collection (e.g. in Japan, and/or MIRCEN in Thailand, in the case of microbiology). Regional repositories or reference centres may also be appropriate for some other taxa.

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- d) Increased support for conservation of specimens, (noted particularly with respect of herbarium collections and marine collections), the issues being collection housing (cabinets etc) and chemical treatments;
- e) Provision for dealing with 'orphan' collections (i.e. those without associated specialists or specialist knowledge) in all countries.
- f) Increased space to store adequate material ('virtual' museums may sometimes be an appropriate solution).
- g) Increased core funding for curatorial staff, to ensure the maintenance and development of the collections.
- h) Increased availability of collection management handbooks.
- i) Demonstration to funders that there is a value for comprehensive collections to enable and support work focussed on priority areas (see also education and awareness-raising).
- j) A DNA directory for microbes.

Communication

- a) Many taxonomists in the region are unaware of international activities such as BioNET INTERNATIONAL and DIWPA. There is generally poor communication between CBD COP and CBD SBSTTA delegates and scientists concerning CBD/GTI issues involving the taxonomic community. The taxonomic community itself needs to be made more aware of issues identified in the Convention process. Because of these communication difficulties individuals and institutions are missing possibilities of participating in projects, opportunities of funding, and informing their national representatives of convention-related taxonomic needs. Similarly, the same national representatives are hindered in their work of gathering information within their countries, and ensuring they are as effective as possible in ensuring CBD implementation.
- b) There is a need to improve communication between taxonomists in the region; there is limited use of existing networks – personal communication is important. There is also poor electronic access for communication and information-gathering and dissemination.
- c) To facilitate communication, and support strengthening of links and network development, information on the existing expertise, institutions, collections and courses available within the region, or relevant to the region, is required.

Funding information and needs

Funding is in general is inadequate to support long-term salaried scientists, technicians, and materials. This was noted as especially so in Malaysia, Indonesia, and Philippines for microbial taxonomy. In Thailand the need for competent taxonomists and database people was recognised. It was noted that the existence of the CBD process helps in the justification for funding for appropriate projects and capacity. However, there is still reluctance among some funding bodies to fund any taxonomic projects, especially in micro-organisms.

An issue raised was the ability to apply for funding and knowledge of the donors and their requirements. In general, individual scientists apply for funding, and their parent institutes seem not to have individuals trained or with the responsibility of preparing proposals and with appropriate knowledge of donors. Some institutions do, however, employ consultant to write proposals.

Human resources

- a) The demography of staff is inappropriate to the growing needs for taxonomic expertise, with an aging population of taxonomists and too few younger researchers, technicians and curators.
- b) There is inadequate staffing, in terms of total numbers of full-time taxonomists and support staff.
- c) The knowledge base in the region is patchy, notably including a poor coverage of many taxonomic groups, especially lower organisms such as lichens, fungi, protozoa, microalgae, and bacteria.

- d) There is a requirement to address declining interest on conventional (morphological) taxonomy against molecular taxonomy, whilst ensuring that molecular techniques and expertise is available.
- e) Career and job opportunities in taxonomy are insufficient to meet the needs of the CBD, and should be expanded.
- f) Often Asian taxonomists do not publish enough due to lack of training or confidence in their work.
- g) Training is needed to enhance skills of existing staff.
- h) Insufficient numbers of young students are taking up taxonomy.
- i) There is a shortage of teachers of specialist taxonomy.
- j) Regional training courses are needed (e.g., the courses organised by Bogor), as well as others (e.g. national, institutional, university-based, out of country etc). Recipients of such training should include young taxonomists and parataxonomists, and coverage will include collection management techniques and use of selected databases (e.g. BRAHMS), perhaps with standardisation of the software at the regional level.

Identification and names

Whilst there is a clear intention and need to develop capacity within the region, there will always be a need to obtain identifications of organisms outside countries and the region. This will be both in terms of meeting problems as they arise, and also developing the reference capacity of collections held within the region. Issues raised in connection with this were:

- a) Restricted access to collections held outside the countries of origin, and a concomitant need for repatriation of data, including data associated with type specimens;
- b) Simplified access to type material, including through images made available on the web;
- c) Free access to types and type strains (microbiology) for all taxonomists;
- d) Provision of authoritatively identified specimens, with up to date nomenclature;
- e) Prepared but unsorted specimens need to be identified (a partial possible solution was identified with the suggestion of taking digital images and sending them to specialists);
- f) Development of protocols for the treatment of raw samples of groups not under study in mass collection projects. Issues include:
 - Legal restrictions preventing specimens to be sent to other countries without permission;
 - Expense of sending specimens abroad;
 - Balancing the costs of storage of material against other collection needs;
 - Dislike of discarding collected material among collection managers and researchers a.
 Some possible solutions were suggested, and concomitant requirements:
 - Information from other countries on what might be exchanged with whom – ‘market research’ is needed;
 - ‘Advertising’ holdings to encourage visitors to work on material , with a need to database mass unsorted collections;
 - Global database of specialists. This is being developed in the region by ASEANET, EASIANET and GTI focal point of Japan. Globally the ETI list of taxonomists is intended to meet this need, although notably no non-European members of the working group had registered themselves on this database. Internet access was identified as an issue in this regard.
- g) Permission to collect specimens in some countries, leading to problems in research. (see further under ‘Access and benefit-sharing’ below)
- h) Cost of obtaining identifications from some institutions.
- i) More publications at all levels of knowledge: from specialist taxonomic publications to field guides, CD-ROMs, general information on-line, etc. Publications should cover marine areas as well as terrestrial.

Information requirements

Many libraries within the region are insufficient; there is a restricted access to taxonomic literature, both old and recent. There is consequently a need for more literature, including in digitised format. The

high cost of journals is a limiting factor, and the poor availability of computers and internet access in some areas also hinders access to digitised data.

Infrastructure

- a) Overall the infrastructure is inadequate (including aging buildings and equipment).
- b) There are inadequate facilities in most cases for collection storage and taxonomic research.
- c) In many cases access to computers and the internet is inadequate.

Long-term sustainability

- a) There is a need for sustainability of taxonomic institutions (cf COP IV/1.D, para 11.a)
- b) There is also a need for long-term planning e.g. predicting storage needs arising from increasing collection size. For example, Bogor has a long-term programme; CAS have long-term funding for training. Other institutes do not have long-term planning.

Technology transfer

- a) Equipment for special fields, for example molecular studies, is needed, especially to allow microbiologists to gain the data locally needed for them to publish species descriptions in international journals.
- b) More IT support and internet access is needed across the region.

2. National and regional actions

Taxonomists are encouraged to participate in projects locally and regionally. One mechanism to ensure this is to provide appropriate funding, training and career-path development. Graduate and postgraduate students should be more involved in taxonomic research, noting that this is usually contingent on professorial grants, although perhaps industry scholarships are possible.

3. Key partnerships

BioNET-INTERNATIONAL; ASEANET; EASIANET; SACNET; Species 2000 Asia Oceania; the ASEAN Regional Center for Biodiversity Conservation (ARCBC); the South-East Asian Biodiversity Information Network (SEABIN); convention mechanisms (e.g. CITES); existing scientific societies, systematic associations, and organizations such as World Federation of Culture Collections.

4. Short-term activities

An international (regional) committee should be formed, including national GTI or CBD focal points, to organize training, establish standards for data collection, and coordinate training workshops for sectoral issues, starting with quarantine and agriculture. Regional collaboration is needed to ensure adequate specimens/cultures are available for easy identification and for further taxonomic research in these groups.

Collections and Collection management

- a) Improve physical conditions for collections. For selected small to medium collections, establish improved collection conditions (simple and cheap methods for improving collection security) and use as pilot for others.
- b) In discussions with government departments raise collection-related obligations under the CBD as stated in COP decisions.
- c) List regional collection resources on the Web, using existing Websites, e.g. Bishop Museum in Hawaii. The following to be created, among others:
 - o directories of relevant types and type photographs, species and specimen databases;
 - o Collections at oversight level (i.e. by higher taxonomic grouping);

- collections held in detail [for some ASEAN countries and Leiden (plants), this is being done under SE Asian Botanical Collections Information Network];
- URLs of available country maps (with scale) and gazetteers in region (1:100,000 appropriate for regional studies). (N.B. Indonesia plans to release their collection management and mapping programs to other countries in the region at the end of this year. As soon as possible thereafter, a training course for taxonomists in this region to learn to how to use these programs would be of significant value.)
- d) Improve arrangements for specimen transfer and living culture transfer and make information available. Establish loans policy and system.
- e) Develop parataxonomists to increase collections.

Communication and networking

- a) A regional society of systematic biologists should be set up, with an Asian–Pacific coverage and national representatives. Its roles will include linking national societies (e.g. the Biodiversity Research Group of Bangladesh, the Association of Systematic Biologists of the Philippines, national mycological societies etc.). Associations of Biologists in the Pacific region could be approached with a view to an alliance. Key personnel to set this in motion have not yet been identified.
- b) Links within and between regional networks and other initiatives and their coordinators should be strengthened, and their national and regional coordinators are urged to take steps to ensure this happens.
- c) National societies should become more actively involved in GTI, etc. Such societies should contact the National GTI or CBD focal points of each country to make them aware of their existence and potential involvement, and to offer partnership in implementation of the GTI. Delegates at the workshop should contact presidents/chairs of their societies, urging them to make contact with GTI / CBD national focal points.
- d) Directories for the region covering a number of aspects of work should be produced and made available. The data will be made available via a web site (although other means of communication are needed as well), initially using the GTI server at NIES. Although some of these data can be collected and made available in the short term, the project will require funding (est. 3 million yen p.a.) if it includes on-line forms for adding entries to directories (for setting up forms and maintaining them), and for maintenance. In addition to the Japanese web site, other initiatives and individuals offered their assistance, as indicated below. Directories will include:
 - Software for taxonomic projects, especially free programs for species and specimen databases, mapping, identification keys. Indonesia plans to release their collection management and mapping programs to other countries in the region at the end of this year. As soon as possible thereafter, a training course for taxonomists in this region to learn to how to use these programs would be of significant value.
 - Centres of expertise in the region, including information on the institution, address, email address and areas of expertise. A directory was planned to be completed in three months, and hosted by ASEANET. The project was to be coordinated by Dr L. Cardenas with the GTI national Focal Points, and the– ASEANET National Coordinator for Thailand.
 - Major national and international initiatives and organisations dealing with biodiversity in the region (see Appendix 2).
 - Taxonomists, following the format of the World Taxonomists Database (www.eti.uva.nl), which includes name, institution address, email address, specific fields or major taxa of interest. Participants at the workshop were asked to send particulars within three days of returning home. ASEANET offered to put information on its Webpage within three weeks, with the aim of producing a comprehensive list in two months. Other main actors will include EASIANET, SACNET, the Japanese national GTI Focal Point and Species 2000 Asia Oceania. Coordinators responsible for the various taxonomic groups were identified: Plants – Dr Ruth Kiew of Botany Asia Network; Fungi – Dr Kevin Hyde; Vertebrates – Dr Keiichi Matsuura; Invertebrates – Dr Jambari; Insects – Dr Christoph Haeuser; Bacteria – Dr Junko Shimura; Micro-algae – Dr Phang.

- Courses or attachment/fellowships offered within the region by centres of expertise, etc. The information needed includes: courses offered, web page, description, fee, length of course, date of offering, language used, qualifications required by participants. Data were required in three months, with the prime actors being NIES, ASEANET and EASIANET.
 - Web list of available country maps (with scale) and gazetteers in region (1:100,000 appropriate for regional studies).
 - List of identification guides.
 - National workshops/training courses in collection database management (particularly important where no national systematic societies are present).
- e) E-mail listservers to facilitate contact between specialists with the same field of interest should be set up, either by specialist networks and research partnerships, via existing networks, or by individual specialists. GTI regional workshop participants and specialists of nemereans are listed on the listserv of Species 2000 Asia Oceania. The address is gtiao@sp2000ao.nies.go.jp and nemertes@sp2000ao.nies.go.jp, respectively. To subscribe to them contact junko@nies.go.jp.
- f) Network of microbial culture collections and living collections.
Bacteria/archaea, fungi, micro-organisms, germplasm, and macro-algae all require similar storage. A network should be developed of people who are currently working in isolation: value-adding, help each other build capacity, develop a directory, help to identify and fill gaps, standardize diagnostic techniques, emphasis on biodiversity. At present there are different objectives in different organizations, some have industrial applications. In the UK, such a network was formed, which led to a benefit in marketing and efficiencies of scale.

Identification resources

- a) Compile a list of identification guides available on Web.
- b) Diagnostic Networks – based on tools being used to identify taxa, should be investigated.
- c) Regional cooperation to name particular groups/identify unsorted collections.
- d) Develop global networks for taxa needed to make contacts and aid identification.

Human resources: training

- a) Regional and national workshops/training programs in, e.g., taxonomy of certain groups, database management, collection management (particularly important where no national systematic societies are present).
- b) A directory of courses or attachment/fellowships offered within the region by centres of expertise, etc. would be of value in identifying training opportunities.
- c) Universities should be encouraged to enhance taxonomic training.

5. Long-term strategies

- a) Institutions to develop long-term strategies, including
 - a marketing strategy, promoting the understanding of the importance of taxonomy, using the example of Bogor, and the 1995 UNEP document ‘Global Biodiversity Assessment’;
 - a business plan, identifying how they can make an income from collections, e.g. private sector funding; taxonomic ecotourism (e.g. guide books for tourists; brochure for national parks).
- b) Community participation should be encouraged.
- c) Stakeholder meetings should be held to identify user needs and how to meet them (as in the recent SABONET meeting)
- d) Establishment of a research associate system for institutions and networks.
- e) Develop a Microbial Culture Collection Network, noting that microbial taxonomy is of relevance to all thematic areas and cross-cutting issues of the CBD. Indications of the regional capacity pertaining to human resources and infrastructure are given elsewhere in the report.

- Coordination mechanism – Build on the experience of the past five years of the Asian Network on Microbial Research. Japanese funding for this has concluded but the network is still virtual; its activities involved specimens/cultures and bioinformation.
- Important to show the benefits (e.g. multiple uses) of long-term collections. Note the relative values of *ex-situ* collections rather than in situ conservation and the necessity to maintain culture to enable correct identification of material collected from the natural environment in the future.
- Participation – Build on the track record of the ANMR. Involve the National Biological Resources Center as a possible leader. MIRCEN could act as a regional centre but needs additional support.
- Funding. Possibly, *Inter alia* GEF. Need to specify the benefits to business of being involved in funding.
- Timing– Resurrection of the ANMR should be achievable quite quickly, given that it is virtual, but must conform to the Japanese fiscal year in terms of crafting a proposal. Plan to have meetings with all stakeholders, including scientists and industry.

Operational Objective 3 – Facilitate an improved and effective infrastructure/system for access to taxonomic information; with priority on ensuring that countries of origin gain access to information concerning elements of their biodiversity

Planned Activity 7. Develop a coordinated global taxonomy information system

1. Core needs

Mechanisms need to be developed to share information at the local level, and make data from the major herbaria or museums more easily available. Such information includes literature, species information, specimen data and checklists for taxa. The latter information will assist in the preparation of national and regional checklists. Where possible material in non-English literature needs to be translated to English. Issues of maintaining data in perpetuity, and of data-sharing (noting the need to maintain ownership or **PR**) need to be addressed. There are issues of standards for data exchange /sharing. These are being addressed by various groups, e.g. the taxonomic data working group (TDWG), and regional involvement in these needs to be at an appropriate level.

Although much of the discussion below is centred on electronic resources, printed resources are also important. Needs regarding conventionally published information have been mentioned above.

2. National and regional actions

Software will soon make it easy to link individual institutes' databases, obviating the need to centralise data. In this context interoperability of different database systems is important for sharing data. The issues is being addressed by various IT research groups, e.g. Species 2000, Species 2000 Asia Oceania, The Species Analyst, EU projects (W. Berendsohn et al.), and links between institutes and networks in the regions and these initiatives should be developed and maintained.

3. Key partnerships

Species 2000, Species 2000 Asia Oceania, The Species Analyst, BioCASE, GBIF, TDWG. FishBase (www.fishbase.org), SEABCIN.

4. Short-term activities

- a) Existing databases of specimen data and checklists for taxa should all be made accessible on-line.
- b) A list of local and regional databases on websites should be compiled and made accessible on-line (with a hard copy list in the near future).

- c) Data-sharing and the use of the Web are important for future communication in Asia. Initiatives, institutes and researchers should make contact with appropriate data-sharing initiatives and seek to participate in their activities (e.g. GBIF, OBIS, Species 2000 and Species 2000 Asia Oceania, FishBase, SEABCIN). GBIF could facilitate such participation by:
- providing arguments for national benefits, especially to governments, noting the immediate benefits for scientific community, that obligations for sharing data are free of risk (the provider retains control), and giving examples for overall benefits at national level (e.g. Mexico and CONABIO)
 - clarifying the required establishment of Participant 'Nodes' in GBIF (one node as a minimum requirement, with no implication for centralisation at national (or regional) level)
 - supplying a 'toolkit' to interested local institutions / individuals in non-participating countries.
 - Participation in forthcoming "Joint International Forum on Biodiversity Information: Building Capacity in Asia and Oceania" in Tsukuba, Japan (October 2003). This will be held in conjunction with GBIF (<http://www-gti.nies.go.jp/forum2003/>).

5. Long-term strategies

- a) A project to compile and coordinate a database of type specimen information for local taxa to be set up, possibly in association with GBIF.
- b) A project to compile regional inventories (checklists, floras and faunas) to be set up.
- c) Initiatives and institutes in the region should work with GBIF work programs in the following areas:
- a. Electronic Catalogue of Names of Known Organisms [ECAT]
 - Start to interlink large regional databases
 - Accommodate and retrieve local/regional checklists
 - Host orphan (local) databases
 - b. Digitisation of Natural History Collection Data [DIGIT]
 - Provide access to type specimen information, esp. for local fauna/flora
 - Incorporate and remain compatible with existing db solutions (e.g., BRAHMS <http://storage.plants.ox.ac.uk/brahms/> , 'Platypus' <http://www.ea.gov.au/biodiversity/abrs/abif/platypus/> and 'Specify')
 - c. Data Access and Database Interoperability [DADI]
 - Provide open source software and (free) IT support
 - Develop/distribute tools to facilitate routine taxonomic work (compilation of checklists and catalogues, interactive identification guides, etc) eg TaxoNote
 - d. Outreach and Capacity Building [OCB]
 - Facilitate Internet access
 - Allow access and develop applications in many different languages
 - Conduct local training courses
 - e. Digital biodiversity literature resources
 - Provide access to old and rare taxonomic references, acting as broker for problems with copyright, IPR, legal issues.

GTI Operational Objective 4 – Within the major thematic work programmes of the Convention include key taxonomic objectives to generate information needed for decision-making in conservation and sustainable use of biological diversity and its components

Taxonomy is essential for the study, conservation and sustainable use of biodiversity, and for ensuring equitable access to the benefits of its genetic resources. The projects suggested below would include extensive collecting to build up correctly identified collections, checklists, keys, etc., particularly for poorly known taxa or ecosystems. For prioritising these, the group gave weight to projects that considered common and urgent concerns with social impact.

Asian ecosystems include many special communities with high levels of endemism. Among the terrestrial systems on this class, and which are most threatened, are those associated with limestone, caves, mountains, swamps, forest canopy and tree holes and phytotomata. Vegetation on ultramafic or on soils of high metal content is important, as are island ecosystems. Inland water and marine and coastal systems important to prioritise are mentioned below under the appropriate planned activities.

In the long term need ecosystem-based taxonomy projects such as limestone ecosystems, freshwater ecosystems, coastal zone ecosystems and agriculture-based ecosystems.

Planned Activity 8. Forest biological diversity

No specific needs were identified by the workshop under this activity, although the immense significance of the forest ecosystem within the region was emphasised. Note was taken of the importance of canopy biodiversity and the fauna and flora of tree holes.

Planned Activity 9. Marine & coastal biological diversity

1. Core needs

Ecosystems within this planned activity that were noted as important in terms of endemism and threat status were small (marine) islands, deepsea vents, sea mounts and the interstitial environment.

2. Key partnerships

Within the region several projects involving Japan are under way, including a GTI Pilot Project. The Ocean Biogeographic Information System is active in the region. Other relevant projects being undertaken at present include:

- A study of a small Indonesian island (DIWPA, Kyoto University)
- Investigation of impacts on small-island biodiversity resources (USM; National Oceanography Directorate, MOSTE)
- Birds and plants on Philippine islands
- Meiofauna in seagrass beds (Thailand)
- Island-biogeography study of mosses (University of Singapore).

3. Short-term activities

Participation in forthcoming JSPS Langkawi Meeting of five countries, coordinated through the Ocean Research Institute of Tokyo University. This is a 10-year project, using an existing network of marine biologists.

5. Long-term strategies

A collaborative project on tropical small island biodiversity should be developed on a regional basis, possibly under the leadership of Indonesia as an archipelagic country.

- Rationale – small tropical islands have a range of major ecological habitats (e.g. coastal forest, mangrove, coralreef) and are susceptible to human perturbation, including introduction of alien species. Such islands generally have high endemism, and require taxonomic examination to provide the tools for adequate management.
- A strategy for longer-term activities has to be developed. New collecting of some taxa (e.g., birds, fish, vascular plants) may not be necessary, especially if good image libraries are built up, otherwise voucher specimens will be needed to ensure taxonomic reliability, as well as subsequent verifiability and repeatability. For new collections, the costs of labour-intensive collecting, preserving, labelling and databasing need to be accommodated in the project.
- A coordination mechanism is required to link existing activities.

- Participants – Ecologists, taxonomists, national and regional museums and herbaria. Possible funding agencies include UNESCO Island Ecology Program, DIWPA, ISME (mangrove ecology), and International Coral Reef Institute (ICRI), etc.

Planned Activity 10. Dry and sub-humid land biodiversity

No priorities were identified by the meeting in this area of activities under the CBD.

Planned Activity 11. Inland waters biodiversity

1. Core needs

There is an urgent need to have detailed biological inventories of fresh water ecosystems in the region, since they are of vital importance as water sources and are being rapidly degraded. The region includes riparian systems, lakes and rivers and estuaries with high levels of endemism. No actions were identified in this aspect of work, but it was noted that key partnerships should be developed with RAMSAR and the Peat Swamp Project. The Penang Declaration was noted as pertinent to this topic.

Planned Activity 12. Agricultural biodiversity

Taxonomy is of particular importance in identification and building up reference collections for agricultural pests and diseases and in terms of biotechnology resources.

Planned Activity 13. Mountain biodiversity

Although the biodiversity of mountain ecosystems was identified by the workshop as being particularly important in terms of convention implementation, no particular activities or needs were identified in this area.

GTI Operational Objective 5 – Within the work on cross-cutting issues of the Convention include key taxonomic objectives to generate information needed for decision-making in conservation and sustainable use of biological diversity and its components.

Planned Activity 14. Access and benefit-sharing

1. Core needs

The issues for countries in the region regarding access and benefit-sharing matters discussed by the workshop come under two headings:

- a) Issues arising from national legislation covering transboundary research and transfer of specimens between countries;
- b) Issues pertaining to identification of taxa to protect stakeholders' rights to the benefits of genetic resources within the region.

Most of the discussion centred on the first issue. Addressing the second issue will involve considerable joint work across the region to clarify species identities and their distributions. The text below is focussed on transboundary issues and specimen transfer.

Species and ecosystems do not adhere to national boundaries, and therefore to be effective and avoid costly duplication much research activity must be carried out across borders. Concomitant with the partnerships established to carry out such research, specimens may be transferred between partner countries for the purposes of taxonomic study to underpin implementation of the CBD. Action is needed on the issues of gaining permission for research, collecting and loans.

2. National and regional actions and recommendations

Networks, partnerships and joint projects within the region should be backed by Memoranda of Understanding (MOUs) between the partners drawn up before joint work commences. The coverage of these should include, as appropriate:

- Agreement at government and science institutional levels, either as a blanket agreement at the national level covering any project, or at an institutional level on a project by project basis. Regulations must be in the spirit of collaboration.
- Designation of institutions to handle the MOU in each country;
- Clarity on the distinctions between bioprospecting and commercialisation on one hand and taxonomic research in support of CBD implementation on the other, to ensure prior informed consent by stakeholders;
- Issues regarding benefit sharing (including data and information, specimens, profit, Intellectual Property Rights). Prior informed consent should be sought as to any subsequent use of specimens collected under the auspices of the MOU, as recommended in the Bonn guidelines¹⁷.
- Deposition of specimens/cultures collected. For example,
 - Holotypes and single specimens collected during the course of a study might be deposited in the country of origin. Other specimens and cultured strains might be divided equally between the participants, where facilities are available. Where the specimens are deposited will depend on the type of specimen – plant, animal or microbe.
 - Paratypes and isotypes should be deposited in more than one location if possible, for security in case of loss.
 - Information and publication should be shared between the collaborating institutions.

Issues concerning permission to collect and conduct research need to be streamlined to facilitate implementation of the Global Taxonomy Initiative.

- The permit system is a sometimes a barrier and should be simplified for scientific work in support of implementing the Convention.
- A streamlined approach to obtaining permission for taxonomic research under the GTI is required. ‘Competent national authorities’ should have information on what permits are needed and where to get them. The ‘Bonn guidelines’ on Access and Benefit Sharing (paras 11L, 34, 36F, 42E and 63B) give some guidance for collection and use of specimens for taxonomy, and can be consulted.
- Dialogue between taxonomists and policy-makers on the issue of permits for collecting, research, import and export should take place.

3. Short-term activities

- Collective lobbying by taxonomists to help persuade governments to develop regulations for access and benefit sharing issues that encompass the specific needs of the GTI, and do not hinder the implementation of this aspect of the CBD.
- Delegates to contact their CBD National focal point and ask for action on the notification on Access and Benefit-sharing issued by the Executive Secretary on 23 July 2001.
- Delegates to share information on permit requirements in their countries and disseminate through ASEANET, EASEINET and other regional networks.
- Delegates should refer to the Bonn guidelines to understand their implications for taxonomic research in the region. Delegates should also refer to the information document on Access and benefit-sharing and the GTI that went to the working group that developed the Bonn Guidelines (see page 13-29 of the PDF file at: <http://www.biodiv.org/doc/meetings/cop/cop-06/official/cop-06-06-en.pdf>).

¹⁷ <http://www.biodiv.org/decisions> (see decision VI/24)

Planned Activity 15. Invasive Alien Species

1. Introduction

Invasive alien species are an established problem in the area, and one that has been largely overlooked by government and taxonomists. There is a growing appreciation of the invasive species issue, which has been the subject of intense global discussion and study over the past decade. Coordination of effort across political boundaries is a promising approach to dealing with this global, multidisciplinary problem.

2. Main issues

- People want lists, i.e. to be told what species to look out for, rather than to create their own lists from risk assessments; solution is possibly to pool efforts into a regional pest risk analysis.
- The baseline biodiversity data of the region is either inside the heads of experts, in collections, or in widely scattered scientific literature and not standardized or shared.
- To identify invasive alien species, a list of unwanted species is needed to guide the development of identification tools – different sorts of tools are required, depending upon the expertise of the user.
- Projects that are needed for combating invasive alien species include holding workshops to train the trainers, creating species lists and identification tools, etc.

3. Synopsis of current capacity and gaps

- Gaps exist in expertise in invertebrates and micro-organisms; flora seems “do-able”.
- Policy concerns e.g. that governments promote the planting of non-natives

4. Baseline needs for maintaining and developing institutional, infrastructural and other resources

- Internet access and information sources (URLs)
- Computer hardware and technological know-how
- Hard copy compendia
- CD ROMs such as CABI compendia
- Species lists from neighbours and from own country
- Identification tools, including simplified ones for non-taxonomists
- Mechanism for telling people what is available
- At least one taxonomist in the region for each key group
- Linkages between taxonomists, specialists, and quarantine officials
- Capacity to do surveys for invasive species
- Secure reference collection, including representatives of key species

5. Regional actions

- Development of an international (regional) committee (including national focal points) to organize training, establish standards for data collection, and coordinate training workshops
 - An initial workshop for the committee might include:
 - Define policy needs
 - Examine technical capacity
 - Determine priority ecosystems and species of concern
 - Identify baseline information, pathways, vectors
 - Identify highest priority sites for survey
 - Best way of organizing information/reporting/IPPC obligations
 - Determining who should coordinate, post-workshop
- Regional coordination established through a designated national focal point, the GTI focal point or alternate.
- Scientific and cost benefits of regional activities and centres should be demonstrated:

/...

- By utilizing existing models of cost benefit developed outside the region.
- Perform local biodiversity studies, including baseline studies before species arrival and contrast with invaded systems
- Promote and publicise such studies and showcase examples.

6. Key partnerships

- Invasive species detection initiatives or surveys for invasives
 - Ecologists, parataxonomists, volunteers, NGO's, the general public, farmers, transporters, foreign horticulturalists, naturalist guides, schools
- Agencies responsible are not fully developed in many countries; this was mentioned as a possible resource that should be compiled. The growing LOOP network is a good place to start.
- Organizations, national examples:
 - National Biological Control Research Center (Thailand)
 - Quarantine Center, Ministry of Agriculture (Malaysia)
 - Organizations, regional examples:
 - AFFA
 - MAF
 - Organizations, international example:
 - Global Invasive Species Programme (GISP)
- Neighbouring developed countries and those with trade/traffic links
- Policy makers and regulators

7. Short term activities, including possible pilot projects with quick returns ('Low hanging fruit')

- Participants at the workshop should make contact with local delegates to the regional workshop of Global Invasive Species Programme (GISP) held recently in Bangkok to discuss needs and possible collaboration on invasive species.
- The development of a 'flying squad' to produce regional cooperation for survey of IAS should be considered.
- Development of a database for regional use which covers problem species, with details of how to identify them.
- Set up training workshops to determine what are the key invasive species in each country. Include an expert from each group of organisms having invasive species. The emphasis should probably be on incipient invasives, rather than established pests.
- Establish a network of focal points (GTI or designated alternate) to accumulate the following standardized catalogues of information:
 - Experts
 - Datasets
 - Organizations
 - Projects
 - Species lists
- Build up participation in (free) listservers e.g. aliens-L, pestnet, etc.

8. Measurements of success

- Presence and rate of flow of information.
- Compiled lists.
- Successful containment of IAS.

9. Long-term goals/projects

- Establishment of a new regional institute for invasive species control; including taxonomist/biocontrol collaboration.
- Long term monitoring plots.

Table 1 FIT OF PROPOSALS WITH THE OPERATIONAL OBJECTIVES OF THE GTI PROGRAMME OF WORK

Operational Objective	Matching proposal on alien invasive species
1: Assess taxonomic needs and capacities at national, regional and global levels for the implementation of the Convention.	<i>Activities will identify needs and existing capacity to develop: *Early warning system *Diagnostic tools, for all life stages *Information; filling the gaps, e.g. degree of infestation *Training new taxonomists in particular areas that have invasives; train specialists for particular taxa *And highlight places where closer ties are required between ecologists and taxonomists for complete coverage of the problem</i>
2: Provide focus to help build and maintain the human resources, systems and infrastructure needed to obtain, collate and curate the biological specimens that are the basis for taxonomic knowledge.	<i>*Activities have goals to designate specific reference centres for invasives *Specific natural history centre for training and display of specimens *"Focus" is also upon an issue of emergency economic importance. *If the project is regional or national, a designated centre is necessary *Each country should have its own specialist who is connected to a network of specialists</i>
3: Facilitate an improved and effective infrastructure/system for access to taxonomic information; with priority on ensuring that countries of origin gain access to information concerning elements of their biodiversity.	<i>*Creates a distributed database with information that is presented in a standardized format</i>
4: Within the major thematic work programmes of the Convention include key taxonomic objectives to generate information needed for decision-making in conservation and sustainable use of biological diversity and its components.	<i>For thematic work programmes, see below</i>
5: Within the work on cross-cutting issues of the Convention, include key taxonomic objectives to generate information needed for decision-making in conservation and sustainable use of biological diversity and its components.	<i>For cross-cutting issues, see below</i>
Thematic Area / Cross-cutting Issue	Matching proposal
P.A. 8: Forest biological Diversity	<i>Invasives impact on forest biodiversity, e.g. weeds at ecotones, pathogens or insects in native plantations.</i>

P.A. 9 Marine & coastal biological diversity	<i>Ballast water Hull fauna Tools</i>
P.A. 10. Dry & sub-humid lands biodiversity	<i>Also susceptible to invasive plants, e.g., grasses, Mimosa pigra (Thailand, Vietnam); invasives can alter fire regimes, etc.</i>
P.A. 11. Inland waters biodiversity	<i>Invasives examples: Melaleuca Molluscs *Bangladesh: Tilapia (African fish), catfish from Thailand Invasives can adversely affect fresh water biodiversity (especially native fish & invertebrates) directly or indirectly by altering hydrology, etc.</i>
P.A. 12. Agricultural biological diversity	<i>Monocultures and chemical use makes the system susceptible to invasion. Invasion by new species can necessitate renewed or increased use of chemicals, which disrupts programmes that conserve natural enemies and implement IPM.</i>
P.A. 13. Mountain biological diversity	<i>These systems are also susceptible to invasion, for example by Lantana.</i>
P.A. 14. Access & benefit-sharing	<i>Not applicable</i>
P.A. 15. Invasive alien species	<i>That's what we're all about</i>
P.A. 16. Article 8(j)	<i>(Indigenous knowledge) Indigenous peoples often have a good historical perspective about what is native, what is not Some invasives can have a significant impact on indigenous peoples but not the mainstream of society</i>
P.A. 17. Ecosystem approach	<i>Species competition. Taxonomists will be needed to assist ecologists do their work on ecosystem parameters. Use the integrity of the whole ecosystem to study the effects of invasives</i>
P.A. 18. Protected areas	<i>May be somewhat less vulnerable if they consist of healthy ecosystems Taxonomists should work with protected areas managers to detect and control invasives Visitors may be vectors of invasives</i>

Planned Activity 16. Support in implementation of Article 8(j) (traditional knowledge)

This topic was not discussed at this workshop. It needs a separate workshop to bring together a different group of workers.

Planned Activity 17. Ecosystem approach

The requirements of the Ecosystem approach to Convention activities were not discussed in depth at the workshop.

Planned Activity 18. Protected areas

This aspect of work under the Convention was not specifically discussed at the workshop.

Appendix 4. Posters presented at the Workshop

Poster title	Presenter	Country/ Economy
India Coordinated Project on Taxonomy Capacity Building (AICOPTAX)	M.A.Haque	India
Conservation status of the Agaricales, Boletales, Cantharellales, Lycoperdales, Phallales and Russulales of South Australia	J.A.Simpson & C.A. Grgurinovic	Australia
A Web-based biodiversity GIS using a robust geo-coding algorithm	Takeshi Sagara, Keiichi Matsuura & Junko Shimura	Japan
All India Coordinated Research Project on Indian Orchids	C. Sathish Kumar	India
An illustrated catalogue of Pakistani opisthobranchs (Cephalaspidea, Anaspidea and Notaspidea)	Itrat Zehra	Pakistan
Australian Plant Pest Database	Ian David Naumann, Lumb & Pheloung	Australia
Biodiversity inventorying Beijing: Actuality and problems	Xianming Gao	China
Biodiversity of bacteria isolated from various environments of Karach: Water, air and soil	Nuzhat Ahmed	Pakistan
Biodiversity of Pakistan: Status and issues	S. Azhar Hasan	Pakistan
Building Taxonomic Capacity in Bangladesh	Badrul Amin Bhuiya	Bangladesh
Computer aided identification for capacity building. An application on trees of Western Ghats (India)	B.R.Ramesh & Grard Pierre	India
Developing the german GTI: Ongoing activities in taxonomy and bioinformatics	Klaus Riede & Christoph Haeuser	Germany
Diversity of glue-green algae and green algae in the deciduous dipterocarp forest at Huai Kha Khang wildlife sanctuary	Duenrut Chonudomkul, Wichien Yongmanitchai & Chantana Sookpreedee	Thailand
Documenting biodiversity minus the most diverse group?: The status, problems and prospects of insect taxonomy and taxonomists in the Philippines	Ireneo L. Lit, Jr.	Philippines
DWNP Scientific Zoological Reference Centre	Sahir Othman, Noor Alif Wira Osman & Lim Boo Liat	Malaysia
Establish biodiversity information network in the Province of Taiwan	Kwang-Tsao Shao, W.J.Wu, C.I.Peng, S.H.Wu, P.F.Lee, S.Lin & Y.L.Yu	Province of Taiwan
Flora of Japan database, and needs for regional flora check list	Motomi Ito	Japan
Freshwater fish introduction in Pakistan: Facts and figures at the beginning of the 21st century	Shahid Mahboob & Mohammad Hassan	Pakistan
Fruit flies: species of economic plant in upper part of northern Thailand	Paitoon Lekeawasdl	Thailand
Identification of Threatened Species from Regional Faunas; Examples from Australian Marine Fishes	John R. Paxton	Australia

Poster title	Presenter	Country/ Economy
Identification of yeasts isolated from Gunung Halimun National Park	Atit Kanti, Heddy Julistiono & I Made Sudiana	Indonesia
Implementation Method for Data Exchange of Biological Diversity Information Databases	Akira Sato, Hirosh Kajihara, Takeshi Sagara, Satoshi Ono & Junko Shimura	Japan
Identification of yeasts isolated from Indonesian fermented foods	Atit Kanti, Susono Saono & Kazuo Komagata	Indonesia
Integration of the Global Environmental Facilities (GEF) and other collaboration projects into Indonesia Biodiversity conservation programme: Lesson learnt from Indonesia	Arie Budiman	Indonesia
Japanese Nemertean Specimen Database	Hiroshi Kajihara, Junko Shimura, Fumie Kasai & Makoto M. Watanabe	Japan
Landscape, Vegetation and Floristic Notes of Nusakambangan Island, Cilacap-Indonesia	Tukirin Partomihardjo	Indonesia
Macrofungal Diversity: The poor state of knowledge in Malaysia	Su See Lee & Yu Shyun Chang	Malaysia
Marine taxonomic research activities in Thailand	Somchai Bussarawit	Thailand
Meristic Character Database of Fishes: A case study of identification tool	Keiichi Matsuura	Japan
Microalgal diversity in Asia: The collaborative research between Japan and Thailand/Indonesia for capacity building of microalgal taxonomy.	Fumie Kasai, Masanobu Kawachi, Wichien Yongmanitchai, Sulastri, Mayumi Erata, Junko Shimura & Makoto M. Watanabe	Japan
Mycology in Asia, the past, the present and future needs	K.D. Hyde	Hong Kong
Natural history of land pulmonate snail collection and species diversity in Thailand: A case study for taxonomy research in developing countries	Somsak Panha	Thailand
New record of aphids (Homoptera: Aphididae) in northern Thailand	Warunee Sirikajornjaru, Valuli Rojanavongse & Suchart Upatham	Thailand
No Title	Ayilliath Kuttiyeri Pradeep	India
No Title	Da-Wei Huang	China
No Title	R. Hendrian, M.Sc.	Indonesia
No Title	Siti Nuramaliati Prijono	Indonesia
No Title	Soenartono Adisoemarto	Indonesia
Nomenclator: A nomenclatural history model to handle multiple taxonomic views	Nozomi Ytow, David R. Morse & David McL. Roberts	Japan, UK
Pacific basin information node, United states geological survey	Mark Fornwall	USA
Palms and palm hotspots in the Philippines	Edwino S. Fernando	Philippines
Parasites of citrus leaf miner, phyllocnistis citrella (Stainton) (Lepidoptera: Phyllocnistidae) in Thailand	Kosol Charernsom	Thailand
Philippine species of Illeis mulsant (Coleoptera: Coccinellidae: Coccinellinae: Phylloborini)	Jessamyn D. Recueno-Adorada	Philippines

Poster title	Presenter	Country/ Economy
Physiological characters and phylogenetic position of yeasts isolated from fermented blaglutinous rice, black 'oncom' and cassava 'tape' based on 18S rDNA sequences	Rostiati N.R. Napitupulu, N. Nikoh & T.Fukatsu	Indonesia
Present state and future trends in taxonomy research in Mongolia	Tsetseg B., Namkhaidorj B. & Galbaatar T.	Mongolia
Revitalisation of Taxonomy-A Business Plan in 21st Century	A.K.Sarbhoj	India
Species Differentiation of an Alcohol-Resistant <i>Monascus</i> sp. MM by Morpho-physiological Characterization	Nandang Suharna & Heddy Julistiono	Indonesia
Stinky Bacteria from World Largest Corpse Flower <i>Amorphophalus titanium</i> Becc	Novik Nurhidayat & Sri Hartin Rahadju	Indonesia
Taxonomic Activities in Brunei Darussalam	Jomari Bin Haji Ahmad	Brunei Darussalam
Taxonomic Condition in Myanmar	Phyu Phyu Lwin	Myanmar
Taxonomic information on the biodiversity in Vietnam	Bui Dinh Chung	Vietnam
Taxonomic needs assessment in Thailand	Banpot Napompeth & Chalinee Kongsawat	Thailand
Taxonomic studies of crustacea in Pakistan	Quddusi B. Kazmi	Pakistan
Taxonomic Studies of Oribatid Mites(ACARI: Oribatida) of Mongolia	Badamdorj Bayartogtokh	Mongolia
Taxonomic studies on Malaysian chrysomelidae (Insecta: Coleoptera)	Mohamed S. Mohamedsaid	Malaysia
Taxonomy of procaryots in water ecosystems of East Asia	Namsaraev Bair, Kozyreva Ludmila, Dagurova Olga & Namsaraev Zorigto	Russia
The activities of Botanical Survey of India	M.Sanjappa	India
The current status and future plants of plant taxonomic research in the Philippines and the role of GTI in its implementation	Domingo A. Madulid	Philippines
The dung beetle fauna (Coleoptera, Scarabaeidae) of Thailand	Yupa Hanboonsong	Thailand
The implementation of database applying Nomenclator schema and the development of the user interface for it	Satoshi Ono, Ryo Fujimoto, Takehisa Okada, Hiroshi Kajihara, Akira Sato, Nozomi Ytow & Junko Shimura	Japan
The inventory of freshwater fishes in Indonesia: A race with the time	Renny Kurnia Hadiaty	Indonesia
The status of insect pests, diseases and herbarium collection at NIPP, Vietnam	Nguyen Van Tuat	Vietnam
The status of insect pests, diseases and herbarium collection at NIPP, Vietnam	Quach Thi Ngo	Vietnam
The status of orchid taxonomy in the Philippines	Esperanza Marbel G. Agoo	Philippines
The Status of Plant diversity and Taxonomic Research in Bangladesh	M.Matiur Rahman	Bangladesh
University of Malaya Algae Culture Collection (UMACC)	Siew-Moi Phang & Wan-Loy Chu	Malaysia

Poster title	Presenter	Country/ Economy
Utilization of Fiels Survey Database Software for flora and fauna data management from Nusakambangan Island, Central Java, Indonesia	Roemantyo & B. Hartoko	Indonesia
Vascular ground flora in a dipterocarp-oak forest in northern Thailand	Wangworn Sankamethawee, J.F.Maxwell & Vilaiwan Anusarnsunthorn	Thailand
Yeasts Diversity of Gunung Halimun National Park (The Last Sub mountain forest in Java)	Atit Kanti, Heddy Julistiono & I Made Sudiana	Indonesia
???????	Jade Donovanik	Thailand

Appendix 5. Participants in the 1st GTI Workshop in Asia

AUSTRALIA

Penny Berents	Australian Museum
Ian Cresswell	Australian Biological Resources Study, Environment Australia
Ian D. Naumann	Agriculture, Fisheries and Forestry Australia
John Paxton	Australian Museum
Karen L. Wilson	Royal Botanic Gardens Sydney

BANGLADESH

Badrul Amin Bhuiya	University of Chittagong (Interim SACNET Coordinator, Bangladesh)
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CHINA

Li-Qiang Ji	Chinese Academia Sinica (CBIS)
Hui Xiao	Chinese Academia Sinica

Province of Taiwan

Chang-Hung Chou	National Pingtung University
Keng-Hsien Lin	Institute of Zoology, Academia Sinica
Yung-Chang Lin	Institute of Zoology, Academia Sinica
Kwang-Tsao Shao	Academia Sinica
Yuan-Lung Yu	Institute of Zoology, Academia Sinica

Hong Kong

Kevin D. Hyde	The University of Hong Kong
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CONVENTION ON BIOLOGICAL DIVERSITY

Christopher H.C. Lyal	Secretariat of the Convention on Biological Diversity
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GERMANY

Christoph L. Haeuser	Global Biodiversity Information Facility (GBIF)
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INDIA

Haque M.A.	Ministry of Environment India
B. R. Ramesh	French Institute of Pondicherry

INDONESIA

Arie Budiman	Indonesian Institute of Sciences (LIPI)
Dedy Darnaedi	LIPI
Roemantyo	LIPI
Setijati Sastrapradja	Indonesian Biodiversity Foundation
Tukirin Partomiharjo	LIPI

JAPAN

Ryo Fujimoto	Lance Co Ltd
Hiromitsu Hagiwara	Department of Botany, National Science Museum
Motomi Ito	University of Tokyo
Hiroshi Kajihara	National Institute for Environmental Studies (NIES)
Fumie Kasai	NIES
Masanobu Kawachi	NIES
Hiroshi Kawai	Kobe University
Keiichi Matsuura	National Science Museum
Akira Nakagiri	National Institutes of Technology and Evaluation
Tohru Nakashizuka	DIVERSITAS in the Western Pacific and Asia (DIWPA)
Takehisa Okada	Lance Co Ltd
Satoshi Ono	Lance Co Ltd

Takeshi Sagara	University of Tokyo
Akira Sato	University of Tsukuba
Junko Shimura	NIES/GTI Japan
Minoru Soeya	Ministry of the Environment
Hiroshi Tobe	Kyoto University
Mitsuo Usuki	UNU/IAS
Makoto M. Watanabe	NIES/GTI Japan
Seiki Yamane	University of Kagoshima (AneT)
JAPAN/MALAYSIA	
A. H. Zakri	UNU/IAS
KENYA	
David Duthie	UNEP/GEF
KOREA	
In Kyu Lee	Seoul National University, Biodiversity Center
MALAYSIA	
Aslitawaty Abu Bakar	Universiti Putra Malaysia (UPM)
Bastiah Ahmad Lembaja	RRIM – Rubber Research Institute Malaysia
Yu Shyun Chang	Forest Research Institute Malaysia (FRIM)
Beng-Jin Chee	FRIM
Lucy Chong	Forest Dept. Sarawak
Richard Chung	FRIM
Bakhtiar Effendi Yahya	Institute for Tropical Biology & Conservation, Universiti Malaysia Sabah (UMS)
Eng Goh Siok	MOSTE
Rusea Go	UPM
Mohd. Fairus Jalil	Institute for Tropical Biology & Conservation, UMS
Claysius Konggoi	UPM
Takahisa Kusano	BBEC Programme, ITBC, UMS
Abdul Latiff Mohamad	Universiti Kebangsaan Malaysia
Lim Boo Liat	Jabatan Perhilitan
Lum Keng Yeang	Malaysian Agriculture R&D Institute (MARDI)
Maryati Mohamed	University of Malaysia Sabah
Mohamed Mohamedsaid	Pusat Sistematiik Serangga, Universiti Kebangsaan Malaysia (Sabah)
Normaya Nordin	FRIM
Joan Pereira	Forest Research Centre, Sabah Forest Department
Phang Siew Moi	Institute of Biological Sciences, University of Malaya
Adib A. Rahman	MOSTE
Phoon Sook Ngoh	UPM
Mariam Abdullah	UPM Undergraduate
Abdul Rahim Ismail	UPM
Amir Feisal Merican	Institut Sains Biologi, University of Malaya
Cheksun Tawan	UNIMAS
Hasdi Hassan	Jabatan Perhilitan
Hjh Rosmah Hj Jafar	Pusat Penyelidikan Pertanian
Idris Abd. Ghani	UKM
Salma Idris	MARDI
Idris Zulkifli	MOSTE
Ismail Ahmad	UKM
Jalil Md. Som	Jabatan Perhutanan Semenanjung Malaysia
Jambari Haji Ali	UPM
Siti Aisah Alias	UM
Mamat Jusoh	ASEANET/MARDI
Mashhor Mansor	USM

Md. Salleh Sazlina	USM
Meriam Mohd Yusof	Malaysian Cocoa Board
Mohd. Nor Burhanuddin	MOSTE
Mohd Rosli Abdullah	MOSTE
Noraini Azhar	MOSTE
Norman Hj Kamarudin	Malaysian Palm Oil Board
Petra Gin Sulai	Jabatan Perhilitan
Rahman Khairul Adib Abd	MOSTE
Rita Manurung	Jabatan Perhilitan
Runi Sylvester Pungga	Forest Research Centre, Sarawak Forest Dept
Yen-Yen Sam	FRIM
Saw Leng Guan	FRIM
Wuu-Kuang Soh	FRIM
Soetikno S. Sastroutomo	ASEANET, MARDI
Monica Suleiman	Institute for Tropical Biology & Conservation, UMS
Siti Ranlah Ahmad Ar	Malaysian Palm Oil Board
Tosiah Sadi	MARDI
Umi Kalsom Yusof	UPM
Joanes Unggang	UPM
Wong Khoon Meng	Rimba Ilmu University of Malaya
Catherine Yule	Monash University Malaysia
MONGOLIA	
Tsetseg Baljinova	Division of Microbiology, Institute of Biology, Mongolian Academy of Sciences
NETHERLANDS	
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Ruth Kiew	Herbarium and Library, Singapore Botanic Gardens
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Somchai Bussarwit	Phuket Marine Biological Center
Wichien Yongmanitchai	Kasetsart University
Wangworn Sankamethawee	CMU Herbarium, Department of Biology, Chiang Mai University
Vullapa Arunpairojana	Microbiological Resource Centre (MIRCEN), Thailand Institute of Scientific and Technological Research (TISTR)
UK	
Nick King	BioNET INTERNATIONAL
David McL. Roberts	Natural History Museum, London
Jameson H. Seyani	Commonwealth Science Council
U.S.A.	
Annie Simpson	National Biological Information Infrastructure, US Geological Survey
Guanghai Zhu	Missouri Botanical Garden (Flora of China)
VIETNAM	
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Editors of the report

Karen L. Wilson, RBG Sydney, Australia

Ian Cresswell, Australian Biological Resources Study

Christopher H.C. Lyal, CBD Secretariat

Junko Shimura, National Institute for Environmental Studies, Japan/GTI of Japan

Contact person

Junko Shimura at junko@nies.go.jp

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